INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

ANALYTICAL CHEMISTRY DIVISION
COMMISSION ON SOLUBILITY DATA

SOLUBILITY DATA SERIES

Volume 41

ALKALINE EARTH METAL PERCHLORATES

SOLUBILITY DATA SERIES

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

IUPAC Secretariat, Bank Court Chambers,
2-3 Pound Way, Cowley Centre, Oxford OX4 3YF, UK

SOLUBILITY DATA SERIES

Volume 41

ALKALINE EARTH METAL PERCHLORATES

Volume Editors

CHEE-YAN CHAN
University of Malaya
Kuala Lumpur, Malaysia

IVAN N. LEPESHKOV
Kurnakov Institute of General & Inorganic Chemistry, Moscow

KEAN H. KHOO
University of Malaya
Kuala Lumpur, Malaysia

Contributors

CHEE-YAN CHAN, CHEE-CHEONG HO, WEE-LAM NG, KEAN H. KHOO
Department of Chemistry, University of Malaya, 59100 Kuala Lumpur, Malaysia

I. N. LEPESHKOV, E. S. GRYZLOVA, I. S. BODNYA, N. A. KOZYREVA, N. A. VASINA
Kurnakov Institute of General & Inorganic Chemistry, Academy of Sciences of the USSR, Leninskii Prospekt 31, SU–117071 Moscow, USSR

TOMASZ MIODUSKI
Institute of Nuclear Chemistry & Technology
ul. Dorodna 16, PL–03195 Warsaw, Poland

PERGAMON PRESS

Member of Maxwell Macmillan Pergamon Publishing Corporation

OXFORD · NEW YORK · BEIJING · FRANKFURT
SÃO PAULO · SYDNEY · TOKYO · TORONTO

U.K.	Pergamon Press plc, Headington Hill Hall, Oxford OX3 0BW, England
U.S.A.	Pergamon Press, Inc., Maxwell House, Fairview Park, Elmsford, New York 10523, U.S.A.
PEOPLE'S REPUBLIC OF CHINA	Pergamon Press, Room 4037, Qianmen Hotel, Beijing, People's Republic of China
FEDERAL REPUBLIC OF GERMANY	Pergamon Press GmbH, Hammerweg 6, D-6242 Kronberg, Federal Republic of Germany
BRAZIL	Pergamon Editora Ltda, Rua Eça de Queiros, 346, CEP 04011, Paraiso, São Paulo, Brazil
AUSTRALIA	Pergamon Press Australia Pty Ltd., P.O. Box 544, Potts Point, N.S.W. 2011, Australia
JAPAN	Pergamon Press, 5th Floor, Matsuoka Central Building, 1-7-1 Nishishinjuku, Shinjuku-ku, Tokyo 160, Japan
CANADA	Pergamon Press Canada Ltd., Suite No. 271, 253 College Street, Toronto, Ontario, Canada M5T 1R5

First edition 1989

The Library of Congress has catalogued this serial title as follows:

Solubility data series.—Vol. 1—Oxford; New York;
Pergamon, c 1979-
v.; 28 cm.
Separately catalogued and classified in LC before no. 18.
ISSN 0191-5622 = Solubility data series.
1. Solubility—Tables—Collected works.
QD543.S6629 541.3'42'05-dc 19 85-641351
AACR 2 MARC-S

British Library Cataloguing in Publication Data

Alkaline earth metal perchlorates.
1. Alkaline earth metals. Solubility
I. Chan, Chee-yan II. Lepeshkov, Ivan N.
III. Khoo, Kean H. IV. Series
546'.39

ISBN 0-08-040198-8

A complete list of volumes published in the Solubility Data Series will be found on p. 281.

Printed in Great Britain by BPCC Wheatons Ltd, Exeter

CONTENTS

FOREWORD

If the knowledge is
undigested or simply wrong,
more is not better.

The Solubility Data Series is a project of Commission V.8 (Solubility Data) of the International Union of Pure and Applied Chemistry (IUPAC). The project had its origins in 1973, when the Analytical Chemistry Division of IUPAC set up a Subcommission on Solubility Data under the chairmanship of the late Prof. A.S. Kertes. When publication of the Solubility Data Series began in 1979, the Committee became a full commission of IUPAC, again under the chairmanship of Prof. Kertes, who also became *Editor-in-Chief* of the Series. The Series has as its goal the preparation of a comprehensive and critical compilation of data on solubilities in all physical systems, including gases, liquids and solids.

The motivation for the Series arose from the realization that, while solubility data are of importance in a wide range of fields in science and technology, the existing data had not been summarized in a form that was at the same time comprehensive and complete. Existing compilations of solubility data indeed existed, but they contained many errors, were in general uncritical, and were seriously out-of-date.

It was also realized that a new series of compilations of data gave educational opportunities, in that careful compilations of existing data could be used to demonstrate what constitutes data of high and lasting quality. As well, if the data were summarized in a sufficiently complete form, any individual could prepare his or her own evaluation, independently of the published evaluation. Thus, a special format was established for each volume, consisting of individual data sheets for each separate publication, and critical evaluations for each separate system, provided sufficient data from different sources were available for comparison. The compilations and, especially, the evaluations were to be prepared by active scientists who were either involved in producing new data, or were interested in using data of high quality. With minor modifications in format, this strategy has continued throughout the Series.

In the standard arrangement of each volume, the Critical Evaluation gives the following information:

(i) A text which discusses the numerical solubility information which has been abstracted from the primary sources in the form of compilation sheets. The text concerns primarily the quality of the data, after consideration of the purity of the materials and their characterization, the experimental method used, the uncertainties in the experimental values, the reproducibility, the agreement with accepted test values, and, finally, the fitting of the data to suitable functions, along with statistical tests of the fitted data.

(ii) A set of recommended data, whenever possible, including weighted averages and estimated standard deviations. If applicable, one or more smoothing equations which have been computed or verified by the evaluator are also given.

(iii) A graphical plot of the recommended data, in the form of phase diagrams where appropriate.

The Compilation part consists of data sheets which summarize the experimental data from the primary literature. Here much effort is put into obtaining complete coverage; many good data have appeared in publications from the late nineteenth and early twentieth centuries, or in obscure journals. Data of demonstrably low precision are not compiled, but are mentioned in the Critical Evaluation. Similarly, graphical data, given the uncertainty of accurate conversion to numerical values, are

compiled only where no better data are available. The documentation of data of low precision can serve to alert researchers to areas where more work is needed.

A typical data sheet contains the following information:

(*i*) list of components: names, formulas, Chemical Abstracts Registry Numbers;
(*ii*) primary source of the data;
(*iii*) experimental variables;
(*iv*) compiler's name;
(*v*) experimental values as they appear in the primary source, in modern units with explanations if appropriate;
(*vi*) experimental methods used;
(*vii*) apparatus and procedure used;
(*viii*) source and purity of materials used;
(*ix*) estimated error, either from the primary source or estimated by the compiler;
(*x*) references relevant to the generation of the data cited in the primary source.

Each volume also contains a general introduction to the particular type of system, such as solubility of gases, of solids in liquids, etc., which contains a discussion of the nomenclature used, the principles of accurate determination of solubilities, and related thermodynamic principles. This general introduction is followed by a specific introduction to the subject matter of the volume itself.

The Series embodies a new approach to the presentation of numerical data, and the details continue to be influenced strongly by the perceived needs of prospective users. The approach used will, it is hoped, encourage attention to the quality of new published work, as authors become more aware that their work will attain permanence only if it meets the standards set out in these volumes. If the Series succeeds in this respect, even partially, the Solubility Data Commission will have justified the labour expended by many scientists throughout the world in its production.

January, 1989

J.W. Lorimer,
London, Canada

PREFACE

This Volume in the IUPAC Solubility Data Series concerns alkaline earth metal perchlorates in aqueous, non-aqueous and mixed solvents systems and follows the objectives and guidelines enunciated in the FOREWORD and INTRODUCTION to the Series.

The first comprehensive review on the manufacture, properties, uses, and analytical chemistry of perchloric acid, its salts and derivative compounds appeared in 1960 in the form of an excellent monograph edited by Schumacher (1), which also included a brief account of the history of the perchlorates. All of the alkaline earth metal perchlorates form several hydrates and ammines (1,2), except perhaps beryllium perchlorate for which only one hydrate, $Be(ClO_4)_2 \cdot 4H_2O$ has been reported (3). Some of these perchlorates have been used as drying agents and ammonia absorbents, and this usage seems to have been their main focus of commercial interest in the past. Their hygroscopic nature precludes their general use in the manufacture of explosives and rocket propellants, unlike ammonium and potassium perchlorates which do not form hydrates. Their use as catalysts in the polymerization of styrene (4) and as catalytic curing agents in a treatment process for textiles (5) have also been reported. Recent patented literature (6) reports many other new and varied uses. Among these are their uses as heat stabilizers and anti-oxidants for synthetic rubbers and PVC, as discoloration prevention agents for polystyrene, in the treatment of polyimide membranes for water desalination and in mixtures with certain polymers for use as electrolytes in solid-state batteries.

The preparation of the alkaline earth metal perchlorates, with the exception of beryllium perchlorate, was first reported by Serullas (7) in 1831 and the preparation of beryllium perchlorate was first reported in 1873 by Atterberg (8) and de Marignac (9). However, reliable solubility data for these perchorates in water and other solvents were not available before 1923. All of the alkaline earth metal perchlorates are very soluble in water and in alcohols. Much of the data compiled here pertain to aqueous multicomponent systems of these perchlorates and it appears that the primary objective of the authors of the original measurements was to obtain solubility data for the construction of phase diagrams and the characterization of the solid phases in equilibrium with the saturated solutions. Several hydrates for each of the alkaline earth metal perchlorates, except for beryllium perchlorate, have been reported, as well as their solid compounds with other salts and organic compounds. However, except for the more common hydrates, information for confirming the existence of most of these compounds is not available. There are relatively fewer compilations on the non-aqueous systems and studies of the variation of the solubilities of these perchlorates with temperature

(continued next page)

have been limited to the range 273 K to 323 K. No attempt has been made in this Volume to determine thermodynamic solubility products and activity coefficients of the perchlorates in the systems reported here which involve very high ionic strengths. It should also be noted that Chemical Abstracts Registry Numbers, where available, for all compounds not listed in the Components boxes in the Compilations and Evaluations are given only in the Formula / Registry Number Index pages in this Volume.

The primary sources used in the literature survey for relevant information were *Chemical Abstracts* from 1907 to 1987 and the volumes on *Solubilities of Inorganic and Metal Organic Compounds* by Linke (10). Other sources include the monographs by Schumacher (1) and Schilt (11), the article by Carlson (12), and the comprehensive treatise by Mellor (13). While the compilers have made their best effort to compile on all relevant and available data published up to 1987, it is possible that certain articles that may be pertinent, but published in obscure journals, have missed their attention. No compilations have been prepared for data presented only in the form of graphs and these involved only a few articles, published in Russian. It is very difficult, if not practically impossible, to communicate with the authors of the original measurements to obtain the numerical data.

This work is the result of several years of joint-effort and close collaboration between the Soviet and Malaysian scientists involved in the Solubility Data Project, with much appreciated help and advice from Dr. M. Salomon (U.S.A.), Prof. J.W. Lorimer (Canada), Prof. R. Cohen-Adad (France), Prof. A.S. Kertes (Israel) and Prof. G.A. Yagodin (U.S.S.R.) in various ways, including liason and literature search. It represents the first successful collaboration of this nature in the Solubility Data Project. It is worth noting that much of the compilations are on original data published in Russian journals which are not readily available outside the U.S.S.R. Most of the calculations (where indicated as compilers' or editors' calculations in footnotes) in all the compilations, the major part of the indexing work, and the preparation of the final camera-ready pages of the entire Volume, except for the Foreword, Introduction, Indexes and Contents CRC pages, were carried out by the Malaysian group in the University of Malaya. The editors and compilers thank the University of Malaya and the Kurnakov Institute of General and Inorganic Chemistry, Moscow for providing facilities used in the preparation of this Volume. They also wish to express their gratitude to all those colleagues in IUPAC Commission V.8 who have helped in one way or another.

(continued next page)

REFERENCES

1. Schumacher, J.C. *PERCHLORATES. Their Properties, Manufacture and Uses*, Reinhold Publ. Corp., New York, 1960.
2. Smeets, C. *Natuurw. Tijdschr.* 1939, *21*, 149.
3. See Evaluation on beryllium perchlorate in this Volume.
4. Losev, B.I.; Zakharova, Y.I. *Doklady Akad. Nauk S.S.S.R.* 1957, *116*, 609.
5. Schroeder, C.W. *U.S. Patent* 2,826,514 (Mar. 11, 1958).
6. *Chemical Abstracts*, 1982 - 1988.
7. Serullas, G.S. *Ann. Chim. Phys.* 1831, *46(2)*, 304.
8. Atterberg, A. *Ber. Dtsch. Chem. Ges.* 1873, *7*, 472.
9. de Marignac, J.C.G. *Ann. Chim. Phys.* 1873, *30(4)*, 45.
10. Linke, W.F. *Solubilities of Inorganic and Metal Organic Compounds Vol.I*, 4th ed., Van Nostrand, 1958 ; *Vol.II*, 4th ed., Am. Chem. Soc. 1965 .
11. Schilt, A.A. *Perchloric Acid and Perchlorates*, G.F. Smith Chem. Co. Publ., 1979 .
12. Carlson, B. in *Festskrift* , ed. P. Klason, Norstedt, Stockholm 1910, 247.
13. Mellor, J.W. *A Comprehensive Treatise on Inorganic and Theoretical Chemistry, Vol.II*, 399, Longmans, Green and Co., London 1967.

C.Y. Chan
K.H. Khoo
I.N. Lepeshkov

November, 1988

INTRODUCTION TO THE SOLUBILITY OF SOLIDS IN LIQUIDS

Nature of the Project

The Solubility Data Project (SDP) has as its aim a comprehensive search of the literature for solubilities of gases, liquids, and solids in liquids or solids. Data of suitable precision are compiled on data sheets in a uniform format. The data for each system are evaluated, and where data from different sources agree sufficiently, recommended values are proposed. The evaluation sheets, recommended values, and compiled data sheets are published on consecutive pages.

Definitions

A *mixture* (1, 2) describes a gaseous, liquid, or solid phase containing more than one substance, when the substances are all treated in the same way.

A *solution* (1, 2) describes a liquid or solid phase containing more than one substance, when for convenience one of the substances, which is called the *solvent*, and may itself be a mixture, is treated differently than the other substances, which are called *solutes*. If the sum of the mole fractions of the solutes is small compared to unity, the solution is called a *dilute solution*.

The *solubility* of a substance *B* is the relative proportion of *B* (or a substance related chemically to *B*) in a mixture which is saturated with respect to solid *B* at a specified temperature and pressure. *Saturated* implies the existence of equilibrium with respect to the processes of dissolution and precipitation; the equilibrium may be stable or metastable. The solubility of a substance in metastable equilibrium is usually greater than that of the corresponding substance in stable equilibrium. (Strictly speaking, it is the activity of the substance in metastable equilibrium that is greater.) Care must be taken to distinguish true metastability from supersaturation, where equilibrium does not exist.

Either point of view, mixture or solution, may be taken in describing solubility. The two points of view find their expression in the quantities used as measures of solubility and in the reference states used for definition of activities, activity coefficients and osmotic coefficients.

The qualifying phrase "substance related chemically to *B*" requires comment. The composition of the saturated mixture (or solution) can be described in terms of any suitable set of thermodynamic components. Thus, the solubility of a salt hydrate in water is usually given as the relative proportion of anhydrous salt in solution, rather than the relative proportions of hydrated salt and water.

Quantities Used as Measures of Solubility

1. *Mole fraction* of substance *B*, x_B:

$$x_B = n_B / \sum_{s=1}^{C} n_s \qquad [1]$$

where n_s is the amount of substance of *s*, and *c* is the number of distinct substances present (often the number of thermodynamic components in the system). *Mole per cent* of *B* is 100 x_B.

2. *Mass fraction* of substance *B*, w_B:

$$w_B = m_B' / \sum_{s=1}^{C} m_s' \qquad [2]$$

where m_s' is the mass of substance *s*. *Mass per cent* is 100 w_B. The equivalent terms *weight fraction* and *weight per cent* are not used.

3. *Solute mole (mass) fraction* of solute *B* (3, 4):

$$x_{s,B} = m_B / \sum_{s=1}^{C'} m_s = x_B / \sum_{s=1}^{C'} x_s \qquad [3]$$

$$w_{s,B} = m_B' / \sum_{s=1}^{C'} m_s' = w_B / \sum_{s=1}^{C'} w_s \qquad [3a]$$

where the summation is over the solutes only. For the solvent A, $x_{S,A} = x_A/(1 - x_A)$, $w_{S,A} = w_A/(1 - w_A)$. These quantities are called *Jänecke mole (mass) fractions* in many papers.

4. *Molality* of solute B (1, 2) in a solvent A:

$$m_B = n_B/n_A M_A \qquad \text{SI base units: mol kg}^{-1} \qquad [4]$$

where M_A is the molar mass of the solvent.

5. *Concentration* of solute B (1, 2) in a solution of volume V:

$$c_B = [B] = n_B/V \qquad \text{SI base units: mol m}^{-3} \qquad [5]$$

The symbol c_B is preferred to $[B]$, but both are used. The terms *molarity* and *molar* are not used.

Mole and mass fractions are appropriate to either the mixture or the solution point of view. The other quantities are appropriate to the solution point of view only. Conversions among these quantities can be carried out using the equations given in Table 1-1 following this Introduction. Other useful quantities will be defined in the prefaces to individual volumes or on specific data sheets.

In addition to the quantities defined above, the following are useful in conversions between concentrations and other quantities.

6. *Density*: $\rho = m/V$ SI base units: kg m^{-3} [6]

7. *Relative density*: d; the ratio of the density of a mixture to the density of a reference substance under conditions which must be specified for both (1). The symbol $d_t^{t'}$ will be used for the density of a mixture at t°C, 1 bar divided by the density of water at t'°C, 1 bar. (In some cases 1 atm = 101.325 kPa is used instead of 1 bar = 100 kPa.)

8. *A note on nomenclature.* The above definitions use the nomenclature of the IUPAC *Green Book* (1), in which a solute is called B and a solvent A In compilations and evaluations, the first-named component (component 1) is the solute, and the second (component 2 for a two-component system) is the solvent. The reader should bear these distinctions in nomenclature in mind when comparing nomenclature and theoretical equations given in this Introduction with equations and nomenclature used on the evaluation and compilation sheets.

Thermodynamics of Solubility

The principal aims of the Solubility Data Project are the tabulation and evaluation of: (a) solubilities as defined above; (b) the nature of the saturating phase. Thermodynamic analysis of solubility phenomena has two aims: (a) to provide a rational basis for the construction of functions to represent solubility data; (b) to enable thermodynamic quantities to be extracted from solubility data. Both these are difficult to achieve in many cases because of a lack of experimental or theoretical information concerning activity coefficients. Where thermodynamic quantities can be found, they are not evaluated critically, since this task would involve critical evaluation of a large body of data that is not directly relevant to solubility. The following is an outline of the principal thermodynamic relations encountered in discussions of solubility. For more extensive discussions and references, see books on thermodynamics, e.g., (5-12).

Activity Coefficients (1)

(a) *Mixtures.* The activity coefficient f_B of a substance B is given by

$$RT \ln (f_B x_B) = \mu_B - \mu_B^* \qquad [7]$$

where μ_B^* is the chemical potential of pure B at the same temperature and pressure. For any substance B in the mixture,

$$\lim_{x_B \to 1} f_B = 1 \qquad [8]$$

(b) *Solutions.*

(1) *Solute B.* The molal activity coefficient γ_B is given by

$$RT \ln(\gamma_B m_B) = \mu_B - (\mu_B - RT \ln m_B)^\infty \qquad [9]$$

where the superscript $^\infty$ indicates an infinitely dilute solution. For any solute B,

$$\gamma_B^\infty = 1 \qquad [10]$$

Activity coefficients y_B connected with concentrations c_B, and $f_{x,B}$ (called the *rational activity coefficient*) connected with mole fractions x_B are defined in analogous ways. The relations among them are (1, 9), where ρ^* is the density of the pure solvent:

$$f_B = (1 + M_A\sum_s m_s)\gamma_B = [\rho + \sum_s (M_A - M_s)c_s]y_B/\rho^* \quad [11]$$

$$\gamma_B = (1 - \sum_s x_s)f_{x,B} = (\rho - \sum_s M_s c_s)y_B/\rho^* \quad [12]$$

$$y_B = \rho^* f_{x,B}[1 + \sum_s (M_s/M_A - 1)x_B]/\rho = \rho^*(1 + \sum_s M_s m_s)\gamma_B/\rho \quad [13]$$

For an electrolyte solute $B \equiv C_{\nu+}A_{\nu-}$, the activity on the molality scale is replaced by (9)

$$\gamma_B m_B = \gamma_\pm^{\nu} m_B^{\nu} Q^{\nu} \quad [14]$$

where $\nu = \nu_+ + \nu_-$, $Q = (\nu_+^{\nu_+}\nu_-^{\nu_-})^{1/\nu}$, and $\gamma_\pm$ is the mean ionic activity coefficient on the molality scale. A similar relation holds for the concentration activity, $y_B c_B$. For the mole fractional activity,

$$f_{x,B}x_B = Q^{\nu} f_\pm^{\nu} x_\pm^{\nu} \quad [15]$$

where $x_\pm = (x_+x_-)^{1/\nu}$. The quantities x_+ and x_- are the ionic mole fractions (9), which are

$$x_+ = \nu_+ x_B/[1 + \sum_s (\nu_s - 1)x_s]; \quad x_- = \nu_- x_B[1 + \sum_s (\nu_s - 1)x_s] \quad [16]$$

where ν_s is the sum of the stoichiometric coefficients for the ions in a salt with mole fraction x_s. Note that the mole fraction of solvent is now

$$x_A' = (1 - \sum_s \nu_s x_s)/[1 + \sum_s (\nu_s - 1)x_s] \quad [17]$$

so that

$$x_A' + \sum_s \nu_s x_s = 1 \quad [18]$$

The relations among the various mean ionic activity coefficients are:

$$f_\pm = (1 + M_A\sum_s \nu_s m_s)\gamma_\pm = [\rho + \sum_s (\nu_s M_A - M_s)c_s]y_\pm/\rho^* \quad [19]$$

$$\gamma_\pm = \frac{(1 - \sum_s x_s)f_\pm}{1 + \sum_s (\nu_s - 1)x_s} = (\rho - \sum_s M_s c_s)y_\pm/\rho^* \quad [20]$$

$$y_\pm = \frac{\rho^*[1 + \sum_s (M_s/M_A - 1)xs]f_\pm}{\rho[1 + \sum_s (\nu_s - 1)x_s]} = \rho^*(1 + \sum_s M_s m_s)\gamma_\pm/\rho \quad [21]$$

(ii) *Solvent, A:*

The *osmotic coefficient*, ϕ, of a solvent A is defined as (1):

$$\phi = (\mu_A^* - \mu_A)/RT\, M_A \sum_s m_s \quad [22]$$

where μ_A^* is the chemical potential of the pure solvent.

The *rational osmotic coefficient*, ϕ_x, is defined as (1):

$$\phi_x = (\mu_A - \mu_A^*)/RT\ln x_A = \phi M_A \sum_s m_s/\ln(1 + M_A \sum_s m_s) \quad [23]$$

The activity, a_A, or the activity coefficient, f_A, is sometimes used for the solvent rather than the osmotic coefficient. The activity coefficient is defined relative to pure A, just as for a mixture.

For a mixed solvent, the molar mass in the above equations is replaced by the average molar mass; i.e., for a two-component solvent with components J, K, M_A becomes

$$M_A = M_J + (M_K - M_J)x_{v,K} \quad [24]$$

where $x_{v,K}$ is the *solvent* mole fraction of component K.

The osmotic coefficient is related directly to the vapor pressure, p, of a solution in equilibrium with vapor containing A only by (12, p.306):

$$\phi M_A \sum_s \nu_s m_s = -\ln(p/p_A^*) + (V_{m,A}^* - B_{AA})(p - p_A^*)/RT \quad [25]$$

where p_A^*, $V_{m,A}^*$ are the vapor pressure and molar volume of pure solvent A, and B_{AA} is the second virial coefficient of the vapor.

The Liquid Phase

A general thermodynamic differential equation which gives solubility as a function of temperature, pressure and composition can be derived. The approach is similar to that of Kirkwood and Oppenheim (7); see also (11, 12). Consider a solid mixture containing c thermodynamic components i. The Gibbs-Duhem equation for this mixture is:

$$\sum_{i=1}^{c} x_i'(S_i'dT - V_i'dp + d\mu_i') = 0 \qquad [26]$$

A liquid mixture in equilibrium with this solid phase contains c' thermodynamic components i, where $c' \geq c$. The Gibbs-Duhem equation for the liquid mixture is:

$$\sum_{i=1}^{c} x_i(S_i dT - V_i dp + d\mu_i') + \sum_{i=c+1}^{c'} x_i(S_i dT - V_i dp + d\mu_i) = 0 \qquad [27]$$

Subtract [26] from [27] and use the equation

$$d\mu_i = (d\mu_i)_{T,p} - S_i dT + V_i dp \qquad [28]$$

and the Gibbs-Duhem equation at constant temperature and pressure:

$$\sum_{i=1}^{c} x_i(d\mu_i')_{T,p} + \sum_{i=c+1}^{c'} x_i(d\mu_i)_{T,p} = 0 \qquad [29]$$

The resulting equation is:

$$RT\sum_{i=1}^{c} x_i'(d\ln a_i)_{T,p} = \sum_{i=1}^{c} x_i'(H_i - H_i')dT/T - \sum_{i=1}^{c} x_i'(V_i - V_i')dp \qquad [30]$$

where

$$H_i - H_i' = T(S_i - S_i') \qquad [31]$$

is the enthalpy of transfer of component i from the solid to the liquid phase at a given temperature, pressure and composition, with H_i and S_i the partial molar enthalpy and entropy of component i.

Use of the equations

$$H_i - H_i^0 = -RT^2(\partial \ln a_i/\partial T)_{x,p} \qquad [32]$$

and

$$V_i - V_i^0 = RT(\partial \ln a_i/\partial p)_{x,T} \qquad [33]$$

where superscript 0 indicates an arbitrary reference state gives:

$$RT\sum_{i=1}^{c} x_i'd\ln a_i = \sum_{i=1}^{c} x_i'(H_i^0 - H_i')dT/T - \sum_{i=1}^{c} x_i'(V_i^0 - V_i')dp \qquad [34]$$

where

$$d\ln a_i = (d\ln a_i)_{T,p} + (\partial \ln a_i/\partial T)_{x,p} + (\partial \ln a_i/\partial p)_{x,T} \qquad [35]$$

The terms involving enthalpies and volumes in the solid phase can be written as:

$$\sum_{i=1}^{c} x_i'H_i' = H_S^* \qquad \sum_{i=1}^{c} x_i'V_i' = V_S^* \qquad [36]$$

With eqn [36], the final general solubility equation may then be written:

$$R\sum_{i=1}^{c} x_i'd\ln a_i = (H_S^* - \sum_{i=1}^{c} x_i'H_i^0)d(1/T) - (V_S^* - \sum_{i=1}^{c} x_i'V_i^0)dp/T \qquad [37]$$

Note that those components which are not present in both phases do not appear in the solubility equation. However, they do affect the solubility through their effect on the activities of the solutes.

Several applications of eqn [37] (all with pressure held constant) will be discussed below. Other cases will be discussed in individual evaluations.

(a) *Solubility as a function of temperature.*

Consider a binary solid compound A_nB in a single solvent A. There is

no fundamental thermodynamic distinction between a binary compound of A and B which dissociates completely or partially on melting and a solid mixture of A and B; the binary compound can be regarded as a solid mixture of constant composition. Thus, with $c = 2$, $x_A' = n/(n + 1)$, $x_B' = 1/(n + 1)$, eqn [37] becomes:

$$d\ln(a_A{}^n a_B) = -\Delta H_{AB}{}^0 d(1/RT) \qquad [38]$$

where

$$\Delta H_{AB}{}^0 = nH_A + H_B - (n + 1)H_s{}^* \qquad [39]$$

is the molar enthalpy of melting and dissociation of pure solid A_nB to form A and B in their reference states. Integration between T and T_0, the melting point of the pure binary compound A_nB, gives:

$$\ln(a_A{}^n a_B) = \ln(a_A{}^n a_B)_{T=T_0} - \int_{T_0}^{T} \Delta H_{AB}{}^0 d(1/RT) \qquad [40]$$

(i) Non-electrolytes

In eqn [32], introduce the pure liquids as reference states. Then, using a simple first-order dependence of $\Delta H_{AB}{}^*$ on temperature, and assuming that the activitity coefficients conform to those for a simple mixture (6):

$$RT \ln f_A = wx_B{}^2 \qquad RT \ln f_B = wx_A{}^2 \qquad [41]$$

then, if w is independent of temperature, eqn [32] and [33] give:

$$\ln\{x_B(1-x_B)^n\} + \ln\left\{\frac{n^n}{(1 + n)^{n+1}}\right\} = G(T) \qquad [42]$$

where

$$G(T) = -\left\{\frac{\Delta H_{AB}{}^* - T^*\Delta C_p{}^*}{R}\right\}\left\{\frac{1}{T} - \frac{1}{T^*}\right\} + \frac{\Delta C_p{}^*}{R} \ln(T/T^*) - \frac{w}{R}\left\{\frac{x_A{}^2 + nx_B{}^2}{T} - \frac{n}{(n + 1)T^*}\right\} \qquad [43]$$

where $\Delta C_p{}^*$ is the change in molar heat capacity accompanying fusion plus decomposition of the pure compound to pure liquid A and B at temperature T^*, (assumed here to be independent of temperature and composition), and $\Delta H_{AB}{}^*$ is the corresponding change in enthalpy at $T = T^*$. Equation [42] has the general form:

$$\ln\{x_B(1-x_B)^n\} = A_1 + A_2/(T/K) + A_3\ln(T/K) + A_4(x_A{}^2 + nx_B{}^2)/(T/K) \qquad [44]$$

If the solid contains only component B, then $n = 0$ in eqn [42] to [44].

If the infinite dilution reference state is used, then:

$$RT \ln f_{x,B} = w(x_A{}^2 - 1) \qquad [45]$$

and [39] becomes

$$\Delta H_{AB}{}^\infty = nH_A{}^* + H_B{}^\infty - (n + 1)H_s{}^* \qquad [46]$$

where $\Delta H_{AB}{}^\infty$ is the enthalpy of melting and dissociation of solid compound A_nB to the infinitely dilute reference state of solute B in solvent A; $H_A{}^*$ and $H_B{}^\infty$ are the partial molar enthalpies of the solute and solvent at infinite dilution. Clearly, the integral of eqn [32] will have the same form as eqn [35], with $\Delta H_{AB}{}^\infty$ replacing $\Delta H_{AB}{}^*$, $\Delta C_p{}^\infty$ replacing ΔCp^*, and $x_A{}^2 - 1$ replacing $x_A{}^2$ in the last term.

See (5) and (11) for applications of these equations to experimental data.

(ii) Electrolytes

(a) Mole fraction scale

If the liquid phase is an aqueous electrolyte solution, and the solid is a salt hydrate, the above treatment needs slight modification. Using rational mean activity coefficients, eqn [34] becomes:

$$\ln\left\{\frac{x_B^{\nu}(1 - x_B)^n}{[1 + (\nu - 1)x_B]^{n+\nu}}\right\} - \ln\left\{\frac{n^n}{(n + \nu)^{n+\nu}}\right\} + \ln\left\{\left[\frac{f_B}{f_B^*}\right]^{\nu}\left[\frac{f_A}{f_A^*}\right]^n\right\}$$
$$= -\left\{\frac{\Delta H_{AB}^* - T^*\Delta C_p^*}{R}\right\}\left\{\frac{1}{T} - \frac{1}{T^*}\right\} + \frac{\Delta Cp^*}{R}\ln(T/T^*) \qquad [47]$$

where superscript * indicates the pure salt hydrate. If it is assumed that the activity coefficients follow the same temperature dependence as the right-hand side of eqn [47] (13-16), the thermochemical quantities on the right-hand side of eqn [47] are not rigorous thermodynamic enthalpies and heat capacities, but are apparent quantities only. Data on activity coefficients (9) in concentrated solutions indicate that the terms involving these quantities are not negligible, and their dependence on temperature and composition along the solubility-temperature curve is a subject of current research.

A similar equation (with $\nu = 2$ and without the heat capacity terms or activity coefficients) has been used to fit solubility data for some MOH-H_2O systems, where M is an alkali metal (13); enthalpy values obtained agreed well with known values. The full equation has been deduced by another method in (14) and applied to MCl_2-H_2O systems in (14) and (15). For a summary of the use of equation [47] and similar equations, see (14).

(2) Molality scale

Substitution of the mean activities on the molality scale in eqn [40] gives:

$$\nu\ln\left\{\frac{\gamma_{\pm}m_B}{\gamma_{\pm}^* m_B^*}\right\} - \nu(m_B/m_B^* - 1) - \nu\{m_B(\phi - 1)/m_B^* - \phi^* + 1\}$$
$$= G(T) \qquad [48]$$

where $G(T)$ is the same as in eqn [47], $m_B^* = 1/nM_A$ is the molality of the anhydrous salt in the pure salt hydrate and $\gamma_{\pm}$ and ϕ are the mean activity coefficient and the osmotic coefficient, respectively. Use of the osmotic coefficient for the activity of the solvent leads, therefore, to an equation that has a different appearance to [47]; the content is identical. However, while eqn [47] can be used over the whole range of composition ($0 \leq x_B \leq 1$), the molality in eqn [48] becomes infinite at $x_B = 1$; use of eqn [48] is therefore confined to solutions sufficiently dilute that the molality is a useful measure of composition. The essentials of eqn [48] were deduced by Williamson (17); however, the form used here appears first in the *Solubility Data Series*. For typical applications (where activity and osmotic coefficients are not considered explicitly, so that the enthalpies and heat capacities are apparent values, as explained above), see (18).

The above analysis shows clearly that a rational thermodynamic basis exists for functional representation of solubility-temperature curves in two-component systems, but may be difficult to apply because of lack of experimental or theoretical knowledge of activity coefficients and partial molar enthalpies. Other phenomena which are related ultimately to the stoichiometric activity coefficients and which complicate interpretation include ion pairing, formation of complex ions, and hydrolysis. Similar considerations hold for the variation of solubility with pressure, except that the effects are relatively smaller at the pressures used in many investigations of solubility (5).

(*b*) *Solubility as a function of composition.*

At constant temperature and pressure, the chemical potential of a saturating solid phase is constant:

$$\mu_{A_nB}^* = \mu_{A_nB}(\text{sln}) = n\mu_A + \mu_B \qquad [49]$$
$$= (n\mu_A^* + \nu_+\mu_+^{\infty} + \nu_-\mu_-^{\infty}) + nRT\ln f_A x_A$$
$$+ \nu RT\ln(\gamma_{\pm}m_{\pm}Q)$$

for a salt hydrate A_nB which dissociates to water (A), and a salt (B), one mole of which ionizes to give ν_+ cations and ν_- anions in a solution in which other substances (ionized or not) may be present. If the saturated solution is sufficiently dilute, $f_A = x_A = 1$, and the quantity K_s in

$$\Delta G^{\infty} = (\nu_+\mu_+^{\infty} + \nu_-\mu_-^{\infty} + n\mu_A^* - \mu_{AB}^*)$$
$$= -RT\ln K_s$$

$$= -\nu RT \ln(Q\gamma_{\pm}m_B) \qquad [50]$$

is called the *solubility product* of the salt. (It should be noted that it is not customary to extend this definition to hydrated salts, but there is no reason why they should be excluded.) Values of the solubility product are often given on mole fraction or concentration scales. In dilute solutions, the theoretical behaviour of the activity coefficients as a function of ionic strength is often sufficiently well known that reliable extrapolations to infinite dilution can be made, and values of K_S can be determined. In more concentrated solutions, the same problems with activity coefficients that were outlined in the section on variation of solubility with temperature still occur. If these complications do not arise, the solubility of a hydrate salt $C_\nu A_\nu \cdot nH_2O$ in the presence of other solutes is given by eqn [50] as

$$\nu \ln\{m_B/m_B(0)\} \simeq -\nu\ln\{\gamma_{\pm}/\gamma_{\pm}(0)\} - n \ln\{a_A/a_A(0)\} \qquad [51]$$

where a_A is the activity of water in the saturated solution, m_B is the molality of the salt in the saturated solution, and (0) indicates absence of other solutes. Similar considerations hold for non-electrolytes.

Consideration of *complex mixed ligand equilibria* in the solution phase are also frequently of importance in the interpretation of solubility equilibria. For nomenclature connected with these equilibria (and solubility equilibria as well), see (19, 20).

The Solid Phase

The definition of solubility permits the occurrence of a single solid phase which may be a pure anhydrous compound, a salt hydrate, a non-stoichiometric compound, or a solid mixture (or solid solution, or "mixed crystals"), and may be stable or metastable. As well, any number of solid phases consistent with the requirements of the phase rule may be present. Metastable solid phases are of widespread occurrence, and may appear as polymorphic (or allotropic) forms or crystal solvates whose rate of transition to more stable forms is very slow. Surface heterogeneity may also give rise to metastability, either when one solid precipitates on the surface of another, or if the size of the solid particles is sufficiently small that surface effects become important. In either case, the solid is not in stable equilibrium with the solution. See (21) for the modern formulation of the effect of particle size on solubility. The stability of a solid may also be affected by the atmosphere in which the system is equilibrated.

Many of these phenomena require very careful, and often prolonged, equilibration for their investigation and elimination. A very general analytical method, the "wet residues" method of Schreinemakers (22), is often used to investigate the composition of solid phases in equilibrium with salt solutions. This method has been reviewed in (23), where [see also (24)] least-squares methods for evaluating the composition of the solid phase from wet residue data (or initial composition data) and solubilities are described. In principle, the same method can be used with systems of other types. Many other techniques for examination of solids, in particular X-ray, optical, and thermal analysis methods, are used in conjunction with chemical analyses (including the wet residues method).

COMPILATIONS AND EVALUATIONS

The formats for the compilations and critical evaluations have been standardized for all volumes. A brief description of the data sheets has been given in the FOREWORD; additional explanation is given below.

Guide to the Compilations

The format used for the compilations is, for the most part, self-explanatory. The details presented below are those which are not found in the FOREWORD or which are not self-evident.

Components. Each component is listed according to IUPAC name, formula, and Chemical Abstracts (CA) Registry Number. The formula is given either in terms of the IUPAC or Hill (25) system and the choice of formula is governed by what is usual for most current users: i.e., IUPAC for inorganic compounds, and Hill system for organic compounds. Components are ordered according to:

(a) saturating components;
(b) non-saturating components in alphanumerical order;
(c) solvents in alphanumerical order.

The saturating components are arranged in order according to a 18-column periodic table with two additional rows:

Columns 1 and 2: H, alkali elements, ammonium, alkaline earth elements
3 to 12: transition elements
13 to 17: boron, carbon, nitrogen groups; chalcogenides, halogens
18: noble gases
Row 1: Ce to Lu
Row 2: Th to the end of the known elements, in order of atomic number.

Salt hydrates are generally not considered to be saturating components since most solubilities are expressed in terms of the anhydrous salt. The existence of hydrates or solvates is carefully noted in the text, and CA Registry Numbers are given where available, usually in the critical evaluation. Mineralogical names are also quoted, along with their CA Registry Numbers, again usually in the critical evaluation.

Original Measurements. References are abbreviated in the forms given by *Chemical Abstracts Service Source Index* (CASSI). Names originally in other than Roman alphabets are given as transliterated by *Chemical Abstracts*.

Experimental Values. Data are reported in the units used in the original publication, with the exception that modern *names* for units and quantities are used; e.g., mass per cent for weight per cent; mol dm^{-3} for molar; etc. Both mass and molar values are given. Usually, only one type of value (e.g., mass per cent) is found in the original paper, and the compiler has added the other type of value (e.g., mole per cent) from computer calculations based on 1983 atomic weights (26).

Errors in calculations and fitting equations in original papers have been noted and corrected, by computer calculations where necessary.

Method. Source and Purity of Materials. Abbreviations used in *Chemical Abstracts* are often used here to save space.

Estimated Error. If these data were omitted by the original authors, and if relevant information is available, the compilers have attempted to estimate errors from the internal consistency of data and type of apparatus used. Methods used by the compilers for estimating and and reporting errors are based on the papers by Ku and Eisenhart (27).

Comments and/or Additional Data. Many compilations include this section which provides short comments relevant to the general nature of the work or additional experimental and thermodynamic data which are judged by the compiler to be of value to the reader.

References. See the above description for Original Measurements.

Guide to the Evaluations

The evaluator's task is to check whether the compiled data are correct, to assess the reliability and quality of the data, to estimate errors where necessary, and to recommend "best" values. The evaluation takes the form of a summary in which all the data supplied by the compiler have been critically reviewed. A brief description of the evaluation sheets is given below.

Components. See the description for the Compilations.

Evaluator. Name and date up to which the literature was checked.

Critical Evaluation

(a) Critical text. The evaluator produces text evaluating all the published data for each given system. Thus, in this section the evaluator reviews the merits or shortcomings of the various data. Only published data are considered; even published data can be considered only if the experimental data permit an assessment of reliability.

(b) Fitting equations. If the use of a smoothing equation is justifiable the evaluator may provide an equation representing the solubility as a function of the variables reported on all the compilation sheets.

(c) Graphical summary. In addition to (b) above, graphical summaries are often given.

(d) Recommended values. Data are *recommended* if the results of at least two independent groups are available and they are in good agreement, and if the evaluator has no doubt as to the adequacy and reliability of the applied experimental and computational procedures. Data are considered as *tentative* if only one set of measurements is

available, or if the evaluator considers some aspect of the computational or experimental method as mildly undesirable but estimates that it should cause only minor errors. Data are considered as *doubtful* if the evaluator considers some aspect of the computational or experimental method as undesirable but still considers the data to have some value in those instances where the order of magnitude of the solubility is needed. Data determined by an inadequate method or under ill-defined conditions are *rejected*. However references to these data are included in the evaluation together with a comment by the evaluator as to the reason for their rejection.

(e) References. All pertinent references are given here. References to those data which, by virtue of their poor precision, have been rejected and not compiled are also listed in this section.

(f) Units. While the original data may be reported in the units used by the investigators, the final recommended values are reported in S.I. units (1, 28) when the data can be accurately converted.

References

1. Whiffen, D.H., ed., *Manual of Symbols and Terminology for Physicochemical Quantities and Units*. *Pure Applied Chem.* 1979, 51, No. 1.
2. McGlashan, M.L. *Physicochemical Quantities and Units*. 2nd ed. Royal Institute of Chemistry. London. 1971.
3. Jänecke, E. *Z. Anorg. Chem.* 1906, 51, 132.
4. Friedman, H.L. *J. Chem. Phys.* 1960, 32, 1351.
5. Prigogine, I.; Defay, R. *Chemical Thermodynamics*. D.H. Everett, transl. Longmans, Green. London, New York, Toronto. 1954.
6. Guggenheim, E.A. *Thermodynamics*. North-Holland. Amsterdam. 1959. 4th ed.
7. Kirkwood, J.G.; Oppenheim, I. *Chemical Thermodynamics*. McGraw-Hill. New York, Toronto, London. 1961.
8. Lewis, G.N.; Randall, M. (rev. Pitzer, K.S.; Brewer, L.). *Thermodynamics*. McGraw Hill. New York, Toronto, London. 1961. 2nd. ed.
9. Robinson, R.A.; Stokes, R.H. *Electrolyte Solutions*. Butterworths. London. 1959. 2nd ed.
10. Harned, H.S.; Owen, B.B. *The Physical Chemistry of Electrolytic Solutions*. Reinhold. New York. 1958. 3rd ed.
11. Haase, R.; Schönert, H. *Solid-Liquid Equilibrium*. E.S. Halberstadt, trans. Pergamon Press, London, 1969.
12. McGlashan, M.L. *Chemical Thermodynamics*. Academic Press. London. 1979.
13. Cohen-Adad, R.; Saugier, M.T.; Said, J. *Rev. Chim. Miner.* 1973, *10*, 631.
14. Counioux, J.-J.; Tenu, R. *J. Chim. Phys.* 1981, *78*, 815.
15. Tenu, R.; Counioux, J.-J. *J. Chim. Phys.* 1981, *78*, 823.
16. Cohen-Adad, R. *Pure Appl. Chem.* 1985, *57*, 255.
17. Williamson, A.T. *Faraday Soc. Trans.* 1944, *40*, 421.
18. Siekierski, S.; Mioduski, T.; Salomon, M. *Solubility Data Series*. Vol. 13. *Scandium, Yttrium, Lanthanum and Lanthanide Nitrates*. Pergamon Press. 1983.
19. Marcus, Y., ed. *Pure Appl. Chem.* 1969, *18*, 459.
20. IUPAC Analytical Division. *Proposed Symbols for Metal Complex Mixed Ligand Equilibria (Provisional)*. *IUPAC Inf. Bull.* 1978, No. 3, 229.
21. Enüstün, B.V.; Turkevich, J. *J. Am. Chem. Soc.* 1960, 82, 4502.
22. Schreinemakers. F.A.H. *Z. Phys. Chem., Stoechiom. Verwandschaftsl.* 1893, 11, 75.
23. Lorimer, J.W. *Can. J. Chem.* 1981, 59, 3076.
24. Lorimer, J.W. *Can. J. Chem.* 1982, *60*, 1978.
25. Hill, E.A. *J. Am. Chem. Soc.* 1900, 22, 478.
26. IUPAC Commission on Atomic Weights. *Pure Appl. Chem.* 1984, 56, 653.
27. Ku, H.H., p. 73; Eisenhart, C., p. 69; in Ku, H.H., ed. *Precision Measurement and Calibration*. NBS Special Publication 300. Vol. 1. Washington. 1969.
28. *The International System of Units*. Engl. transl. approved by the BIPM of *Le Système International d'Unités*. H.M.S.O. London. 1970.

September, 1986

R. Cohen-Adad,
Villeurbanne, France

J. W. Lorimer,
London, Ontario, Canada

M. Salomon,
Fair Haven, New Jersey, U.S.A.

Table I-1

Quantities Used as Measures of Solubility of Solute B
Conversion Table for Multicomponent Systems
Containing Solvent A and Solutes s

	mole fraction x_B =	mass fraction w_B =	molality m_B =	concentration c_B =
x_B	x_B	$\dfrac{M_B x_B}{M_A + \sum_s (M_s - M_A) x_s}$	$\dfrac{x_B}{M_A (1 - \sum_s x_s)}$	$\dfrac{\rho x_B}{M_A + \sum_s (M_s - M_A) x_s}$
w_B	$\dfrac{w_B/M_B}{1/M_A + \sum_s (1/M_s - 1/M_A) w_s}$	w_B	$\dfrac{w_B}{M_B (1 - \sum_s w_s)}$	$\rho w_B / M_B$
m_B	$\dfrac{M_A m_B}{1 + M_A \sum_s m_s}$	$\dfrac{M_B m_B}{1 + \sum_s m_s M_s}$	m_B	$\dfrac{\rho m_B}{1 + \sum_s M_s m_s}$
c_B	$\dfrac{M_A c_B}{\rho + \sum_s (M_A - M_s) c_s}$	$M_B c_B / \rho$	$\dfrac{c_B}{\rho - \sum_s M_s c_s}$	c_B

ρ = density of solution
M_A, M_B, M_s = molar masses of solvent, solute B, other solutes s
Formulas are given in forms suitable for rapid computation; all calculations should be made using SI base units.

COMPONENTS:	EVALUATOR:
(1) Beryllium perchlorate; $Be(ClO_4)_2$; [13597-95-0]	C.Y. Chan
(2) Water; H_2O; [7732-18-5]	Department of Chemistry
	University of Malaya
	Kuala Lumpur, Malaysia
	March, 1987

CRITICAL EVALUATION:

SOLUBILITY OF BERYLLIUM PERCHLORATE IN WATER

Data for the solubility of $Be(ClO_4)_2$ in water, with its tetrahydrate $Be(ClO_4)_2.4H_2O$ [7787-48-6] as the solid phase have been reported by Lilich and Dzhurinsky (1), Tamm et al (2,3) and Sidgwick and Lewis(4). The value 8.26 mol kg^{-1} at 298 K reported in (1) agrees with the value 8.22 mol kg^{-1} (compiler) from the work of Tamm et al within the estimated experimental uncertainties (± 0.3% of soly value, compiler). The good agreement between these values from the two independent groups, who used different analytical methods in the solubility determinations, should lend support to the credibility of their other results. The value of 7.07 mol kg^{-1} calculated from Sidgwick and Lewis' data is too low by comparison, and since no details of salt purity and method of determination were reported by them, their data are probably erroneous.

Recommended value at 298 K

The recommended value for the solubility of beryllium perchlorate in water at 298 K is 8.24 mol kg^{-1} (12.93 mol %), when the solid phase in equilibrium with the saturated solution is $Be(ClO_4)_2.4H_2O$. The experimental uncertainty is ± 0.3% of the solubility value.

Solubility at various temperatures

Only one investigation of the variation of the solubility of $Be(ClO_4)_2$ in water with temperature has been reported, that by Lilich and Dzhurinsky (1). They reported a linear plot of log x versus T^{-1} , where x is the mol fraction of $Be(ClO_4)_2.4H_2O$ as the solute and T the temperature. Linear regression analysis (evaluator) on their data combined with the data at 298 K from (2,3) gave the following best-fit equation with a regression coefficient of 0.988,

$$\ln x = -94.8\ (T/K)^{-1} - 1.725 \qquad (1)$$

where x = mol fraction of $Be(ClO_4)_2$. The standard errors in the gradient and the intercept are 4.7 and 0.017 respectively. This empirical equation gives values of x to within ± 0.45 % of the observed values over the temperature range 273 - 323 K, but does not take account of the fact that the electrolyte is dissociated into its ions in solution. Based on a more appropriate theoretical treatment given in (5) and the INTRODUCTION to this Volume, and assuming that terms involving variation of activity

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Beryllium perchlorate; $Be(ClO_4)_2$; [13597-95-0]	C.Y. Chan
(2) Water; H_2O; [7732-18-5]	Department of Chemistry
	University of Malaya
	Kuala Lumpur, Malaysia
	March, 1987

CRITICAL EVALUATION: (continued)

coefficients with solubility and temperature have the same form, an improved fit can be obtained (evaluator) using the equation

$$F(x) = a(T/\mathrm{K})^{-1} + b \ln (T/\mathrm{K}) + c \qquad (2)$$

where $F(x) = \ln [x^{\nu}(1-x)^{n}/(1 + (\nu-1)x)^{n+\nu}]$,

$a = -[(\Delta H - T^{*} \Delta C_p^{*})/R]$, $b = \Delta C_p^{*}/R$,

$c = \ln [n^{n}/(n + \nu)^{n+\nu}] - a(T^{*}/\mathrm{K})^{-1} + b \ln (T^{*}/\mathrm{K})^{-1}$,

ΔH = composite of the enthalpies of melting, dissolution and dissociation of $Be(ClO_4)_2.4H_2O$ in its infinitely dilute aqueous solution,

T^{*} = congruent melting-point of the tetrahydrate, and

ΔC_p^{*} = molar heat capacity change accompanying fusion plus dissociation of the tetrahydrate at the congruent melting-pt.

For $Be(ClO_4)_2$, ν=3, with n=4 for the tetrahydrate. Regression analysis on the data from (1) and the values at 298 K from (2,3) yielded a = 285.6 , b = 1.2702 , and c = -16.495 , with a regression coefficient of 0.995 and the std. error of the Y estimate = 0.002. The corresponding equation in terms of molality is given by

$$F(m) = \ln m + (1 + n/\nu) \ln(\nu M(H_2O) + 1)$$

$$= 95.31(T/\mathrm{K})^{-1} + 0.4235 \ln (T/\mathrm{K}) - 1.4825 \qquad (3)$$

with a regression coefficient of 0.995 and std. error of the Y estimate being 0.0006. Equations (2) and (3) can be used to calculate solubility in terms of mol fraction of the perchlorate and molality, respectively, to within about $\pm$0.25% of the observed value at the given temperature, except for the value at 313 K, but within the probable experimental uncertainties. Table 1 lists tentative smoothed values of solubility of beryllium perchlorate (solid phase $Be(ClO_4)_2.4H_2O$) in water at various selected temperatures. The std. deviation of observed values from calculated values is 0.02 mol % for soly in mol % and for molality values 0.014 mol kg^{-1} .

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Beryllium perchlorate; $Be(ClO_4)_2$; [13597-95-0]	C.Y. Chan Department of Chemistry University of Malaya Kuala Lumpur, Malaysia
(2) Water; H_2O; [7732-18-5]	March, 1987

CRITICAL EVALUATION: (continued)

Table 1. Tentative smoothed solubility data for $Be(ClO_4)_2$ in water at selected temperatures, based on equation (2).

T/K	Solubility	
	mol %	mol kg^{-1}
273.15	12.63	8.03
278.15	12.69	8.07
283.15	12.74	8.11
288.15	12.80	8.15
293.15	12.87	8.20
298.15	12.93 ± 0.03[a]	8.24 ± 0.02[a]
303.15	13.01	8.30
308.15	13.08	8.36
313.15	13.16	8.41
318.15	13.25	8.47
323.15	13.33	8.54

[a] Recommended value.

TERNARY SYSTEMS

$Be(ClO_4)_2$-NH_4ClO_4-H_2O :

The only investigation of this system is that reported by Tamm, Serezkina and Novoselova (2) at 298 K. While their soly results for $Be(ClO_4)_2$ and NH_4ClO_4 in water alone are in good agreement with those of other workers, the phase diagram given in Fig. 1 in the Compilation for this system should be considered as tentative only, until such time as when suitable data from other sources are available for comparison. So are the values (compiler) for the isothermal invariant solubilities of beryllium perchlorate and ammonium perchlorate in water at 298 K in the presence of both solids, $Be(ClO_4)_2 \cdot 4H_2O$ and NH_4ClO_4, which are 7.89 ± 0.06 mol kg^{-1} and 0.792 ± 0.014 mol kg^{-1} , respectively.

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Beryllium perchlorate; $Be(ClO_4)_2$; [13597-95-0]	C.Y. Chan Department of Chemistry University of Malaya Kuala Lumpur, Malaysia
(2) Water; H_2O; [7732-18-5]	March, 1987

CRITICAL EVALUATION: (continued)

$Be(ClO_4)_2$-$HClO_4$-H_2O :
The only investigation of this system was that by Serezkhina et al (3). The phase diagram given in Fig. 1 of the Compilation of this system is incomplete. At the isothermal invariant point, when the solid phases in equilibrium with the saturated solution are $Be(ClO_4)_2 \cdot 4H_2O$ and $HClO_4 \cdot H_2O$, the solution composition (tentative) at 298 K is as follows: $Be(ClO_4)_2$ 0.682 $\pm$ 0.002 mol kg^{-1} and $HClO_4$ 35.6 $\pm$ 0.3 mol kg^{-1} (compiler).

REFERENCES

1. Lilich, L.S.; Dzhurinsky, B.F. *Zh. Obshchei Khim.* 1956, *26*, 1549; *J. Gen. Chem. USSR (Engl. Transl.)* 1956, *26*, 1733.

2. Tamm, N.S.; Serezhkina, L.B.; Novoselova, A.V. *Zh. Neorg. Khim.* 1971, *16*, 571; *Russ. J. Inorg. Chem. (Engl. Transl.)* 1971, *16*, 306.

3. Serezhkina, L.B.; Tamm, N.S.; Grigorovich, Z.I.; Novoselova, A.V. *Zh. Neorg. Khim.* 1973, *18*, 513; *Russ. J. Inorg. Chem. (Engl. Transl.)* 1973, *18*, 269.

4. Sidwick, N.V.; Lewis, N.B. *J. Chem. Soc.* 1926, 1287.

5. Cohen-Adad, R.; Saugier, M.T.; Said, J. *Rev. Chim. Miner.* 1973, *10*, 631.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Beryllium perchlorate; $Be(ClO_4)_2$; [13597-95-0] (2) Water; H_2O; [7732-18-5]	Lilich, L.S.; Dzhurinsky, B.F. *Zh. Obshchei Khim.* 1956, *26*, 1549-53; **J. Gen. Chem. USSR (Engl. Transl.)* 1956, *26*, 1733-7.
VARIABLES: Temperature: 273 - 323 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

Solubility of beryllium perchlorate in water at various temperatures, the solid phase being $Be(ClO_4)_2.4H_2O$:

t/°C	mol %[a]	molality/mol kg^{-1}	t/°C	mol %[a]	molality/mol kg^{-1}
0	12.62	8.02	30	12.99	8.29
5	12.71	8.08	35	13.08	8.35
10	12.73	8.10	40	13.21	8.45
15	12.82	8.16	45	13.25	8.48
20	12.87	8.20	50	13.31	8.52
25	12.95	8.26			

[a] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solid tetrahydrate was stirred continuously with solvent in the solubilization chamber of the soly apparatus (sketch given in original publication) which was placed in a "Hoppler ultrathermostat". Solution samples were sunction-filtered through a porous filter and forced into small weighed glass containers using a rubber bulb-and-tube arrangement. Perchlorate was analysed by precipitation as $KClO_4$ in anhy. alcohol (ref.1). The time required for saturation equilibrium was 1-4 h, as determined by successive withdrawal of samples at various time intervals for analysis. Solid samples were withdrawn from the soly chamber with a glass sleeve, pressed with filter paper between metal plates which were heated or cooled to approx. the temperature of the soly determination. The weighed samples were then analysed for perchlorate.

SOURCE AND PURITY OF MATERIALS:

$Be(ClO_4)_2.4H_2O$ was prepared by dissolving "pure grade" $BeCO_3$ in the equivalent amount of $HClO_4$ followed by 2-3 recrystallizations. Source and purity not stated.

ESTIMATED ERROR:

Not stated. Precision in soly probably $\pm$0.02 mol kg^{-1}(compiler).

REFERENCES:

1. Chaney, A.L.; Mann, A. *J. Phys. Chem.* 1931, *35*, 2289.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Beryllium perchlorate; $Be(ClO_4)_2$; [13597-95-0]	Lilich, L.S.; Dzhurinsky, B.F.
(2) Water; H_2O; [7732-18-5]	*Zh. Obshchei Khim.* 1956, *26*, 1549-53; **J. Gen. Chem. USSR (Engl. Transl.)* 1956, *26*, 1733-7.

EXPERIMENTAL VALUES:(continued)

COMMENTS AND/OR ADDITIONAL DATA

The authors reported a linear plot of log x versus $(T/K)^{-1}$, where x was the mol fraction of $Be(ClO_4)_2.4H_2O$ as the solute. A linear least squares analysis of their data (compiler) gave a value of -0.9920 for the correlation coefficient and the best-fit equation as follows:

$$\ln x = A (T/K)^{-1} + B$$

where x = mol fraction of $Be(ClO_4)_2$, A = -95.0 and B = -1.724 . The std. deviations in A and B were 4.0 and 0.014 respectively. Within the temperature range studied, this equation gives calculated solubility values to within $\pm$0.3% of the observed values of x.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Beryllium perchlorate; $Be(ClO_4)_2$; [13597-95-0]	Sidgwick, N.V.; Lewis, N.B.
(2) Water; H_2O; [7732-18-5]	*J. Chem. Soc.* 1926, 1287-1302.
VARIABLES:	PREPARED BY:
Temperature: 273 - 323 K	C.Y. Chan

EXPERIMENTAL VALUES:

The solubility of beryllium perchlorate in water at 25°C was 59.5 g(1)/100g sln., the solid phase being $Be(ClO_4)_2.4H_2O$; [7787-48-6]. The corresponding mol% and molality values (compiler's calculations) are 11.30% and 7.07 mol kg^{-1} .

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
No details given.	Not stated.
	ESTIMATED ERROR: Not stated.
	REFERENCES:

COMPONENTS:

(1) Beryllium perchlorate; $Be(ClO_4)_2$; [13597-95-0]

(2) Perchloric acid; $HClO_4$; [7601-90-3]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Serezhkina, L.B.; Tamm, N.S.; Grigorovich, Z.I.; Novoselova, A.V.

Zh. Neorg. Khim. 1973, *18*, 513-7; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1973, *18*, 269-71.

VARIABLES:

One temperature: 298 K

Composition

PREPARED BY:

C.Y. Chan

EXPERIMENTAL VALUES:

Solubility system $Be(ClO_4)_2$-$HClO_4$-H_2O at 25°C :

Liquid phase composition						Solid phase
mass %		mol %[a]		Solute mol %[a]		
(1)	(2)	(1)	(2)	(1)	(2)	
63.09	-	12.900	-	100.00	-	$Be(ClO_4)_2.4H_2O$
55.02	7.92	11.023	3.284	77.05	22.95	"
48.25	14.41	9.479	5.859	61.80	38.20	"
39.94	24.57	7.982	10.16	43.99	56.01	"
20.78	45.27	4.104	18.51	18.15	81.85	"
15.44	51.50	3.066	21.17	12.65	87.35	"
6.16	62.47	1.238	25.99	4.55	95.45	"
4.16	67.69	0.887	29.86	2.88	97.12	"
3.02	75.80	0.747	38.80	1.89	98.11	"

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The "isothermal dissolution" method was used. All operations with (1), (2) and $HClO_4.H_2O$ were carried out in a nitrogen atmosphere in a dry-box. The acid was stored at -78°C in jacketted vessels with ground-glass stoppers. The soly vessels were specially constructed to exclude atmospheric moisture during dissolution and sampling processes, and 5-7h allowed for attainment of equilibrium. Both liquid and "wet solid" phases were analysed for Be^{2+}, determined gravimetrically as $[Co(NH_3)_6]_2[Be_4O(CO_3)_6].10H_2O$, (ref. 2,3) and for ClO_4^- by precipitation as nitron perchlorate (ref.4). The compositions of the solid phases were determined using Schreinemakers' method. When anhydrous (2) was used as solvent, saturation was carried

SOURCE AND PURITY OF MATERIALS:

$Be(ClO_4)_2.4H_2O$ crystals were obtained by reaction of $BeCO_3$ with commercial 57% perchloric acid and recrystallization from the acid sln. Analysis of the salt gave : mass % Be 3.20%; ClO_4 71.30%; H_2O 25.50%. Anhydrous (2) was prepared by vacuum distillation from a mixture of $HClO_4.2H_2O$ and oleum (ref.5) and was 100.00 ± 0.05% pure. The acid dihydrate was prepared by vacuum distillation of the commercial acid; the acid monohydrate prepared from a mixture of the anhy. acid and its dihydrate.

ESTIMATED ERROR:

Not stated.

(continued next page)

COMPONENTS:

(1) Beryllium perchlorate; $Be(ClO_4)_2$; [13597-95-0]

(2) Perchloric acid; $HClO_4$; [7601-90-3]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Serezhkina, L.B.; Tamm, N.S.; Grigorovich, Z.I.; Novoselova, A.V.

Zh. Neorg. Khim. 1973, *18*, 513-7; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1973, *18*, 269-71.

EXPERIMENTAL VALUES:(continued)

Solubility system $Be(ClO_4)_2$-$HClO_4$-H_2O at 25°C :(continued)

Liquid phase composition						Solid phase
mass %		mol %[a]		Solute mol %[a]		
(1)	(2)	(1)	(2)	(1)	(2)	
3.01	75.70	0.742	38.65	1.88	98.12	$Be(ClO_4)_2.4H_2O$ + $HClO_4.H_2O$
3.00	75.87	0.743	38.88	1.87	98.13	" "
3.01	75.76	0.744	38.73	1.88	98.12	$HClO_4.H_2O$
-	79.00[b]	-	40.29	-	100.00	"
-	92.23[b]	-	68.04	-	100.00	"
3.53	88.25	1.256	64.99	1.90	98.10	"
5.43	86.61	1.963	64.82	2.94	97.06	"
10.78	79.90	3.800	58.29	6.12	93.88	"
18.03	72.10	6.413	53.07	10.78	89.22	"
24.01	64.00	8.143	44.92	15.35	84.65	"
23.87	64.11	8.084	44.94	15.25	84.75	$Be(ClO_4)_2.4H_2O$ + $HClO_4.H_2O$
24.00	63.96	8.127	44.82	15.35	84.65	" "
23.91	64.13	8.114	45.04	15.26	84.74	" "
24.07	64.01	8.184	45.04	15.38	84.62	$Be(ClO_4)_2.4H_2O$
27.27	61.64	9.642	45.11	17.61	82.39	"
32.24	56.42	11.519	41.72	21.64	78.36	"
34.50	53.53	12.172	39.09	23.75	76.25	"

[a] Compiler's calculations. [b] Wyk's data (ref.1)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:(cont.)

out in the presence of solid $Be(ClO_4)_2.4H_2O$, and of its mixture with solid $HClO_4.H_2O$. When water was the solvent, saturation was carried out in $Be(ClO_4)_2$ solutions, and vice versa.

REFERENCES:

1. Wyk, H.J. *Z. Anorg. Chem.* 1902, *32*, 115.
2. Freeth, F.A. *Recl. Trav. Chim. Pays-Bays.* 1924, *43*, 476.
3. Pirtea, Th.J.; Michail, J. *Z. Analyt. Chem.* 1958, *159*, 205.
4. Loeblich, O. *Z. Analyt. Chem.* 1926, *68*, 34.
5. Rosolovskii, V.Ya. *Khimiya Bezvodnoi Khlornoi Kisloty*, Izd. Nauka., Moscow, 1966.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Beryllium perchlorate; $Be(ClO_4)_2$; [13597-95-0]	Serezhkina, L.B.; Tamm, N.S.; Grigorovich, Z.I.; Novoselova, A.V.
(2) Perchloric acid; $HClO_4$; [7601-90-3]	*Zh. Neorg. Khim.* 1973, *18*, 513-7; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1973, *18*, 269-71.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES:(continued)

COMMENTS AND/OR ADDITIONAL DATA

The authors contended that the isothermal phase diagram (Fig.1) for this solubility system consisted of the isotherms of the partial systems $Be(ClO_4)_2.4H_2O$-H_3OClO_4-H_2O and $Be(ClO_4)_2.4H_2O$-H_3OClO_4-$HClO_4$. For the first partial system, the solubility of $Be(ClO_4)_2.4H_2O$ in aqueous $HClO_4$ solutions decreased with increase in acid concentration until the isothermal invariant point was reached when the solid phase in equilibrium consisted of the solid tetrahydrate and solid $HClO_4.H_2O$. At this point the solubility of the salt was 0.682 ± 0.002 mol kg^{-1} while that of the acid monohydrate was 35.6 ± 0.3 mol kg^{-1} (compiler). For the latter partial system, the authors contended that all the water molecules in solution were bound up in the form of the H_3O^+ and $Be(H_2O)_4^{2+}$ ions. Ion association aspects of the complex species in solution were not considered.

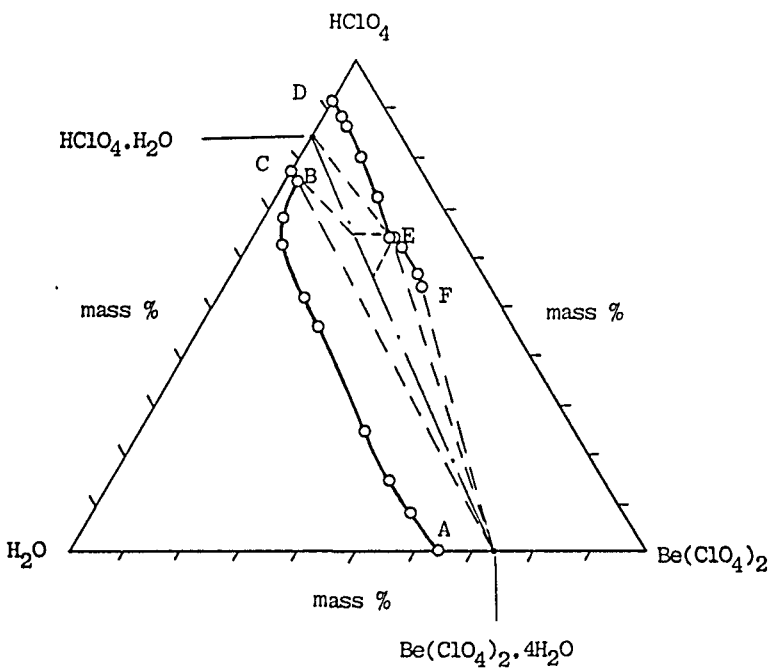


Figure 1. Isothermal phase diagram for the system $Be(ClO_4)_2$-$HClO_4$-H_2O at 298 K.
ABC — $Be(ClO_4)_2.4H_2O$-H_3OClO_4-H_2O isotherm.
DEF — $Be(ClO_4)_2.4H_2O$-H_3OClO_4-$HClO_4$ isotherm.
o — sat. sln.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Beryllium perchlorate; $Be(ClO_4)_2$; [13597-95-0]	Lilich, L.S.; Dzhurinsky, B.F.
(2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	*Zh. Neorg. Khim.* 1971, *16*, 571-2; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1971, *16*, 306-7.
(3) Water; H_2O; [7732-18-5]	
VARIABLES:	PREPARED BY:
One temperature: 298 K	C.Y. Chan
Composition	

EXPERIMENTAL VALUES:

Solubility system $Be(ClO_4)_2$-NH_4ClO_4-H_2O at 25°C :

Liquid phase composition							Solid phase
mass %			mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(3)	(1)	(2)	(1)	(2)	
-	19.99	80.01	-	3.690	-	2.127	NH_4ClO_4
10.54	11.33	78.13	1.131	2.151	0.649	1.234	"
28.27	4.17	67.56[b]	3.467	0.905	2.013	0.525	"
37.21	3.93	58.86	5.143	0.961	3.041	0.568	"
50.38	4.13	45.49	8.646	1.254	5.327	0.773	"
59.16	3.71	37.13	11.970	1.328	7.663	0.851	"

[a] Compiler's calculations.

[b] Original value was 76.56; value corrected (compiler) assuming values for (1) and (2) correct.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The "isothermal dissolution" method was used, allowing 70h for attainment of equilibrium at 25°C. Samples of the liquid phases were withdrawn with glass pipettes fitted with filter nozzles and solid phases were withdrawn with glass filters. These were analysed for Be gravimetrically as $[Co(NH_3)_6]_2[Be_4O(CO_3)_6].10H_2O$ (ref.1-2), and for total perchlorate gravimetrically by precipitation with nitron (ref.3). Solid phases were determined using Schreinemakers' method and checked by X-ray diffraction (ref.4).

SOURCE AND PURITY OF MATERIALS:

Hydrated (1) was prepared by reacting beryllium carbonate with 57% perchloric acid, followed by double recrystallization. Purity of the acid and carbonate not stated. Analysis of the prepared hydrate gave the composition : Be 3.20%, ClO_4 71.30%, H_2O 25.5% (by difference).

(2) was prepared by neutralization of the acid with ammonia (purity not stated). Analysis gave : NH_4 15.19%, ClO_4 84.81%.

ESTIMATED ERROR:

Compiler's estimate: errors in analyses probably ranged from 0.3% - 1%, depending on sample concentration.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Beryllium perchlorate; $Be(ClO_4)_2$; [13597-95-0]	Lilich, L.S.; Dzhurinsky, B.F.
(2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	*Zh. Neorg. Khim.* 1971, *16*, 571-2; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1971, *16*, 306-7.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES:(continued)

Solubility system $Be(ClO_4)_2$-NH_4ClO_4-H_2O at 25°C :(continued)

Liquid phase composition							Solid phase
mass %			mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(3)	(1)	(2)	(1)	(2)	
59.79	3.38	36.83	12.182	1.219	7.808	0.781	NH_4ClO_4 + $Be(ClO_4)_2.4H_2O$
60.03	3.41	36.56	12.301	1.237	7.897	0.794	" "
59.98	3.48	36.54	12.295	1.262	7.895	0.811	" "
60.23	3.35	36.42	12.381	1.219	7.954	0.783	" "
60.19	3.31	36.50	12.352	1.202	7.931	0.772	$Be(ClO_4)_2.4H_2O$
63.09	-	36.91	12.900	-	8.221	-	"

[a] Compiler's calculations.

COMMENTS AND/OR ADDITIONAL DATA

The solubility isotherm (Fig.1) at 25°C for the above mentioned ternary system consists of two branches, one corresponding to the crystallization of anhydrous ammonium perchlorate and the other to that of beryllium perchlorate tetrahydrate. No double salt and solid solution were observed. The isothermal invariant solubilities of $Be(ClO_4)_2.4H_2O$ and NH_4ClO_4 in water at 25°C in equilibrium with both salts in their solid phases are 7.89 ± 0.06 mol kg^{-1} and 0.792 ± 0.014 mol kg^{-1} respectively (compiler).

AUXILIARY INFORMATION

REFERENCES:

1. Freeth, F.A. *Recl. Trav. Chim. Pays-Bas.* 1924, *43*, 475.
2. Pirtea, T.J.; Michail, J. *Z. Analyt. Chem.* 1958, *159*, 205.
3. Loeblich, O. *Z. Analyt. Chem.* 1926, *68*, 34.
4. Serezhkina, V.N.; Novoselova, A.V. *Russ. J. Inorg. Chem.* 1971, *16*, 1539.

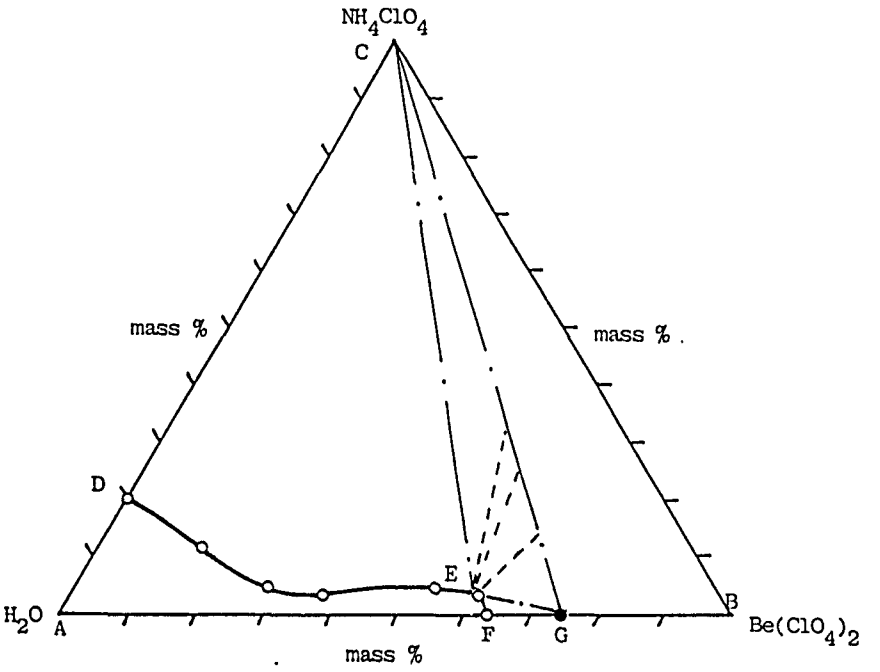
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Beryllium perchlorate; $Be(ClO_4)_2$; [13597-95-0]	Lilich, L.S.; Dzhurinsky, B.F.
(2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	*Zh. Neorg. Khim.* 1971, *16*, 571-2; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1971, *16*, 306-7.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES:(continued)

Figure 1. Isothermal phase diagram for the system $Be(ClO_4)_2$-NH_4ClO_4-H_2O at 298 K.

Region	Phases in equilibrium
CDE	solution + solid NH_4ClO_4
CEG	" + " " + $Be(ClO_4)_2.4H_2O$
EFG	" + " $Be(ClO_4)_2.4H_2O$



COMPONENTS:	EVALUATORS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	I.N. Lepeshkov ; E.S. Gryzlova
(2) Water; H_2O; [7732-18-5]	Institute Obshchej i Neorganicheskoi Khimii AN SSSR, Moscow.
(3) Other solvents	April, 1986

CRITICAL EVALUATION:

[Editor's note : This evaluation has been substantially revised by one of the editors (K.H. Khoo) who also evaluated the solubility of $Mg(ClO_4)_2$ in binary systems.]

Binary systems

1. Solubility in water at 298 K

In common with other Group IIA metal perchlorate solubility systems, the data for $Mg(ClO_4)_2$ systems are found predominantly in Russian journals, with only three publications found elsewhere. Almost without exception, the experimental information given is either lacking (1-4) or vague (5-8). While a few papers quote the precision of temperature control, only one paper (9) gives the estimated errors in the solubility analyses. The experimental method used to determine the solubility is invariably the analytical method in which magnesium is analyzed titrimetrically with ethylenediaminetetraacetic acid, EDTA (sometimes named Trilon B). There is no mention about the criterion used to ascertain the attainment of equilibrium, although in a few cases, periods of equilibration ranging from a few hours to several days have been mentioned. Nineteen publications on ternary systems have been selected as the basis for evaluating the solubility of $Mg(ClO_4)_2$ in water at 298 K. These are given in Table I. All the data are given equal weightage except for those

Table I. Solubility of $Mg(ClO_4)_2$ in water at 298 K
[Solid phase : $Mg(ClO_4)_2.6H_2O$]

Soly/mass %	Ref.	Soly/mass %	Ref.
49.83[a,b]	1	49.98	12
49.90[a]	2	49.80	13
49.78[a]	4	49.87	14
50.07	5	49.99	15
49.80	6	49.80	16
49.73	7	50.00	17
49.65	8	49.90	19
50.00[c]	9	49.80	20
49.83[a,b]	10	49.90	23
49.67[a]	11		

[a] half weightage ; [b] these two values appears to be from same source ; [c] double weightage

Average : (49.9±0.2) mass % or (4.46±0.02) mol kg^{-1}

indicated in the footnote of the table. The weightage of the experimental data is based on factors such as experimental information (or lack of it)

COMPONENTS:	EVALUATORS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	I.N. Lepeshkov ; E.S. Gryzlova
(2) Water; H_2O; [7732-18-5]	Institute Obshchej i Neorganicheskoi Khimii AN SSSR, Moscow.
(3) Other solvents	April, 1986

CRITICAL EVALUATION: (continued)

and the manner in which the experimental data have been treated. Based on Table I, it is recommended that the solubility of $Mg(ClO_4)_2$ in water at 298 K be as follows:

$$\text{solubility} = 49.9 \text{ mass \%} = (4.46 \pm 0.02) \text{ mol kg}^{-1}$$
$$[\text{Solid phase} = Mg(ClO_4)_2.6H_2O]$$

2.Solubility in water at other temperatures

Lilich et al (9) reported the solubility of $Mg(ClO_4)_2$ at 273 K as 48.21 mass % (4.17 mol kg^{-1}) while Leboshchina (21) quoted the solubility at 308 K as 51.2 mass % or 4.7 mol kg^{-1}. Since there is only one publication in each case, these values are regarded as tentative ones. However, at 323 K, there are five publications for the solubility of $Mg(ClO_4)_2$ in water, as shown in Table II, of which only three are independent sources while two (No. 4 and 5) are probably derived from the same source. The results show much better agreement than the data at 298 K where the scatter is larger than expected.

Table II. Solubility of $Mg(ClO_4)_2$ in water at 323 K
[Solid phase : $Mg(ClO_4)_2.6H_2O$]

No.	Soly/mass %	Ref.	No.	Soly/mass %	Ref.
1	52.25	9	4	52.21	3
2	52.19	17	5	52.21	12
3	52.24	2			

recommended solubility : (52.22 ± 0.03) mass %
: (4.896 ± 0.003) mol kg^{-1}

There is only one publication for the solubility of $Mg(ClO_4)_2$ in water at 363 K which is given as 55.57 mass % (21). Table III summarizes the solubility of $Mg(ClO_4)_2$ in water at various temperatures.

3. Solubility in nonaqueous solvents

Willard and Smith (23) have measured the solubility of $Mg(ClO_4)_2$ in a number of organic solvents, as shown in Table IV. No mention is made of the analyis of the solid phase which is claimed to be $Mg(ClO_4)_2$. The precision in temperature is ± 0.01 K while the estimated error in the solubility analysis is ± 0.05 %. Although the solvents were purified and their densities quoted, nothing is said about their moisture content.

COMPONENTS:	EVALUATORS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	I.N. Lepeshkov ; E.S. Gryzlova
(2) Water; H_2O; [7732-18-5]	Institute Obshchej i Neorganicheskoi Khimii AN SSSR, Moscow.
(3) Other solvents	April, 1986

CRITICAL EVALUATION: (continued)

Table III. Solubility of $Mg(ClO_4)_2$ in water at various temperatures
[Solid phase : $Mg(ClO_4)_2.6H_2O$]

Temp./K	273	298	308	323	363
Soly. : mass %	48.2	49.9	51.2	52.22	55.6
: mol kg^{-1}	4.17	4.46	4.70	4.896	5.60
Status[a]	T	R	T	R	T

[a] T = tentative ; R = recommended

Table IV. Solubility of $Mg(ClO_4)_2$ in organic solvents at 298 K
[Solid phase : $Mg(ClO_4)_2$]

Solvent	Solubility				
	mass %	g/100 cm^3 sln	mol %	mol dm^{-3}	mol kg^{-1}
methanol	34.1	37.7	6.93	1.69	2.32
ethanol	19.3	18.4	4.71	8.24	1.07
n-propanol	42.3	50.5	16.5	2.26	3.29
n-butanol	39.2	44.6	17.6	2.00	2.88
isobutanol	31.3	33.2	13.1	1.49	2.04
acetone	30.0	32.4	10.0	1.45	1.92
ethyl acetate	41.5	54.2	21.9	2.43	3.18
hydrazine[a]			9.0		3.09
sulfolane[b]				0.36	
tetrahydrofuran[c]				1.25	
diethyl ether	0.29	0.2059	0.097	0.009	0.013

[a] Ref. (25) ; [b] at 313 K Ref. (26) ; [c] Ref. (27)

For diethyl ether, their results are at variance with the more recent results of Rowley and Seiler (24) who studied the solubility over the temperature range 273-298 K (Table V). The much higher value of Willard and Smith is ascribed to traces of moisture in their solvents, the effect

COMPONENTS:	EVALUATORS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	I.N. Lepeshkov ; E.S. Gryzlova
(2) Water; H_2O; [7732-18-5]	Institute Obshchej i Neorganicheskoi Khimii AN SSSR, Moscow.
(3) Other solvents	April, 1986

CRITICAL EVALUATION: (continued)

of which is more deleterious for diethyl ether than for the other solvents. Since no meaningful evaluation can be made on the solubility of $Mg(ClO_4)_2$ in organic solvents, it is suggested that the values of Rowley and Seiler be taken as tentative values for the solubility in diethyl ether at various temperatures while for the other solvents, the values given in Table IV be accepted as tentative values. The number of decimal figures have been truncated to reflect the experimental uncertainties more appropriately.

Table V. Solubility of $Mg(ClO_4)_2$ in diethyl ether at various temperatures

Temp/K	solubility	
	g/100g solvent	molality/10^{-3} mol kg^{-1}
273	0.044	1.96
288	0.059	2.63
298	0.064	2.88

Ternary Systems

1. Solubility of $Mg(ClO_4)_2$ in the presence of perchlorates in water.

The compilations for ternary systems show only one publication for each system. In most of these systems experimental information is often lacking and experimental data scarce so that evaluation of the solubility data is precluded. There are apparently two publications for the system $Mg(ClO_4)_2$-dimethylurea-water, one by Vasil'eva and Rylenkova (1) and the other by Karnaukhov and Vasil'eva (10). However, an examination of the data indicates that these two sets of data are the same. There are also two publications for the system $Mg(ClO_4)_2$-$MgCl_2$-H_2O, but the data in one publication appears incomplete while the data in another is inadequate. In view of this, no evaluation on the ternary systems will be made. Instead, comments relevant to each system will be made where necessary.

1.1 The system $Mg(ClO_4)_2$-$HClO_4$-H_2O

This system was studied by Lilich, et al (9) at 273, 298 and 323 K. Their paper is one of the few among the Russian publications which give estimated errors in the solubility determinations. They claim estimated errors of as low as $\pm$0.05 % at low perchloric acid concentrations and $\pm$0.1 % at high acid concentrations. If these are acceptable, then in the

COMPONENTS:	EVALUATORS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	I.N. Lepeshkov ; E.S. Gryzlova
(2) Water; H_2O; [7732-18-5]	Institute Obshchej i Neorganicheskoi Khimii AN SSSR, Moscow.
(3) Other solvents	April, 1986

CRITICAL EVALUATION: (continued)

absence of other sources of reference, it is suggested that their values be accepted as tentative values since their measurements are extensive and appear to have been carefully performed. The solubility isotherm shows a distinct minimum, indicating salting-out of perchloric acid by the strongly hydrated cation. As the temperature increases, the solubility minimum deepens in line with the more pronounced salting-out of the acid.

1.2 The system $Mg(ClO_4)_2$-$NaClO_4$-H_2O

A study of this system was made by Karnaukhov and Kudryakova (20) at 298 K while another was made by Kudryakova and Lepeshkov at 363 K (22). No solid solutions or chemical compounds are formed in the system. The component salts separate out as $Mg(ClO_4)_2.6H_2O$ and $NaClO_4$.

1.3 The system $Mg(ClO_4)_2$-$KClO_4$-H_2O at 298 K

The solubility isotherm shows one branch of crystallization corresponding to sparingly soluble $KClO_4$ (28, 29). The eutectic mixture consists of 0.09 mass % $KClO_4$, 49.54 mass % $Mg(ClO_4)_2$ and 50.37 mass % H_2O. The solid phase contains rhombic plates of potassium perchlorate and hexagonal acicular crystals of magnesium perchlorate hexahydrate. Magnesium perchlorate has a strong salting-out effect on potassium perchlorate.

1.4 The solubility of $Mg(ClO_4)_2$ in aqueous solutions of other univalent perchlorates

The solubility of $Mg(ClO_4)_2$ has also been studied in aqueous solutions of $LiClO_4$ (30), $TlClO_4$ (4) and NH_4ClO_4 (31). In all these systems, the added salt is salted out by $Mg(ClO_4)_2$. Each system is characterized by the existence of a simple eutectic and the absence of chemical interaction between the components with no formation of solid solutions. Although in some cases, the experimental information is lacking, there is no reason to doubt the reliability of the data. Hence, the data on these systems can be accepted tentatively. The solubility isotherms are given in the compilations, where appropriate.

1.5 The solubility of $Mg(ClO_4)_2$ in aqueous solutions of trivalent perchlorates

The solubility of $Mg(ClO_4)_2$ has been reported in aqueous solutions of $La(ClO_4)_3$ (18), $Ce(ClO_4)_3$ (13), $Gd(ClO_4)_3$ (5), $Sm(ClO_4)_3$ (6) and $Tb(ClO_4)_3$ (11). Each of these systems possesses a simple eutectic, a

COMPONENTS:	EVALUATORS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	I.N. Lepeshkov ; E.S. Gryzlova
(2) Water; H_2O; [7732-18-5]	Institute Obshchej i Neorganicheskoi Khimii AN SSSR, Moscow.
(3) Other solvents	April, 1986

CRITICAL EVALUATION: (continued)

solid phase of composition $Mg(ClO_4)_2.6H_2O$ and another solid phase of composition $M(ClO_4)_3.9H_2O$, where M is the trivalent metal.

2. The solubility of $Mg(ClO_4)_2$ in aqueous solutions of other magnesium salts

2.1 The system $Mg(ClO_4)_2$-$MgSO_4$-H_2O

This system has been studied at 298 K (33) and 308 K (34). Magnesium forms more stable aquo-complexes with sulfate than with perchlorate ions so that magnesium sulfate exhibits a stronger salting-out effect in the presence of magnesium perchlorate. Magnesium perchlorate crystallizes as the hexahydrate while magnesium sulfate crystallizes as $MgSO_4.7H_2O$ at 298 K (21). At 308 K, a new branch appears in the solubility isotherm indicating the appearance of another solid phase of composition $MgSO_4.6H_2O$. The point of conversion of $MgSO_4.7H_2O$ to $MgSO_4.6H_2O$ is not shown. A comparison of the solubility isotherms at the two temperatures indicates that an increase in temperature causes an increase in the field of existence of $MgSO_4.6H_2O$ which is stable at 308 K. Further dehydration to lower hydrates does not occur (21) but may be presumed to occur at higher temperatures.

2.2 Other systems

The solubility of $Mg(ClO_4)_2$ has also been studied in aqueous solutions of the following magnesium salts:

(i) $MgCl_2$ at 298 K (20) and 363 K (22)

(ii) $MgCrO_4$ at 298 K (14) and 323 K (35)

(iii) $Mg(NO_3)_2$ at 298 and 323K (12)

3. The solubility of $Mg(ClO_4)_2$ in aqueous solutions of nonelectrolytes at 298 K

3.1 Dimethylurea

Dimethylurea forms complexes with magnesium perchlorate more readily than does urea (3) or thiourea (36). At low concentrations of dimethylurea, the complex $Mg(ClO_4)_2.4C_3H_8N_2O.2H_2O$ precipitates, while at high concentrations of dimethylurea, the solid $Mg(ClO_4)_2.5C_3H_8N_2O.H_2O$ separates from solution. The composition of these complexes indicates that complexation is of the substitution type, with the substitution of the water of crystallization in the crystal hydrate occuring stepwise.

COMPONENTS:	EVALUATORS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	I.N. Lepeshkov ; E.S. Gryzlova
(2) Water; H_2O; [7732-18-5]	Institute Obshchej i Neorganicheskoi Khimii AN SSSR, Moscow.
(3) Other solvents	April, 1986

CRITICAL EVALUATION: (continued)

3.2 Other nonelectrolytes

The solubility of $Mg(ClO_4)_2$ has also been studied in aqueous solutions of the following nonelectrolytes:

(i) urea (1)
(ii) acetamide (16)
(iii) thiourea (15)
(iv) hexamethylenetetramine (8)

Quaternary Reciprocal Systems

1. The system Mg^{2+}, $Li^+//ClO_4^-$, CrO_4^{2-} - H_2O at 298 K

There are four crystallization fields in the solubility diagram. These are:

(a) $MgCrO_4.5H_2O$, (b) $LiClO_4.3H_2O$,
(c) $Li_2CrO_4.2H_2O$, and (d) $Mg(ClO_4)_2.6H_2O$

The largest field, $MgCrO_4.5H_2O$ occupies 57.97 % of the diagram space, while the field $LiClO_4.3H_2O$ takes up 41.29% of the area, thus leaving very small fields of very soluble $Li_2CrO_4.3H_2O$ and $Mg(ClO_4)_2.6H_2O$. Due to its low solubility, $MgCrO_4$ is salted out by all the other salts in the system.

2. Other systems

Other quaternary reciprocal systems which have been reported are the systems:

(i) Mg^{2+}, $La^{3+}//ClO_4^-$, SO_4^{2-} - H_2O at 298 K (38)
(ii) Mg^{2+}, $Na^+//ClO_4^-$, Cl^- - H_2O at 298 K (20) and 282 K (22)
(iii) Mg^{2+}, $K^+//ClO_4^-$, Cl^- - H_2O at 298 K (29)
(iv) Mg^{2+}, $Ce^{3+}//ClO_4^-$, Cl^- - H_2O at 298 K (39)
(v) Mg^{2+}, $NH_4^+//ClO_4^-$, Cl^- - H_2O at 298 K (2,19,32)
(vi) Mg^{2+}, $NH_4^+//ClO_4^-$, NO_3^- - H_2O at 298 K (40)

Quaternary Systems

Two quaternary systems consisting of water and a nonelectrolyte as two of the components have been reported at 298 K. These are:

(i) $Mg(ClO_4)_2$-$Ca(ClO_4)_2$-$CS(NH_2)_2$-H_2O, (41) and
(ii) $Mg(ClO_4)_2$-$LiClO_4$-$C_6H_{12}N_4$-H_2O (42)

COMPONENTS:	EVALUATORS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	I.N. Lepeshkov ; E.S. Gryzlova
(2) Water; H_2O; [7732-18-5]	Institute Obshchej i Neorganicheskoi Khimii AN SSSR, Moscow.
(3) Other solvents	April, 1986

CRITICAL EVALUATION: (continued)

References

1. Vasil'eva, S.I.; Rylenkova, I.N. *Sb. Tr. Smolensk. Gos. Ped. Inst.* 1979, 7-15.
2. Leboshchina, V.I. *Uch. Zap. Vladim. Gos. Ped. Inst.* 1970, *22(1)*, 60-5.
3. Bitokov, V.T.; Ivanov, S.A. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1970, *79*, 61-6.
4. Ivanov, S.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1973, *120*, 20-3.
5. Andronova, N.P.; Druzhnina, G.V. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1980, *185*, 9-12.
6. Guseva, A.D. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1978, *169*, 5-7.
7. Troitskii, E.N.; Gumenyuk, V.P.; Prishel'tsev, N.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1977, *164*, 30.
8. Karnaukhov, A.S.; Kosheleva, N.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1976, *154*, 62-6.
9. Lilich, L.S.; Kurbanova, Z.I.; Kocheregin, S.B.; Chernykh, L.V. *Zh. Neorg. Khim.* 1971, *16*, 2268-72; **Russ. J. Inorg. Chem.* (Engl. Transl.) 1971, *16*, 1210-2.
10. Karnaukhov, A.S.; Vasil'eva, S.I.; Rylenkova, I.N. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1979, *178*, 43-8.
11. Andronova, N.P. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1979, *178*, 7-10.
12. Bitokov, V.T. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1970, *78*, 142-9.
13. Guseva, A.D.; Druzhnina, G.V. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1975, *144*, 81-6.
14. Lepeshkov, I.N.; Orekhov, O.L. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1969, *66*, 62-71.
15. Karnaukhov, A.S.; Zakharova, V.P. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1970, *78*, 122-6.
16. Tarakanov, V.F. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1976, *154*, 37-9.
17. Lilich, L. S.; Druzhnina, B. F. *Zh. Obshchei Khim.* 1956, *26*, 1549-53; **J. General Chem. U.S.S.R.* (Engl. Transl.) 1956, *26*, 1733-7.
18. Chernova, L.P. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1976, *154*, 16-8.
19. Lepeshkov, I.N.; Leboshchina, V.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1966, *59*, 48-66.
20. Karnaukhov, A.S.; Kudryakova, S.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1966, *59*, 119-36.
21. Leboshchina, V.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1973, *120*, 47-53.

COMPONENTS:	EVALUATORS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	I.N. Lepeshkov ; E.S. Gryzlova
(2) Water; H_2O; [7732-18-5]	Institute Obshchej i Neorganicheskoi Khimii AN SSSR, Moscow.
(3) Other solvents	April, 1986

CRITICAL EVALUATION: (continued)

22. Kudryakova, S.A.; Lepeshkov, I.N. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1969, *66*, 40-50.
23. Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1923, *45*, 286-96.
24. Rowley, H.H.; Seiler, F.J. *Proc. Iowa Acad. Sci.* 1940, *47*, 159-63.
25. Sakk, Z.G.; Rosolovskii, V.Y. *Zh. Neorg. Khim.* 1972, *17*, 1783-4; **Russ. J. Inorg. Chem.* 1972, *17*, 927-8.
26. Starkovich, J.A.; Janghorbani, M. *J. Inorg. Nucl. Chem.* 1972, *34*, 789-91.
27. Makarenko, B.K.; Mendzheritskii, E.A.; Sobolev, R.P.; Pavarov, Y.M.; Sereda, P.A. *Elektrokhimiya,* 1974, *10*, 355-8; **Soviet Electrochem.* (Engl. Transl.) 1974, *10*, 337-40.
28. Troitskii, E.N. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1966, *59*, 3-7.
29. Troitskii, E.N. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1969, *66*, 23-33.
30. Voronina, T.N.; Karnaukhov, A.S. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1970, *78*, 27-31.
31. Karnaukhov, A.S.; Vasil'eva, S.I. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1969, *66*, 129-33.
32. Ivanov, C.I.; Orekhov, O.L. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1970, *78*, 203-6.
33. Troitskii, E. N.; Gumenyuk, V.P.; Proshletsov, A.I. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1970, *78*, 82-5.
34. Karnaukhov, A.S.; Kudryakova, S.A.; Troitskii, E.N. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1977, *164*, 29-30.
35. Bykov, V.T.; Ivanov, S.A. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1970, *79*, 61-6.
36. Collander, R. *Acta Chim. Scand.* 1949, *3*, 717.
37. Voronina, T.I. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1970, *79*, 3-8.
38. Chernova, L.P. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1979, *178*, 13-7.
39. Guseva, A.D. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1976, *154*, 27-30.
40. Karnaukhov, A.S.; Bitkov, V.T. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1920, *79*, 51-6.
41. Zakharov, V.M. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1971, *95*, 98-100.
42. Kosheleva, N.I. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1977, *164*, 5-7.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Water; H_2O; [7732-18-5]	Lilich, L.S.; Dzhurinsky, B.F. *Zh. Obshchei Khim. U.S.S.R.* 1956, *26*, 1549-53; **J. Gen. Chem. U.S.S.R.* (Engl. Transl.) 1956, *26*, 1733-7.
VARIABLES: Temperature: 273-323 K	PREPARED BY: K.H. Khoo

EXPERIMENTAL VALUES:

Solubility of $Mg(ClO_4)_2$ in water : Solid phase = $Mg(ClO_4)_2.6H_2O$

t/°C	soly /mol kg^{-1}	t/°C	soly /mol kg^{-1}
0	4.10	30	4.57
5	4.20	35	4.68
10	4.26	40	4.72
15	4.34	45	4.79
20	4.44	50	4.89
25	4.48		

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The salt was stirred with water in a thermostat. Equilibrium was reached after continuous stirring for 1-4 h. Approach to equilibrium from above or below had no effect. Magnesium was determined by precipitation as the sulfate [1]. The composition of the solid phase was determined at the same time as the solubility by pressing a sample with filter paper between metal plates kept at about the same temperature as the solution.

SOURCE AND PURITY OF MATERIALS:

$Mg(ClO_4)_2$ was prepared by saturating $HClO_4$ with MgO (analytically pure grade) and recrystallized twice or thrice from solution. The purity of the salt was not stated.

ESTIMATED ERROR:

Not stated.

REFERENCES:

1. Kolthoff, I.M.; Lundell, G.E., *Quantitative Analysis*, 1948, 772.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Water; H_2O; [7732-18-5]	Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1923, *45*, 286-96.
VARIABLES: One temperature: 298.15 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of magnesium perchlorate in water at 25.00°C :

mass %	g/100 cm^3 sln.	mol %	mol dm^{-3}	mol kg^{-1}	sat. sln. density/g cm^{-3}
49.90	73.453	7.441[b]	3.294[b]	4.462[b]	1.4720

[a] The solid phase was a mixture of the anhydrous salt and the hydrate (not specified) that had crystallized from the saturated solution.

[b] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A sat. sln. of the salt was prepared at a temperature slightly above 25°C and sealed together with about 1 g of the anhydrous salt in a solubility tube, capacity 18-20 cm^3. This tube was then rotated end-over-end in the thermostat bath at 25.00°C for 24-48h and stood vertically to allow the solids to settle. Samples of the clear sat. sln. were then analysed for solute content by an evaporation-to-dryness method using Pt crucibles. The salt was dried to constant wt. at 250°C in a current of air dried with P_2O_5. Duplicate soly determinations were made, those analyses in which chloride (from thermal decomposition) was found present being rejected.

The equilibrium solid phase was a mixture of the anhydrous salt and its hydrate.

SOURCE AND PURITY OF MATERIALS:

Anhydrous magnesium perchlorate was prepared as described in ref.1 .

ESTIMATED ERROR:

Precision in temp. was ±0.01°C; precision in soly. about ±0.05% .

REFERENCES:

1. Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1922, *44*, 2816.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Hydrogen peroxide; H_2O_2; [7722-84-1]	Titova, K.V.; Kolmakova, E.I.; Rosolovskii, V.Ya. *Zh. Neorg. Khim.* 1986, *31*, 3213-5; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1986, *31*, 1846-7.
VARIABLES: One temperature: 273 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

The solubility[a] of magnesium perchlorate in hydrogen peroxide at 0°C :

g(1)/ 100 g(2)	mass %	mol %	molality/ mol kg^{-1}
70.1	41.21	9.65	3.141

[a] Mass %, mol % and molality values calculated by compiler. The solid phase was reported as $Mg(ClO_4)_2 \cdot xH_2O_2$ because its low stability prevented reliable analysis of its composition.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
No details of saturation method was given. Solubility equilibrium was established in 1-1.5 h. The concentration of the solutions did not change noticeably during the next 3h but after that slow decomposition of peroxide began. The concentrations of perchlorate in the satd solutions were determined by gravimetric analysis using nitron as the agent for precipitation. H_2O_2 was analysed by permanganate titration.	The anhydrous perchlorate was prepared by heating the hydrate in vacuum (source not given). Samples that showed no water I.R. absorption bands in the range 1620-1635 cm^{-1} were used. The H_2O_2 was 99.8% ± 0.2% pure.
	ESTIMATED ERROR: Not stated.
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) *Alcohols*: (A) Methanol (*methyl alcohol*); CH_4O; [67-56-1] (B) Ethanol (*ethyl alcohol*); C_2H_6O; [64-17-5] (C) 1-Propanol (*n-propyl alcohol*); C_3H_8O; [71-23-8] (D) 1-Butanol (*n-butyl alcohol*); $C_4H_{10}O$; [71-36-3] (E) 2-Methyl-1-propanol (*iso-butyl alcohol*); $C_4H_{10}O$; [78-83-1]	Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1923, *45*, 286-96.
VARIABLES: One temperature: 298.15 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of magnesium perchlorate in various alcohols at 25.00°C, the solid phase being the anhydrous salt :

soly in :	methanol	ethanol	1-propanol	1-butanol	2-methyl-1-propanol
mass %	34.14	19.33	42.33	39.16	31.27
g/100 cm^3 sln.	37.749	18.398	50.483	44.638	33.174
mol %[a]	6.926	4.713	16.50	17.61	13.13
mol dm^{-3} [a]	1.691	8.241	2.261	2.000	1.486
mol kg^{-1} [a]	2.322	1.074	3.288	2.884	2.038

[a] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
A sat. sln. of the salt was prepared at a temperature slightly above 25°C and sealed together with about 1 g of the anhydrous salt in a solubility tube, capacity 18-20 cm^3. This tube was then rotated end-over-end in the thermostat bath at 25.00°C for 24-48h	Anhydrous magnesium perchlorate was prepared as described in ref.1 . Alcohols purified by fractional distillation after refluxing with calcium metal.

(continued next page)

COMPONENTS:

(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]

(2) *Alcohols*:

(A) Methanol (*methyl alcohol*); CH_4O; [67-56-1]

(B) Ethanol (*ethyl alcohol*); C_2H_6O; [64-17-5]

(C) 1-Propanol (*n-propyl alcohol*); C_3H_8O; [71-23-8]

(D) 1-Butanol (*n-butyl alcohol*); $C_4H_{10}O$; [71-36-3]

(E) 2-Methyl-1-propanol (*iso-butyl alcohol*); $C_4H_{10}O$; [78-83-1]

ORIGINAL MEASUREMENTS:

Willard, H.H.; Smith, G.F.

J. Am. Chem. Soc. 1923, *45*, 286-96.

EXPERIMENTAL VALUES:(continued)

	methanol	ethanol	1-propanol	1-butanol	2-methyl-1-propanol
sat. sln. density/g cm^{-3}	1.1057	0.9518	1.1926	1.1399	1.0609
pure solvent density/g cm^{-3}	0.78705	0.78515	0.7989	0.8059	0.7981

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:(continued)

and stood vertically to allow the solids to settle. Samples of the clear sat. sln. were then analysed for solute content by an evaporation-to-dryness method using Pt crucibles. The salt was dried to constant wt. at 250°C in a current of air dried with P_2O_5. Duplicate soly determinations were made, those analyses in which chloride (from thermal decomposition) was found present being rejected.

ESTIMATED ERROR:

Precision in temp. was ±0.01°C; soly precision probably about ± 0.1% (compiler).

REFERENCES:

1. Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1922, *44*, 2816.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Acetone; C_3H_6O; [67-64-1]	Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1923, *45*, 286-96.
VARIABLES: One temperature: 298.15 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of magnesium perchlorate in acetone at 25.00°C :

mass %	g/100 cm^3 sln.	mol %	mol dm^{-3}	mol kg^{-1}	sat. sln. density/g cm^{-3}
30.015	32.410	10.039[b]	1.452[b]	1.9214[b]	1.0798

[a] The solid phase was the anhydrous salt.

[b] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A sat. sln. of the salt was prepared at a temperature slightly above 25°C and sealed together with about 1 g of the anhydrous salt in a solubility tube, capacity 18-20 cm^3. This tube was then rotated end-over-end in the thermostat bath at 25.00°C for 24-48h and stood vertically to allow the solids to settle. Samples of the clear sat. sln. were then analysed for solute content by an evaporation-to-dryness method using Pt crucibles. The salt was dried to constant wt. at 250°C in a current of air dried with P_2O_5. Duplicate soly determinations were made, those analyses in which chloride (from thermal decomposition) was found present being rejected.

SOURCE AND PURITY OF MATERIALS:

Anhydrous (1) was prepared as described in ref. 1.
(2) was purified by refluxing with KOH and fractional distillation. Density of (2) at 25°C was 0.7852 g cm^{-3}; b.p. was 56.16-56.51 °C.

ESTIMATED ERROR:

Precision in temp. was ± 0.01°C .

REFERENCES:

1. Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1922, *44*, 2816.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Tetrahydrofuran; C_4H_8O; [109-99-9]	Makarenko, B.K.; Mendzheritskii, E.A.; Sobolev, R.P.; Povarov, Yu.M.; Sereda, P.A. *Elektrokhimiya* 1974, *10*, 355-8; **Soviet Electrochem. (Engl. Transl.)* 1974, *10*, 337-40.
VARIABLES: One temperature: 298 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

The solubility of magnesium perchlorate in tetrahydrofuran at 25°C was 1.25 mol L^{-1} and the specific conductivity of the saturated solution was 4.1×10^{-3} S cm^{-1}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
No details given. Solubility was determined by polarographic analysis of the ions in solution. Saturated solution contained not more than 0.02% water.	(1) was recrystallized twice from aqueous sln. and dried under vacuum at 150-160 °C for 20-25 h; (2) was dried for 5-7 days with metallic lithium. Sources not given.
	ESTIMATED ERROR: Temperature ± 0.1°C .
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Willard, H.H.; Smith, G.F.
(2) Ethyl acetate; $C_4H_8O_2$; [141-78-6]	*J. Am. Chem. Soc.* 1923, *45*, 286-96.
VARIABLES:	PREPARED BY:
One temperature: 298.15 K	C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of magnesium perchlorate in ethyl acetate at 25.00°C :

mass %	g/100 cm^3 sln.	mol %	mol dm^{-3}	mol kg^{-1}	sat. sln. density/g cm^{-3}
41.49	54.173	21.87[b]	2.427[b]	3.177[b]	1.3057

[a] The solid phase was the anhydrous salt.

[b] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A sat. sln. of the salt was prepared at a temperature slightly above 25°C and sealed together with about 1 g of the anhydrous salt in a solubility tube, capacity 18-20 cm^3. This tube was then rotated end-over-end in the thermostat bath at 25.00°C for 24-48h and stood vertically to allow the solids to settle. Samples of the clear sat. sln. were then analysed for solute content by an evaporation-to-dryness method using Pt crucibles. The salt was dried to constant wt. at 250°C in a current of air dried with P_2O_5. Duplicate soly determinations were made, those analyses in which chloride (from thermal decomposition) was found present being rejected.

SOURCE AND PURITY OF MATERIALS:

Anhydrous (1) was prepared as described in ref. 1.
(2) was purified by refluxing with P_2O_5 and fractional distillation. Density of (2) at 25°C was 0.89457 g cm^{-3}; b.p. was 77.14-77.16 °C.

ESTIMATED ERROR:

Precision in temp. was ± 0.01°C .

REFERENCES:

1. Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1922, *44*, 2816.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) 1,1'-oxybis-ethane (*diethyl ether*); $C_4H_{10}O$; [60-29-7]	Rowley, H.H.; Seiler, F.J. **Proc. Iowa Acad. Sci.* 1940, *47*, 159-63; *Trans. Illinois State Acad. Sci.* 1940, *33*, 117-9.
VARIABLES: One temperature: 273 -298 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

Solubility of magnesium perchlorate in anhydrous *diethyl ether* at various temperatures :

t/°C	g(1)/100g(2)	molality[a]/10^{-3} mol kg^{-1}
0	0.0437	1.958
15	0.0588	2.634
25	0.0643	2.881

[a] Compiler's calculation.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consisted of a 50 cm^3 pyrex tube and a 250 cm^3 pyrex flask, joined together at the necks via a 20 cm tubing with a stopcock in the middle. The neck of each had been drawn out so that it could be sealed off when necessary. About 150 cm^3 of (2) was placed in the larger flask and fresh sodium wire added. When the sodium had ceased reacting, the stopcock was closed and the flask was sealed after gentle suction had been applied. Solid (1) was placed in the tube and heated at 250°C. The drawn outlet of the tube was connected to a vacuum pump. After several hours this outlet was sealed off and the sample allowed to cool in vacuum. The tube was then cooled with dry ice, the stopcock opened, and (2) readily distilled over from the flask at room temperature. When about 50 cm^3 of (2) had collected in the tube, it was

SOURCE AND PURITY OF MATERIALS:

Anhy. (1) prepared by dehydration of commercial dehydrite (G.F. Smith and Co.) at 250°C under vacuum and was 99.9% pure.
Anhy. (2) prepared by distilling reagent grade ether over sodium and collecting the middle fraction for use.

ESTIMATED ERROR:

Reproducibility of triplicate determinations was ± 7% of the mean.

REFERENCES:

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Rowley, H.H.; Seiler, F.J.
(2) 1,1'-oxybis-ethane (*diethyl ether*); $C_4H_{10}O$; [60-29-7]	**Proc. Iowa Acad. Sci.* 1940, *47*, 159-63; *Trans. Illinois State Acad. Sci.* 1940, *33*, 117-9.

EXPERIMENTAL VALUES: (continued)

Composition of solid phase in equilibrium with saturated solution :

temp.	mass % (1)	mol ratio, (1):(2)
0°C	50.2	2.99
	45.4	3.64
Mean[a]:	47.8	3.32
25°C	63.7	1.75
	64.7	1.65
	62.8	1.79
	58.4	2.15
Mean[a]:	62.4 ± 2.8	1.84 ± 0.21

[a] Compiler's calculation.

COMMENTS AND/OR ADDITIONAL DATA :

It is believed that solid $Mg(ClO_4)_2.3(C_2H_5)_2O$ is in equilibrium with sat. sln. at 0°C and possibly at 25°C. Tests showed the existence of three etherates of (1), viz. $Mg(ClO_4)_2.(C_2H_5)_2O$, $Mg(ClO_4)_2.2(C_2H_5)_2O$ and $Mg(ClO_4)_2.3(C_2H_5)_2O$. The dietherate is fairly stable but loses one ether molecule fairly readily at 25°C, but much more slowly at 0°C. The monoetherate is fairly stable up to 100°C.

Solubility of (1) in (2) in the presence of small amts. of water:

mol H_2O/mol (2)	g (1)/100g (2)		molality/mol kg^{-1}	
	15°C	25°C	15°C	25°C
0.016	0.381	0.519	0.01707	0.02325
0.115		1.401		0.0628

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE: (continued)

sealed and disconnected from the apparatus. Several such sealed tubes were rotated end-over-end in constant temperature baths at 0, 15 and 25 °C. After allowing the solids to settle, the ends of the tubes were broken off and the clear solution quickly filtered through glass wool in enclosed tubes into weighing bottles and then weighed. The contents were then analysed for Mg by the pyrophosphate gravimetric method.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) 1,1'-oxybis-ethane (*diethyl ether*); $C_4H_{10}O$; [60-29-7]	Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1923, *45*, 286-96.
VARIABLES: One temperature: 298.15 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of magnesium perchlorate in *diethyl ether* at 25.00°C :

mass %	g/100 cm^3 sln.	mol %	mol dm^{-3}	mol kg^{-1}	sat. sln. density/g cm^{-3}
0.29	0.2059	0.097[b]	0.00936[b]	0.013[b]	0.7101

[a] The solid phase was the anhydrous salt.

[b] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A sat. sln. of the salt was prepared at a temperature slightly above 25°C and sealed together with about 1 g of the anhydrous salt in a solubility tube, capacity 18-20 cm^3. This tube was then rotated end-over-end in the thermostat bath at 25.00°C for 24-48h and stood vertically to allow the solids to settle. Samples of the clear sat. sln. were then analysed for solute content by an evaporation-to-dryness method using Pt crucibles. The salt was dried to constant wt. at 250°C in a current of air dried with P_2O_5. Duplicate soly determinations were made, those analyses in which chloride (from thermal decomposition) was found present being rejected.

SOURCE AND PURITY OF MATERIALS:

Anhydrous (1) was prepared as described in ref. 1.
(2) was purified by refluxing with P_2O_5 and fractional distillation. Density of (2) at 25°C was 0.7081 g cm^{-3}.

ESTIMATED ERROR:

Precision in temp. was ± 0.01°C .

REFERENCES:

1. Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1922, *44*, 2816.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Hydrazine; N_2H_4; [302-01-2]	Sakk, Zh.G.; Rosolovskii, V.Ya. *Zh. Neorg. Khim.* 1972, *17*, 1783-4; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1972, *17*, 927-8.
VARIABLES: One temperature: 298.2 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

The solubility of magnesium perchlorate in hydrazine at 25.0°C was reported as 69.0 g(1)/100 g(2). The corresponding mol % and molality values calculated by the compiler are 9.01% and 3.091 mol kg^{-1} respectively. The solid phase was presumably the anhydrous salt (compiler).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
4-6 g of the salt and 8-11 cm^3 of hydrazine were thermostated at 25°C for 7-8 h with continuous stirring in a vessel isolated from atmospheric moisture. Samples for analysis were removed by drawing solution and part of the solid phase into a vessel fitted with a porosity no.4 filter at reduced pressure. After separating the phases, the solution was analysed for hydrazine. Methods of analysis not given. Replicate soly determinations were made.	The methods of purification of the perchlorate and of preparation of hydrazine were as described in ref.1 . Salt purity was about 99.5 - 99.9% . ESTIMATED ERROR: Precision in temp. was ±0.1°C; Absolute error in soly value was 0.4% . REFERENCES: 1. Rosolovskii, V.Ya.; Sakk, Zh.G. *Zh. Neorg. Khim.* 1970, *15*, 2262.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Perchloric acid; $HClO_4$; [7601-90-3] (3) Water; H_2O; [7732-18-5]	Lilich, L.S.; Kurbanova, Z.I.; Kocheregin, S.B.; Chernykh, L.V. *Zh. Neorg. Khim.* 1971, *16*, 2268-72; **Russ. J. Inorg. Chem.* (Engl. Transl.) 1971, *16*, 1210-2.
VARIABLES: Temperature/K: 273.2, 298.15 and 323.15 Composition	PREPARED BY: K.H. Khoo

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$HClO_4$-H_2O at 0.0°C

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
48.21	-	6.988	-	4.170	-	$Mg(ClO_4)_2.6H_2O$
41.19	7.21	5.914	2.300	3.576	1.391	"
29.37	19.19	4.140	6.011	2.558	3.714	"
20.74	28.75	2.919	8.992	1.840	5.666	"
15.56	34.90	2.201	10.97	1.407	7.013	"

[a] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility was measured by the isothermal saturation method. The time taken to attain equilibrium was 6-10 h, depending on the temperature. Mg^{2+} was determined by titration with Trilon B using eriochrome black as indicator. $HClO_4$ was determined by titration with borax solution using methyl red as indicator. The compositions of the solid phases were determined using Schreimemakers' method [1].

SOURCE AND PURITY OF MATERIALS:

Magnesium perchlorate was made by neutralizing "pure" grade $MgCO_3$ with "analytical reagent" grade $HClO_4$ and recrystallized thrice. The purity was not stated. $HClO_4$ was the anhydrous acid as well as the "chemically pure" grade 57 % acid which was checked for the contents of Cl^- and SO_4^{2-} ions.

ESTIMATED ERROR:

Temperature : ±0.2 K at 273 K;
±0.02 K at 298 K;
±0.05 K at 323 K.

Solubility : ±0.05 % (±0.1% at high $HClO_4$ concentrations

(continued next page)

REFERENCES:

1. Schreinemakers, F.A.H. *Z. Phys. Chem.* 1983, *11*, 81.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Lilich, L.S.; Kurbanova, Z.I.; Kocheregin, S.B.; Chernykh, L.V.
(2) Perchloric acid; $HClO_4$; [7601-90-3]	*Zh. Neorg. Khim.* 1971,*16*, 2268-72; **Russ. J. Inorg. Chem.* (Engl. Transl.) 1971, *16*, 1210-2.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility system $Mg(ClO_4)_2$-$HClO_4$-H_2O at 0.0°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
9.10	42.22	1.289	13.29	0.837	8.633	A
4.34	49.05	0.628	15.78	0.417	10.48	A
1.08	55.90	0.164	18.87	0.112	12.94	A
0.05	66.36	0.009	26.16	0.007	19.67	A
0.29	71.24	0.057	30.96	0.046	24.91	A
1.43	75.35	0.313	36.67	0.276	32.30	A
3.25	72.56	0.700	34.73	0.602	29.86	A + B
3.17	72.62	0.682	34.74	0.587	29.86	B
3.54	72.79	0.772	35.27	0.670	30.61	B
5.00	72.76	1.131	36.56	1.007	32.57	B + C
3.28	75.05	0.748	38.03	0.678	34.48	C
3.00	75.61	0.688	38.53	0.628	35.19	C + D
1.18	76.40	0.263	37.83	0.236	33.92	D
-	77.81	-	38.61	-	34.91	D

Solubility system $Mg(ClO_4)_2$-$HClO_4$-H_2O at 25.00°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
50.00	-	7.468	-	4.480	-	A
32.67	17.68	4.755	5.717	2.948	3.545	A
21.32	29.80	3.076	9.552	1.954	6.069	A
11.85	41.59	1.740	13.57	1.140	8.892	A
2.80	55.00	0.432	18.86	0.297	12.97	A
0.62	63.90	0.106	24.39	0.078	17.93	A
0.77	68.71	0.145	28.72	0.113	22.41	A
1.70	71.14	0.343	31.85	0.280	26.07	A
6.08	68.92	1.296	32.65	1.090	27.44	A
7.03	68.30	1.514	32.67	1.277	27.56	A + B
7.03	69.47	1.553	34.11	1.340	29.43	B
8.25	69.34	1.875	35.02	1.649	30.80	B + C
6.80	71.41	1.562	36.44	1.398	32.62	B + C
5.33	73.71	1.243	38.19	1.139	35.01	C
4.34	75.76	1.035	40.15	0.977	37.90	C
3.17	77.69	0.768	41.80	0.742	40.41	C + D
1.72	78.21	0.406	40.97	0.384	38.79	D
-	79.41	-	40.89	-	38.39	D

[a] Compiler's calculations.

[b] A = $Mg(ClO_4)_2.6H_2O$; B = $Mg(ClO_4)_2.4H_2O$; C = $Mg(ClO_4)_2.2H_2O$; D = $HClO_4.H_2O$.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Lilich, L.S.; Kurbanova, Z.I.; Kocheregin, S.B.; Chernykh, L.V.
(2) Perchloric acid; $HClO_4$; [7601-90-3]	*Zh. Neorg. Khim.* 1971, *16*, 2268-72; **Russ. J. Inorg. Chem.* (Engl. Transl.) 1971, *16*, 1210-2.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility system $Mg(ClO_4)_2$-$HClO_4$-H_2O at 50.00°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
52.25	-	8.115	-	4.902	-	A
37.40	15.20	5.680	5.129	3.535	3.192	A
25.00	28.75	3.777	9.651	2.422	6.188	A
7.55	50.03	1.172	17.25	0.797	11.74	A
2.20	60.85	0.370	22.72	0.267	16.39	A
1.88	66.12	0.345	26.94	0.263	20.57	A
3.45	68.19	0.681	29.92	0.545	23.94	A
5.77	67.31	1.180	30.59	0.960	24.89	A
8.06	65.91	1.690	30.70	1.387	25.21	A
13.12	61.31	2.815	29.22	2.299	23.87	A
13.90	60.56	2.990	28.94	2.438	23.60	A + B
14.00	60.78	3.033	29.26	2.487	23.99	A + B
14.18	61.71	3.151	30.47	2.635	25.48	B
15.67	61.88	3.633	31.88	3.127	27.44	B
16.11	61.57	3.751	31.85	3.234	27.46	B
16.42	61.27	3.828	31.74	3.297	27.34	B + C
13.93	64.41	3.275	33.64	2.881	29.60	B + C
11.27	67.55	2.659	35.42	2.384	31.75	C
6.05	74.81	1.478	40.60	1.416	38.91	C
2.85	80.50	0.735	46.10	0.767	48.13	C

[a] Compiler's calculations.

[b] A = $Mg(ClO_4)_2.6H_2O$; B = $Mg(ClO_4)_2.4H_2O$; C = $Mg(ClO_4)_2.2H_2O$.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sodium perchlorate; $NaClO_4$; [7601-89-0] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Water; H_2O; [7732-18-5]	Karnaukhov, A.S.; Kudryakova, S.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1966, *59*, 119-36.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$NaClO_4$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	49.80	-	7.413	-	4.444	A
2.95	47.88	0.812	7.228	0.490	4.363	A
9.12	43.76	2.581	6.793	1.581	4.161	A
15.13	40.51	4.465	6.558	2.786	4.091	A
20.26	37.75	6.208	6.345	3.941	4.028	A
25.57	34.50	8.095	5.991	5.230	3.871	A
26.73	33.75	8.517	5.899	5.524	3.826	A
28.05	33.13	9.047	5.861	5.901	3.823	A
27.80	33.13	8.924	5.834	5.811	3.799	A + B
27.85	33.18	8.958	5.854	5.837	3.815	A + B
28.08	33.43	9.116	5.954	5.958	3.891	A + B
28.00	33.56	9.101	5.984	5.949	3.911	A + B
28.12	33.60	9.168	6.009	6.000	3.932	A + B
28.20	33.73	9.232	6.058	6.050	3.969	A + B
28.30	33.73	9.283	6.069	6.087	3.980	B
31.48	30.27	10.22	5.390	6.722	3.545	B
35.49	27.04	11.64	4.863	7.736	3.233	B
40.48	22.77	13.37	4.126	8.996	2.776	B
45.59	18.61	15.24	3.413	10.40	2.329	B
50.27	14.72	16.97	2.725	11.73	1.884	B
54.38	11.01	18.39	2.043	12.83	1.425	B

[a] Editors' calculations.

[b] A = $Mg(ClO_4)_2.6H_2O$; B = $NaClO_4.H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal method was used. Periods of equilibration varied from 20 to 70 h. Mg^{2+} was determined by complexometric titration, Na^+ gravimetrically as sodium zinc uranyl acetate, and ClO_4^- gravimetrically by nitron precipitation.	The salts were recrystallized twice. Purity: 95.58-99.75%.
	ESTIMATED ERROR: Temperature: ±0.1°C.
	REFERENCES: None.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sodium perchlorate; $NaClO_4$; [7601-89-0]	Karnaukhov, A.S.; Kudryakova, S.A.
(2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1966, *59*, 119-36.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility system $Mg(ClO_4)_2$-$NaClO_4$-H_2O at 25°C

[Solid phase : $NaClO_4.H_2O$]

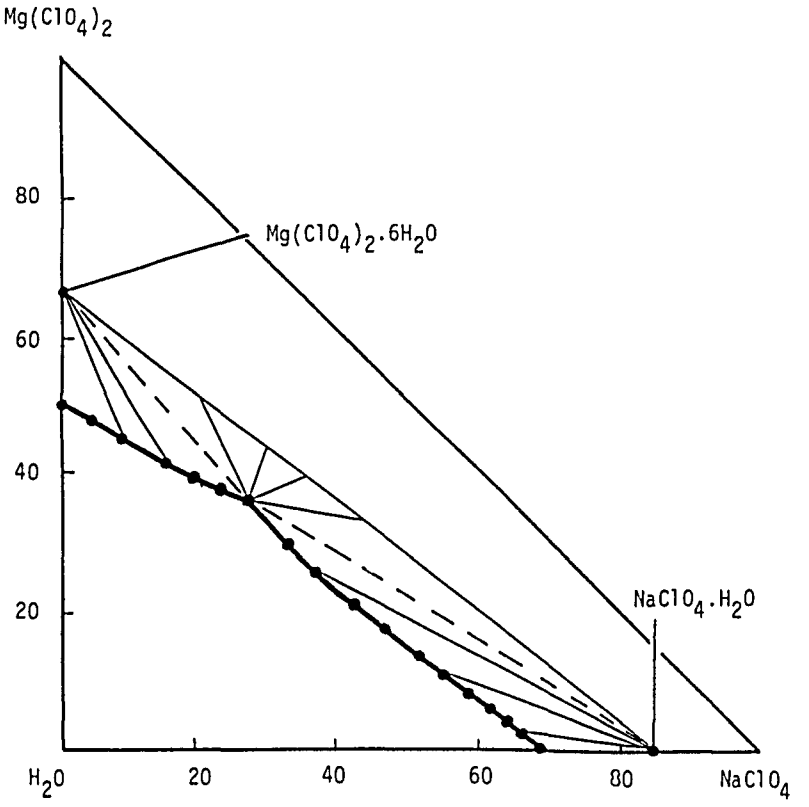
Liquid phase composition

mass %		mol %[a]		molality[a]/mol kg^{-1}	
(1)	(2)	(1)	(2)	(1)	(2)
57.58	8.35	19.60	1.559	13.80	1.098
60.37	6.12	20.71	1.152	14.71	0.818
64.51	2.38	22.18	0.449	15.91	0.322
67.86	-	23.70	-	17.24	-

[a] Editors' calculations.

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is shown below. The mean eutectic composition is 28.05 % $NaClO_4$, 33.43 % $Mg(ClO_4)_2$ and 38.52 % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sodium perchlorate; $NaClO_4$; [7601-89-0] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Water; H_2O; [7732-18-5]	Kudryakova, S.A.; Lepeshkov, I.N. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1969, *66*, 40-50.
VARIABLES: One temperature: 363 K Composition	PREPARED BY: I.S. Bodnya

EXPERIMENTAL VALUES:

Solubility System $Mg(ClO_4)_2$-$NaClO_4$-H_2O at 90°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	55.57	-	9.167	-	5.603	A
4.40	52.15	1.340	8.713	0.827	5.377	A
8.07	49.67	2.502	8.448	1.560	5.266	A
14.54	45.18	4.644	7.916	2.948	5.025	A
19.87	42.03	6.582	7.638	4.259	4.942	A
24.22	39.21	8.230	7.309	5.409	4.804	A
28.63	36.39	9.999	6.972	6.685	4.661	A
34.01	33.10	12.34	6.586	8.445	4.509	A
34.08	32.87	12.32	6.516	8.422	4.456	A + B
34.27	32.75	12.40	6.500	8.487	4.449	A + B
34.57	32.56	12.53	6.475	8.590	4.438	A + B
35.10	31.89	12.67	6.317	8.684	4.328	A + B
34.57	32.18	12.43	6.345	8.491	4.336	A + B
34.60	32.28	12.47	6.384	8.532	4.367	B
37.58	29.81	13.64	5.934	9.412	4.095	B
41.69	26.57	15.33	5.359	10.73	3.750	B
45.56	23.78	17.06	4.886	12.14	3.475	B
49.37	20.81	18.74	4.333	13.52	3.126	B
55.45	15.49	21.21	3.250	15.58	2.388	B
61.75	11.03	24.43	2.393	18.53	1.815	B
69.13	5.45	28.23	1.221	22.21	0.961	B
74.51	1.33	31.12	0.305	25.19	0.247	B
76.27	-	32.11	-	26.25	-	B

[a] Editors's calculations ; [b] A = $Mg(ClO_4)_2.6H_2O$; B = $NaClO_4$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal method was used. Mg^{2+} was determined volumetrically by titration with Trilon B; Na^+ gravimetrically by precipation with zinc uranyl acetate; and ClO_4^- gravimetrically by nitron precipitation. The density and relative viscosity of the saturated solutions were measured.	Not given.
	ESTIMATED ERROR: Not given.
	REFERENCES: None.

(continued next page)

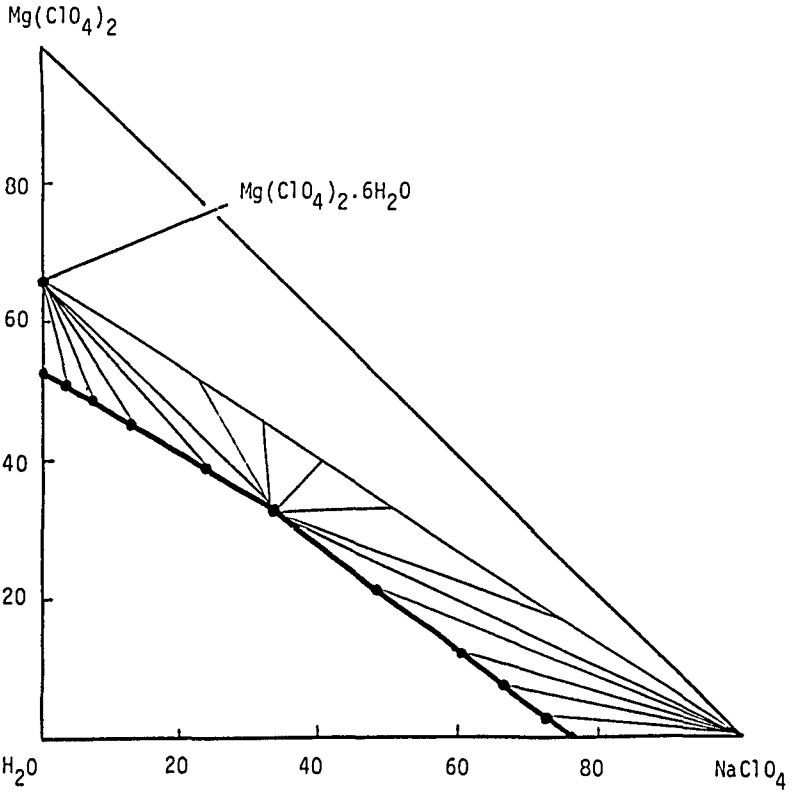
COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sodium perchlorate; $NaClO_4$; [7601-89-0]	Kudryakova, S.A.; Lepeshkov, I.N.
(2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	*Sb. Tr. Yarosl. Gos. Ped. Inst.* 1969, *66*, 40-50.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm below (mass %) shows two branches of crystallization, the first indicating the crystallization of $Mg(ClO_4)_2.6H_2O$ and the second, $NaClO_4$. The eutectic composition is:

33.68 mass % $Mg(ClO_4)_2$
33.04 mass % $NaClO_4$
33.28 mass % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Potassium perchlorate; $KClO_4$; [7778-74-7] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Water; H_2O; [7732-18-5]	Troitskii, E.N. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1969, *66*, 23-33.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$KClO_4$-H_2O at 25° C :

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	2.00	-	0.164	-	0.091	$KClO_4$
1.86	1.24	0.249	0.103	0.139	0.057	"
5.02	0.82	0.688	0.070	0.385	0.039	"
12.65	0.43	1.856	0.039	1.050	0.022	"
22.32	0.31	3.614	0.031	2.082	0.018	"
30.14	0.17	5.323	0.019	3.121	0.011	"
37.39	0.15	7.220	0.018	4.321	0.011	"
41.94	0.12	8.601	0.015	5.224	0.009	"
47.06	0.11	10.38	0.015	6.430	0.009	"
49.58	0.10	11.35	0.014	7.113	0.009	$KClO_4$ + $Mg(ClO_4)_2.6H_2O$
49.52	0.08	11.33	0.011	7.091	0.007	"
49.54	0.09	11.34	0.013	7.099	0.008	"
49.50	0.08	11.32	0.011	7.086	0.007	"
49.48	0.08	11.31	0.011	7.080	0.007	"
49.61	0.11	11.37	0.016	7.121	0.010	"
49.54	0.09	11.34	0.013	7.099	0.008	$Mg(ClO_4)_2.6H_2O$
49.85	-	11.45	-	7.174	-	"

[a] Editors' calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The isothermal method was used. K^+ was determined gravimetrically using tetraphenylborate, Mg^{2+} by titration with Trilon B and ClO_4^- by precipitation with nitron. The density, viscosity and refractive index of the saturated solutions were measured. The composition of the solid phases was confirmed by X-ray powder analysis and the solid phases were determined by Schreinemakers' method.

SOURCE AND PURITY OF MATERIALS:	REFERENCES:
Not stated.	None.
ESTIMATED ERROR: Temperature: ±0.05° C.	

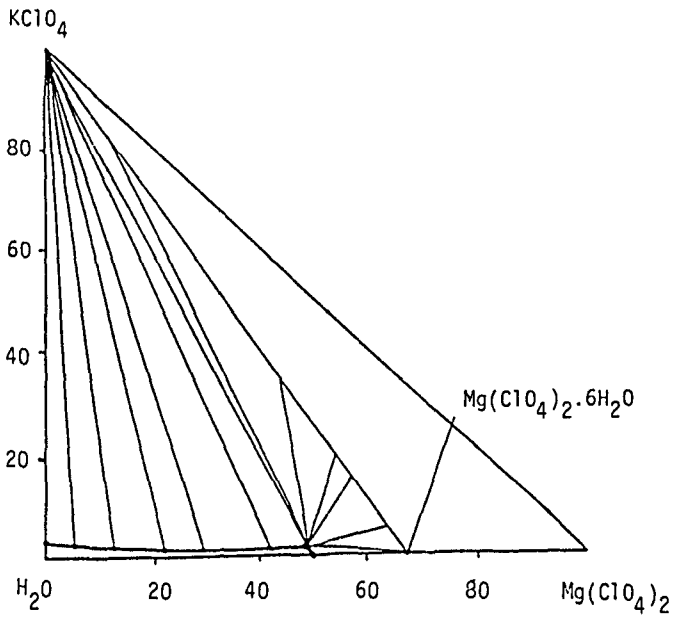
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Potassium perchlorate; $KClO_4$; [7778-74-7] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Water; H_2O; [7732-18-5]	Troitskii, E.N. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1969, *66*, 23-33.

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is given below. It shows a long branch of crystallization of $KClO_4$. Magnesium perchlorate has a strong salting-out effect on potassium perchlorate. The eutectic contains 0.09 % $KClO_4$, 49.54 % $Mg(ClO_4)_2$ and 50.37 % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Lepeshkov, I.N.; Leboshchina, V.I.
(2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	*Sb. Nauch. Tr. Vladimir Politekh. Inst.* 1969, *7*, 115-20.
(3) Water; H_2O; [7732-18-5]	
VARIABLES:	PREPARED BY:
One temperature: 298 K	N.A. Kozyreva
Composition	

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-NH_4ClO_4-H_2O at 25°C

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	19.78	-	3.643	-	2.099	NH_4ClO_4
1.00	18.21	0.096	3.338	0.055	1.918	"
3.25	16.30	0.315	3.004	0.181	1.725	"
7.99	12.27	0.784	2.287	0.449	1.310	"
9.39	10.77	0.921	2.008	0.527	1.148	"
19.06	5.94	1.986	1.176	1.139	0.674	"
24.90	3.78	2.719	0.784	1.564	0.451	"
32.00	1.90	3.745	0.422	2.169	0.245	"
33.48	1.68	3.986	0.380	2.313	0.221	"
37.60	0.91	4.712	0.216	2.751	0.126	"
42.30	0.58	5.632	0.147	3.318	0.086	"
43.70	0.30	5.921	0.077	3.496	0.046	"
46.80	0.29	6.658	0.078	3.963	0.047	"
49.70	0.19	7.407	0.051	4.443	0.031	NH_4ClO_4 + $Mg(ClO_4)_2.6H_2O$
49.66	0.14	7.391	0.040	4.432	0.024	"
49.70	0.16	7.404	0.045	4.441	0.027	"
49.70	0.19	7.408	0.054	4.444	0.032	"
49.70	0.16	7.404	0.045	4.441	0.027	"
49.90	-	7.441	-	4.462	-	$Mg(ClO_4)_2.6H_2O$

[a] Editors' calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Isothermal method. Details not given. Mg^{2+} was determined by titration with EDTA; NH_4^+ by distilling off NH_3 into boric acid solution and titration with H_2SO_4; ClO_4^- was determined with nitron.	The salts were recrystallized.
	ESTIMATED ERROR: Not stated.
	REFERENCES: None.

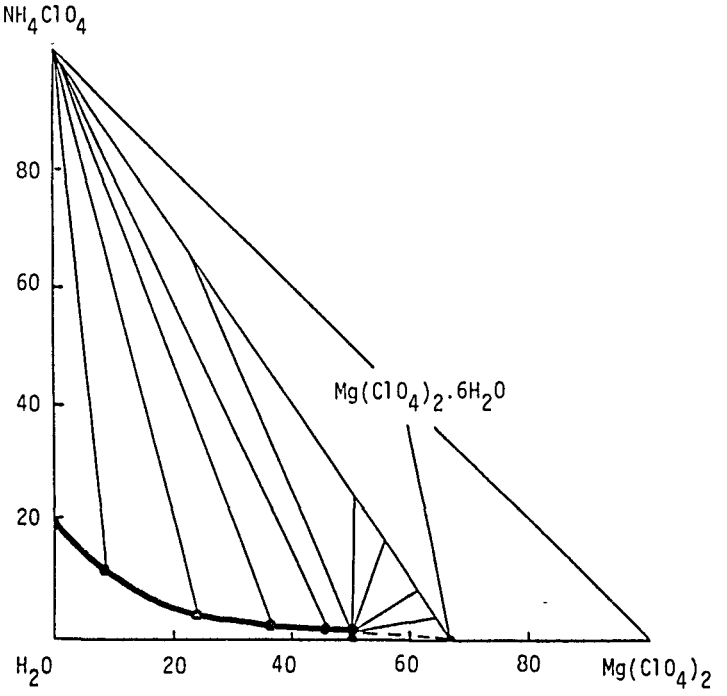
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Lepeshkov, I.N.; Leboshchina, V.I.
(2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	*Sb. Nauch. Tr. Vladimir Politekh. Inst.* 1969, *7*, 115-20.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is given below. The eutectic mixture consists of 0.19 % NH_4ClO_4, 49.70 % $Mg(ClO_4)_2$ and 50.11 % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9] (3) Water; H_2O; [7732-18-5]	Ivanov, S.A.; Orekhov, O.L. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *78*, 203-10.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-NH_4ClO_4-H_2O at 25°C

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	20.02	-	3.696	-	2.131	NH_4ClO_4
1.00	18.21	0.096	3.338	0.055	1.918	"
3.25	16.30	0.315	3.004	0.181	1.725	"
9.39	10.77	0.921	2.008	0.527	1.148	"
19.06	5.94	1.986	1.176	1.139	0.674	"
24.90	3.78	2.719	0.784	1.564	0.451	"
33.48	1.68	3.986	0.380	2.313	0.221	"
37.70	0.91	4.712	0.216	2.751	0.126	"
46.80	0.29	6.658	0.078	3.963	0.047	"
46.90	0.28	6.682	0.076	3.978	0.045	"
49.70	0.18	7.407	0.051	4.443	0.031	NH_4ClO_4 + $Mg(ClO_4)_2.6H_2O$
49.66	0.14	7.391	0.040	4.432	0.024	"
49.70	0.16	7.404	0.045	4.441	0.027	"
49.70	0.19	7.408	0.054	4.444	0.032	"
49.70	0.16	7.404	0.045	4.441	0.027	$Mg(ClO_4)_2.6H_2O$
49.87	-	7.43	-	4.46	-	$Mg(ClO_4)_2.6H_2O$

[a] Editors' calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Isothermal method. Details not given. NH_4^+ was determined by distilling off NH_3 into boric acid and then titrating with H_2SO_4; Mg^{2+} by titration with Trilon B at pH 10-11 with chrome blue black as indicator; ClO_4^- by difference. The density, viscosity and electrical conductivity of the saturated solutions were measured.	The salts were recrystallized.
	ESTIMATED ERROR: Temperature: ±0.1°C.
	REFERENCES: None.

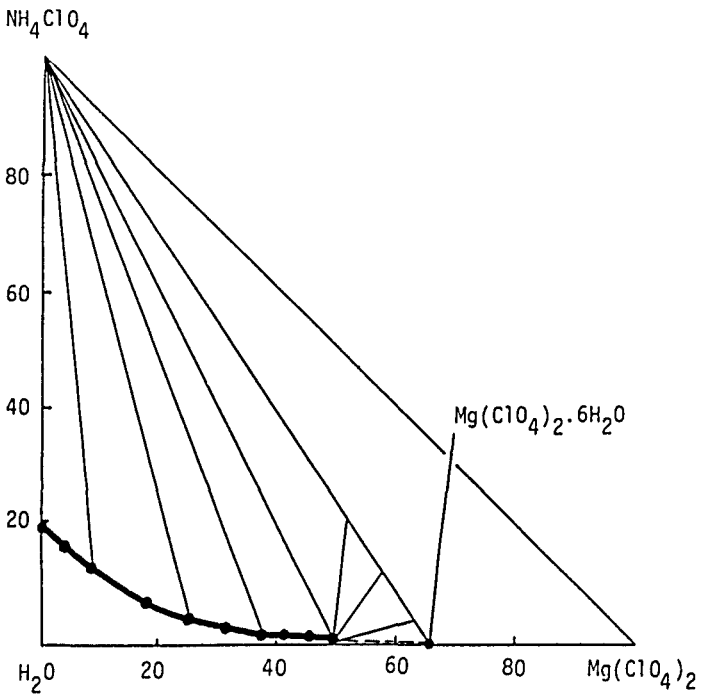
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Ivanov, S.A.; Orekhov, O.L.
(2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *78*, 203-10.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is given below. The eutectic composition is 0.15 % NH_4ClO_4, 49.68 % $Mg(ClO_4)_2$ and 50.17 % H_2O. Magnesium perchlorate has a strong salting-out action on ammonium perchlorate.



COMPONENTS:

(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]

(2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Karnaukhov, A.S.; Vasil'eva, S.I.

Uch. Zap. Yarosl. Gos. Ped. Inst. 1969, *66*, 122-31.

VARIABLES:

One temperature: 313 K

Composition

PREPARED BY:

I.S. Bodnya

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-NH_4ClO_4-H_2O at 40°C

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	26.67	-	5.282	-	3.096	NH_4ClO_4
1.20	24.71	0.124	4.859	0.073	2.839	"
1.48	24.36	0.153	4.788	0.089	2.796	"
4.03	21.36	0.416	4.188	0.242	2.437	"
5.76	19.86	0.597	3.910	0.347	2.273	"
8.61	18.06	0.905	3.606	0.526	2.096	"
11.94	15.43	1.269	3.115	0.737	1.808	"
17.08	12.34	1.867	2.562	1.084	1.488	"
23.02	8.16	2.583	1.740	1.499	1.009	"
25.91	6.75	2.968	1.469	1.724	0.853	"
36.61	3.30	4.650	0.796	2.730	0.467	"
39.50	2.88	5.205	0.721	3.071	0.425	"
43.42	2.37	6.034	0.626	3.588	0.372	"
51.23	1.19	7.967	0.352	4.824	0.213	NH_4ClO_4 + $Mg(ClO_4)_2.6H_2O$
51.16	1.11	7.936	0.327	4.802	0.198	"
51.39	0.93	7.981	0.274	4.829	0.166	"
51.49	1.02	8.023	0.302	4.858	0.183	"
51.65	1.15	8.088	0.342	4.903	0.207	"
51.42	1.09	8.011	0.323	4.851	0.195	"
51.62	0.97	8.055	0.288	4.878	0.174	"
52.00	-	8.040	-	4.854	-	$Mg(ClO_4)_2.6H_2O$

[a] Editors' calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method. NH_4^+ was determined by distilling off NH_3 into boric acid followed by titration with H_2SO_4; Mg^{2+} was determined by titration with Trilon B using chrome blue black as indicator at pH 10-11, and ClO_4^- iodimetrically. The density and relative viscosity of the saturated solutions were determined.

SOURCE AND PURITY OF MATERIALS:

The salts were recrystallized twice.

ESTIMATED ERROR:

Not stated.

REFERENCES:

None.

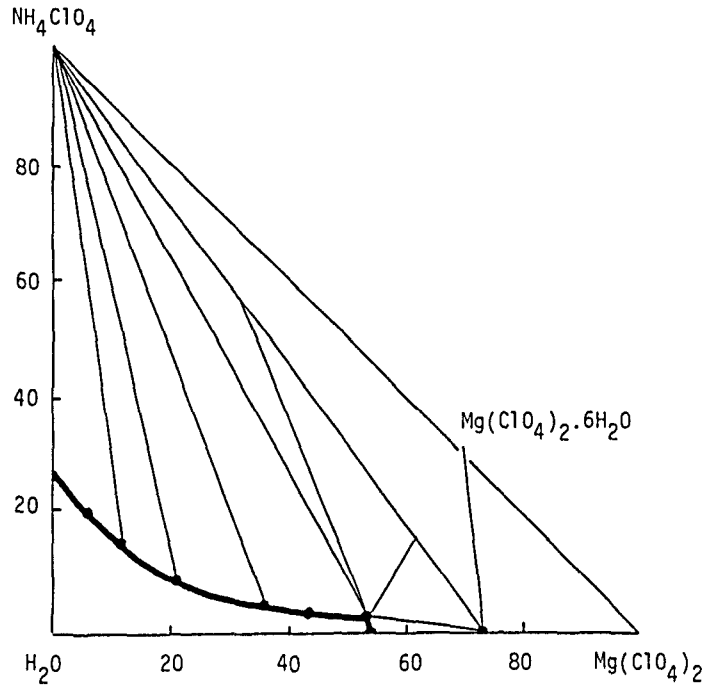
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Karnaukhov, A.S.; Vasil'eva, S.I.
(2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1969, *66*, 122-31.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is given below. The eutectic composition is 1.07 % NH_4ClO_4, 51.42 % $Mg(ClO_4)_2$ and 47.51 % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9] (3) Water; H_2O; [7732-18-5]	Karnaukhov, A.S.; Leboshchina, V. I.; Lepeshkov, I.N. *Zh. Neorg. Khim.* 1967, *12*, 3153-6; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1967, *12*, 1168-70.
VARIABLES: Temperature/K: 298 and 323 Composition	PREPARED BY: C.C. Ho

EXPERIMENTAL VALUES:

Solubility in the system $Mg(ClO_4)_2$-NH_4ClO_4-H_2O

Temp.	Liquid phase composition						Solid[b]
°C	mass %		mol %[a]		molality[a]/mol kg^{-1}		phase
	(1)	(2)	(1)	(2)	(1)	(2)	
25	49.7[c]	0.19[c]	7.41	0.054	4.44	0.032	A + B
50	52.24	-	8.112	-	4.900	-	A
	51.72[c]	0.9760[c]	8.086	0.290	4.898	0.1760	A + B
	-	30.00	-	6.170	-	3.648	B

[a] Compiler's calculation. [b] A = $Mg(ClO_4)_2$
B = NH_4ClO_4

[c] Eutonic point .

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The solubility was measured by the isothermal saturation method. Mg^{2+} concentration was determined by complexometry at pH 10-11, NH_4^+ determined by formalin and ClO_4^- by difference.	"Chemically pure" and "analytical reagent" materials thoroughly purified by recrystallization. Chemical analysis: ammonium perchlorate: 99.85% pure magnesium perchlorate: 99.91% pure
	ESTIMATED ERROR: Temp.: precision ±0.1°C Composition : nothing specified.
	REFERENCES:

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Karnaukhov, A.S.; Leboshchina, V. I.; Lepeshkov, I.N.
(2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	*Zh. Neorg. Khim.* 1967, *12*, 3153-6; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1967, *12*, 1168-70.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS/ADDITIONAL DATA:

The densities of the saturated solutions at 25.0°C were 1.098 g cm^{-3} for ammonium perchlorate and 1.470 g cm^{-3} for magnesium perchlorate. Thus the solubility in volume units at 25.0°C became 0.0353 mol dm^{-3} for ammonium perchlorate and 3.278 mol dm^{-3} for magnesium perchlorate. The 25.0°C and 50.0°C isotherms are shown in Fig. 1 and 2 respectively. The isotherm at 25.0°C had two branches. The first corresponded to the crystallization of anhydrous ammonium perchlorate. The second branch corresponded to solutions in equilibrium with a solid phase of $Mg(ClO_4)_2.6H_2O$. The isotherm showed the marked salting out action of magnesium perchlorate on ammonium perchlorate. The isotherm at 50.0°C also had two branches. The first (points 1 to 9) corresponded to separation of ammonium perchlorate as solid phase.

Fig. 1

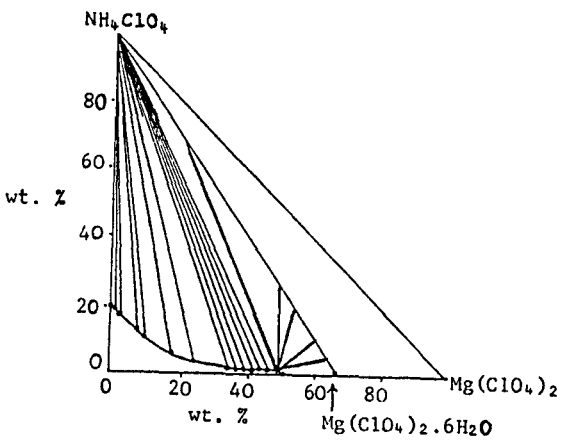
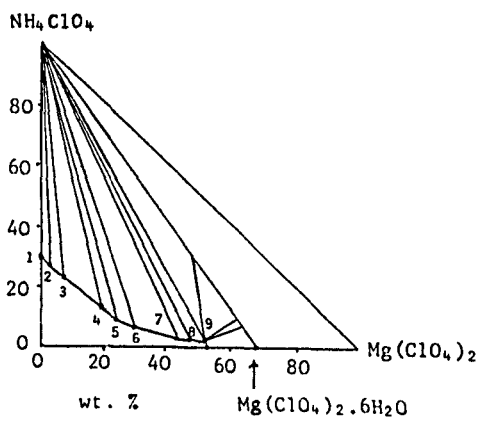


Fig. 2



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9] (3) Water; H_2O; [7732-18-5]	Leboshchina, V.I. *Uch. Zap. Vladim. Gos. Ped. Inst.* 1970, *22(1), Ser. Khim.* 60-5.
VARIABLES: Temperature/K: 298 and 323 Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-NH_4ClO_4-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	19.78	-	3.643	-	2.099	A
1.00	18.21	0.096	3.338	0.055	1.918	A
3.25	16.30	0.315	3.004	0.181	1.725	A
7.99	12.27	0.784	2.287	0.449	1.310	A
9.39	10.77	0.921	2.008	0.527	1.148	A
19.06	5.94	1.986	1.176	1.139	0.674	A
24.90	3.78	2.719	0.784	1.564	0.451	A
32.00	1.90	3.745	0.422	2.169	0.245	A
33.48	1.68	3.986	0.380	2.313	0.221	A
37.70	0.91	4.712	0.216	2.751	0.126	A
42.30	0.58	5.632	0.147	3.318	0.086	A
43.70	0.30	5.921	0.077	3.496	0.046	A
46.80	0.003	6.630	0.001	3.941	0.000	A
49.70	0.19	7.408	0.054	4.444	0.032	A + B
49.66	0.14	7.391	0.040	4.432	0.024	A + B
49.70	0.16	7.404	0.045	4.441	0.027	A + B
49.70	0.19	7.408	0.054	4.444	0.032	A + B
49.70	0.16	7.404	0.045	4.441	0.027	A + B
49.90	-	7.441	-	4.462	-	B

[a] Editors' calculations.

[b] A = NH_4ClO_4 ; B = $Mg(ClO_4)_2.6H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The experimental procedure was as reported elsewhere[1].	Not stated.
ESTIMATED ERROR: Not stated.	REFERENCES: 1. Karnaukhov, A.S.; Leboshchina, V.I.; Lepeshkhov, I.N., *Zh. Neorg. Khim.* 1967, No. 11.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Leboshchina, V.I.
(2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	*Uch. Zap. Vladim. Gos. Ped. Inst.* 1970, *22(1)*, *Ser. Khim.* 60-5.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility system $Mg(ClO_4)_2$-NH_4ClO_4-H_2O at 50°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	30.00	-	6.166	-	3.648	A
2.60	27.28	0.282	5.614	0.166	3.311	A
7.06	22.84	0.768	4.722	0.451	2.773	A
18.88	12.20	2.107	2.587	1.227	1.507	A
24.04	9.13	2.765	1.995	1.612	1.613	A
30.00	5.78	3.586	1.312	2.093	0.766	A
42.97	2.35	5.928	0.616	3.521	0.366	A
47.25	1.69	6.917	0.470	4.146	0.282	A
51.74	0.945	8.087	0.281	4.899	0.170	A + B
51.70	0.976	8.079	0.290	4.894	0.176	A + B
51.72	0.99	8.086	0.294	4.899	0.178	A + B
51.75	0.934	8.089	0.277	4.900	0.168	A + B
51.70	1.040	8.088	0.309	4.901	0.187	B
52.24	-	8.112	-	4.900	-	B

[a] Editors' calculations.

[b] A = NH_4ClO_4 ; B = $Mg(ClO_4)_2 \cdot 6H_2O$.

COMMENTS AND/OR ADDITIONAL DATA:

At both temperatures, the solubility isotherm is dominated by the NH_4ClO_4 field because of the strong salting-out effect of $Mg(ClO_4)_2$. The two isotherms (mass %) are shown below.

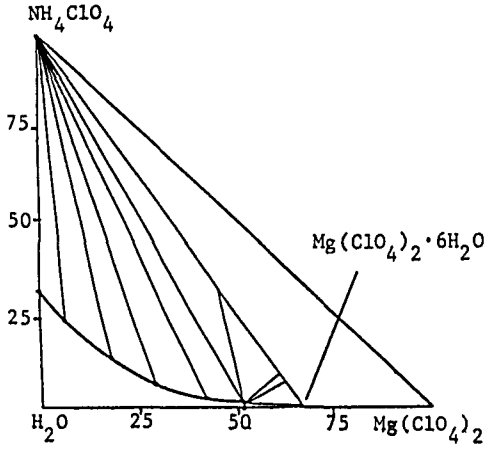


Figure 1. 25°C isotherm

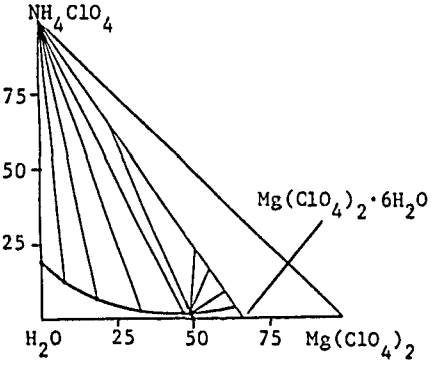


Figure 2. 50°C isotherm

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Thallium perchlorate; $TlClO_4$; [13453-40-2] (3) Water; H_2O; [7732-18-5]	Ivanov, S.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1973, *120*, 20-3.
VARIABLES: One temperature: 298 K Composition.	**PREPARED BY:** N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$TlClO_4$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	14.09	-	0.963	-	0.540	A
12.01	6.22	1.166	0.444	0.658	0.250	A
27.45	2.36	3.054	0.193	1.752	0.111	A
42.02	1.50	5.656	0.148	3.333	0.087	A
49.73	1.64	7.610	0.184	4.582	0.111	A + B
49.67	1.72	7.604	0.193	4.578	0.116	B
49.78	-	7.408	-	4.441	-	B

[a] Editors' calculations.

[b] A = $TlClO_4$; B = $Mg(ClO_4)_2.6H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The conditions of saturation are not given. Mg^{2+} was determined by titration with Trilon B; Tl^+ by the bromate method and ClO_4^- by precipitation with nitron.

SOURCE AND PURITY OF MATERIALS:

Not stated.

ESTIMATED ERROR:

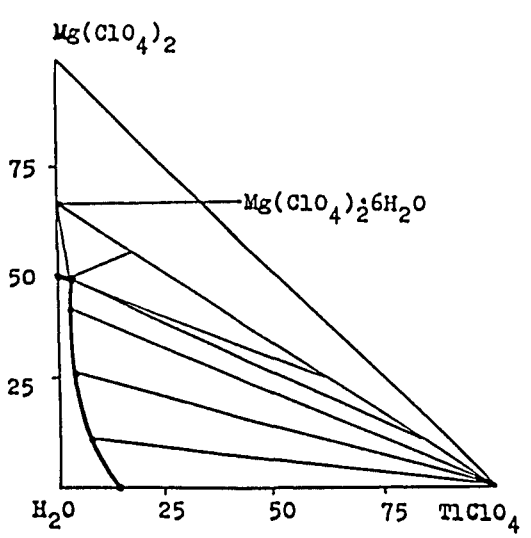
Not stated.

REFERENCES:

None.

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is given below. The composition of the eutectic mixture is: 1.64% $TlClO_4$, 49.73% $Mg(ClO_4)_2$ and 48.63 % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium chromate; $MgCrO_4$; [13423-61-5] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Water; H_2O; [7732-18-5]	Lepeshkhov, I.N.; Orekhov, O.L. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1969, *66*, 62-71.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$MgCrO_4$-H_2O at 25°C[a]

Liquid phase composition					
mass %		mol %[b]		molality[b]/mol kg^{-1}	
(1)	(2)	(1)	(2)	(1)	(2)
35.39	-	6.571	-	3.904	-
33.73	0.91	6.208	0.105	3.678	0.062
32.80	1.25	5.994	0.144	3.545	0.085
30.31	4.06	5.572	0.469	3.292	0.277
25.98	8.86	4.820	1.033	2.842	0.609
23.50	11.86	4.398	1.395	2.591	0.822
17.68	17.30	3.305	2.033	1.938	1.192
14.38	21.18	2.716	2.514	1.591	1.473
9.43	26.99	1.808	3.253	1.057	1 902
6.52	31.83	1.287	3.949	0.754	2.313
3.40	38.83	0.712	5.109	0.419	3.011
2.69	41.31	0.579	5.587	0.342	3.305
2.01	44.32	0.449	6.221	0.267	3.700
1.19	48.02	0.279	7.070	0.167	4.236

[a] Solid phase : $MgCrO_4.5H_2O$; [b] Editors' calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal method was used. Mg^{2+} was determined by titration with Trilon B using chrome blue black as indicator at pH 10-11; CrO_4^{2-} iodimetrically ; and ClO_4^- by difference. Schreinemakers' method of "residues" was used to determine the composition of the solid phases. Electrical conductivity, density, viscosity and refractive index measurements were made.	The salts were recrystallized. $MgCrO_4$ was dissolved, filtered and evaporated under reduced pressure until crystals appeared. The salt was cooled for 12 h, centrifuged and dried, first in air and then in a desiccator for 7 days. The $MgCrO_4.5H_2O$ obtained was 99.86 % pure.
REFERENCES: None.	ESTIMATED ERROR: Temperature: ±0.1°C.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium chromate; $MgCrO_4$; [13423-61-5]	Lepeshkhov, I.N.; Orekhov, O.L.
(2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	*Sb. Tr. Yarosl. Gos. Ped. Inst.* 1969, *66*, 62-71.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility system $Mg(ClO_4)_2$-$MgCrO_4$-H_2O at 25°C

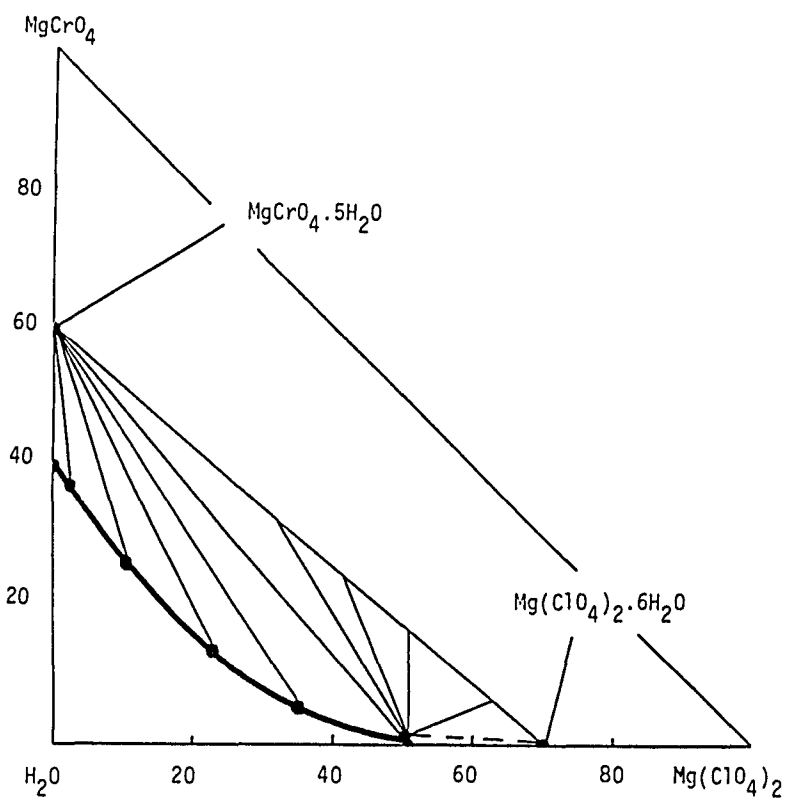
Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
0.75	49.70	0.179	7.476	0.108	4.494	A + B
0.75	49.71	0.180	7.479	0.108	4.596	A + B
0.74	49.70	0.177	7.475	0.106	4.493	A + B
0.75	49.72	0.180	7.481	0.108	4.497	A + B
0.74	49.72	0.177	7.480	0.106	4.496	A + B
-	49.87	-	7.433	-	4.457	B

[a] Editors' calculations.

[b] A = $MgCrO_4.5H_2O$; B = $Mg(ClO_4)_2.6H_2O$.

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is given below. There is virtually one long branch of crystallization of $MgCrO_4.5H_2O$. The eutectic composition is 0.74 % $MgCrO_4$, 49.71 % $Mg(ClO_4)_2$, and 49.55 % H_2O; the solid phase consists of pinacoid crystals of $MgCrO_4.5H_2O$ and hexagonal crystals of $Mg(ClO_4)_2.6H_2O$.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium chromate: $MgCrO_4$; [13423-61-5] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Water; H_2O; [7732-18-5]	Bitokov, V.T.; Ivanov, S.A. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1970, *79*, 61-6.
VARIABLES: One temperature: 323 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$MgCrO_4$-H_2O at 50°C

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
36.89	-	6.982	-	4.166	-	$MgCrO_4.5H_2O$
35.78	1.14	6.780	0.136	4.043	0.081	"
33.34	3.17	6.293	0.376	3.743	0.224	"
30.90	5.09	5.802	0.601	3.441	0.356	"
26.85	8.81	5.033	1.038	2.974	0.613	"
21.00	14.02	3.919	1.645	2.303	0.967	"
17.21	18.96	3.271	2.265	1.922	1.331	"
12.50	23.62	2.382	2.829	1.395	1.657	"
10.00	26.47	1.918	3.191	1.122	1.867	"
6.41	34.28	1.309	4.399	0.770	2.589	"
5.05	37.40	1.059	4.931	0.625	2.912	"
3.20	42.88	0.711	5.989	0.423	3.563	"
1.81	47.77	0.426	7.073	0.256	4.245	"
1.44	51.63	0.361	8.126	0.219	4.929	$MgCrO_4.5H_2O$ + $Mg(ClO_4)_2.6H_2O$
0.38	51.98	0.094	8.086	0.056	4.888	$Mg(ClO_4)_2.6H_2O$
-	52.21	-	8.103	-	4.895	"

[a] Editors' calculations.

AUXILIARY INFORMATION

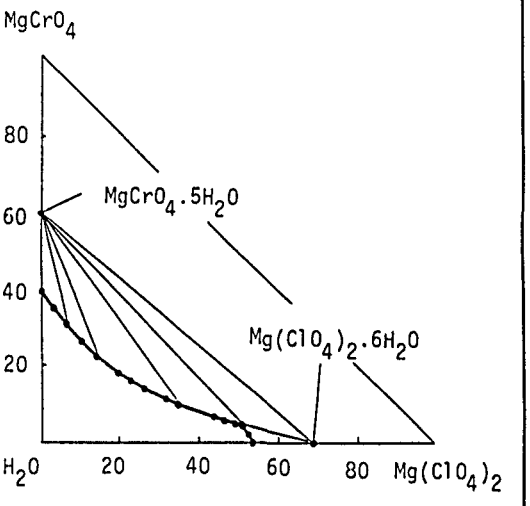
METHOD/APPARATUS/PROCEDURE:
The isothermal method was used [1].

SOURCE AND PURITY OF MATERIALS:
Not stated.

ESTIMATED ERROR:
Not stated.

REFERENCES:
1. Lepeshkhov, I.N.; Orekhov, O.L. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1969, *66*, 62.

COMMENTS AND/OR ADDITIONAL DATA:
The solubility isotherm (mass %) is given below.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium nitrate; $Mg(NO_3)_2$; [10377-60-3] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Water; H_2O; [7732-18-5]	Bitokov, V.T. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1970, *78*, 142-9.
VARIABLES: Temperature/K: 298 and 323 Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$Mg(NO_3)_2$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
42.57	-	8.260	-	4.998	-	A
40.18	3.08	7.888	0.402	4.775	0.243	A
36.86	7.63	7.388	1.106	4.477	0.616	A
34.69	10.71	7.061	1.448	4.284	0.879	A
30.00	17.50	6.331	2.454	3.853	1.493	A
27.22	21.83	5.902	3.145	3.602	1.920	A
25.41	24.42	5.589	3.569	3.415	2.181	A
22.70	28.70	5.137	4.316	3.149	2.646	A
21.17	31.03	4.863	4.737	2.986	2.908	A + B
19.97	31.84	4.561	4.832	2.794	2.960	B
18.24	32.82	4.118	4.923	2.513	3.004	B
15.13	34.81	3.359	5.136	2.038	3.115	B
11.73	37.47	2.579	5.474	1.557	3.305	B
10.10	38.79	2.212	5.644	1.332	3.400	B
6.38	42.19	1.394	6.123	0.836	3.675	B
4.19	44.60	0.920	6.507	0.552	3.902	B
1.46	47.79	0.324	7.041	0.194	4.219	B
-	49.98	-	7.463	-	4.477	B

[a] Editors' calculations.

[b] A = $Mg(NO_3)_2.6H_2O$; B = $Mg(ClO_4)_2.6H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal method was used. Periods of equilibration were 5-6 days at 25°C and 3-4 days at 50°C. Mg^{2+} was determined by complexometric titration with Trilon B using chrome blue black indicator at pH 10-12; NO_3^- was reduced to NH_3 with Devarda's alloy, distilled into 4% boric acid and titrated with 0.1 mol dm^{-3} H_2SO_4; and ClO_4^- was determined by difference. Density and viscosity measurements were made.	Not stated. ESTIMATED ERROR: Not stated. REFERENCES: None.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium nitrate; $Mg(NO_3)_2$; [10377-60-3]	Bitokov, V.T.
(2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	*Sb. Tr. Yarosl. Gos. Ped. Inst.* 1970, *78*, 142-9.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility system $Mg(ClO_4)_2$-$Mg(NO_3)_2$-H_2O at 50°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
46.00	-	9.377	-	5.744	-	A
42.98	4.46	8.979	0.619	5.513	0.380	A
37.61	11.37	8.085	1.624	4.970	0.998	A
33.82	16.09	7.402	2.340	4.552	1.439	A
29.63	22.01	6.698	3.306	4.131	2.039	A
24.90	28.82	5.858	4.505	3.628	2.790	A
23.61	30.70	5.619	4.855	3.484	3.010	A
22.15	34.46	5.506	5.692	3.442	3.558	A + B
19.94	34.18	4.743	5.403	2.930	3.338	B
14.29	38.12	3.312	5.871	2.025	3.589	B
12.09	39.82	2.783	6.090	1.695	3.710	B
8.94	42.01	2.029	6.335	1.229	3.837	B
6.75	44.80	1.550	6.837	0.939	4.143	B
-	52.21	-	8.103	-	4.895	B

[a] Editors' calculations.

[b] A = $Mg(NO_3)_2.6H_2O$; B = $Mg(ClO_4)_2.6H_2O$.

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherms (mass %) are shown below. There are two branches of crystallization corresponding to the separation of the components. $Mg(ClO_4)_2$ has an insignificant salting-out effect on $Mg(NO_3)_2$.

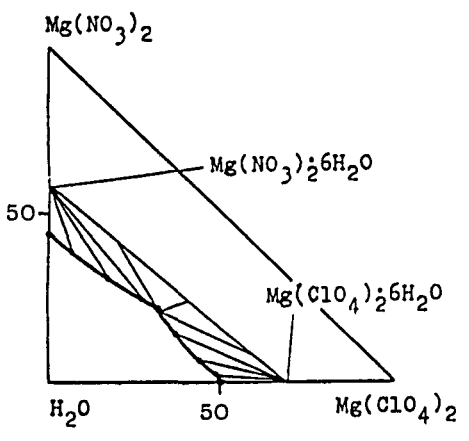


Figure 1. 25°C isotherm

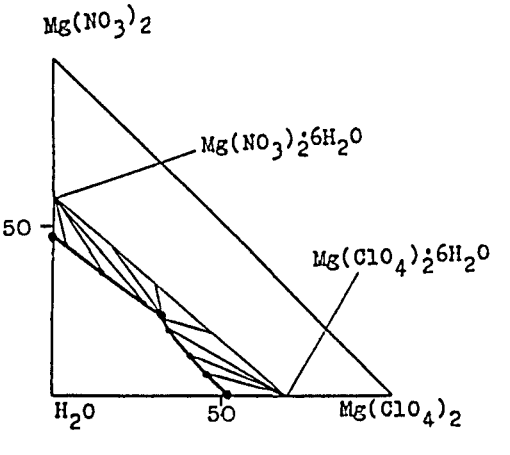


Figure 2. 50°C isotherm

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium sulfate; $MgSO_4$; [7487-88-9]	Troitskii, E.N.; Gumenyuk, V.P.; Prishel'tsev, N.I.
(2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1977, *164*, 30.
(3) Water; H_2O; [7732-18-5]	
VARIABLES:	**PREPARED BY:**
One temperature: 298.15 K	I.S. Bodnya
Composition	

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$MgSO_4$-H_2O at 25.00°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
27.35	-	5.334	-	3.128	-	A
25.23	1.45	4.891	0.152	2.859	0.089	A
23.65	3.44	4.613	0.362	2.695	0.211	A
15.78	13.21	3.173	1.432	1.846	0.833	A
9.26	21.36	1.912	2.378	1.109	1.379	A
4.17	30.85	0.917	3.657	0.533	2.127	A
2.53	37.17	0.595	4.711	0.349	2.762	A
1.51	43.45	0.385	5.967	0.228	3.537	A
1.03	48.83	0.284	7.267	0.171	4.363	A
1.05	48.82	0.290	7.266	0.174	4.363	A + B
1.04	48.81	0.287	7.262	0.172	4.360	A + B
1.04	48.82	0.287	7.265	0.172	4.362	A + B
1.05	48.80	0.290	7.261	0.174	4.360	A + B
1.02	48.79	0.281	7.255	0.169	4.355	B
0.51	49.27	0.141	7.327	0.084	4.395	B
-	49.73	-	6.131	-	3.626	B

[a] Editors' calculations.

[b] A = $MgSO_4.7H_2O$; B = $Mg(ClO_4)_2.6H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal method was used. Periods of equilibration of saturated solutions were 3-4 days. Mg^{2+} was determined by complexometric titration with EDTA; SO_4^{2-} gravimetrically as barium sulfate and ClO_4^- by difference.	$MgSO_4$ and $Mg(ClO_4)_2$ were purified by recrystallization twice.
	ESTIMATED ERROR: Temperature : ±0.05°C.
	REFERENCES: None.

(continued next page)

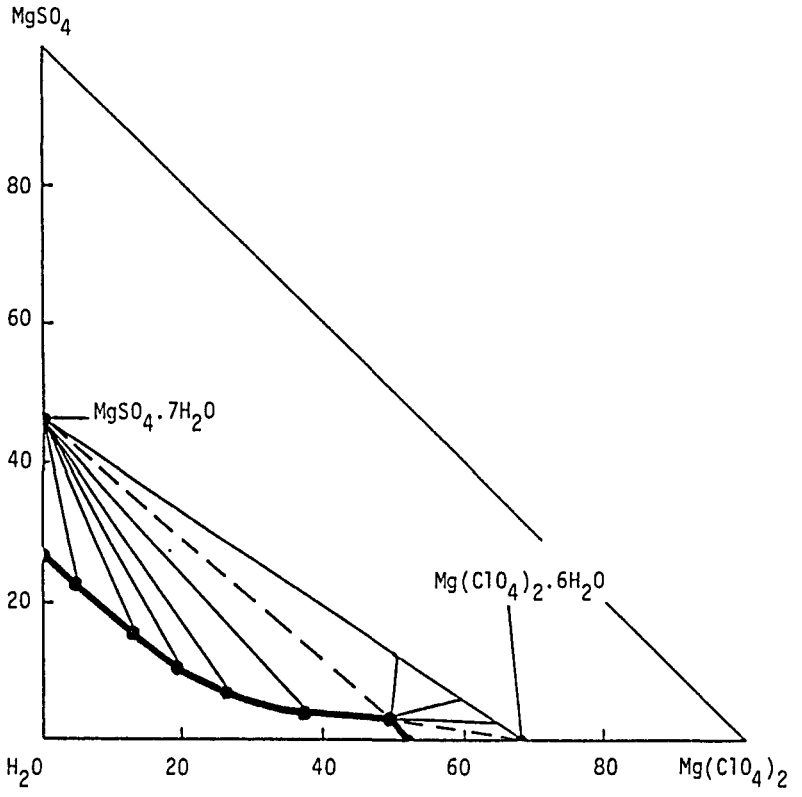
COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium sulfate; $MgSO_4$; [7487-88-9]	Troitskii', E.N.; Gumenyuk, V.P.; Prishel'tsev, N.I.
(2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1977, *164*, 30.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is given below. This shows two branches of crystallization of the component salts. The first branch corresponds to the separation of the solid phase $MgSO_4.7H_2O$ and the second branch corresponds to the separation of $Mg(ClO_4)_2.6H_2O$. The eutectic composition is:

1.05 mass % $MgSO_4$, 48.80 mass % $Mg(ClO_4)_2$ and 50.15 mass % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium sulfate; $MgSO_4$; [7487-88-9] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Water; H_2O; [7732-18-5]	Leboshchina, V.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1973, *120*, 47-53.
VARIABLES: One temperature: 308 K Composition	PREPARED BY: I.S. Bodnya

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$MgSO_4$-H_2O at 35°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
29.74	-	5.958	-	3.517	-	A
8.46	26.66	1.854	3.151	1.083	1.841	A
5.53	32.77	1.270	4.058	0.745	2.379	A
4.63	35.29	1.089	4.477	0.640	2.632	A + B
2.47	41.57	0.619	5.621	0.367	3.328	B
1.77	46.47	0.475	6.725	0.284	4.022	B
0.67	50.62	0.190	7.724	0.114	4.656	B + C
0.58	50.64	0.164	7.718	0.099	4.651	C
-	51.20	-	7.807	-	4.700	C

[a] Editors' calculations.

[b] A = $MgSO_4.7H_2O$; B = $MgSO_4.6H_2O$; C = $Mg(ClO_4)_2.6H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal recrystallization method was used. Periods of equilibration varied from 7-8 days. Mg^{2+} was determined by titration using the indicator chrome blue black at pH 10-12, ClO_4^- gravimetrically by precipitation with nitron, and SO_4^{2-} by difference. The composition of the solid phases was determined by Schreinemakers' method of "residues".	The salts were purified by recrystallization.
	ESTIMATED ERROR: Not stated.
	REFERENCES: None.

(continued next page)

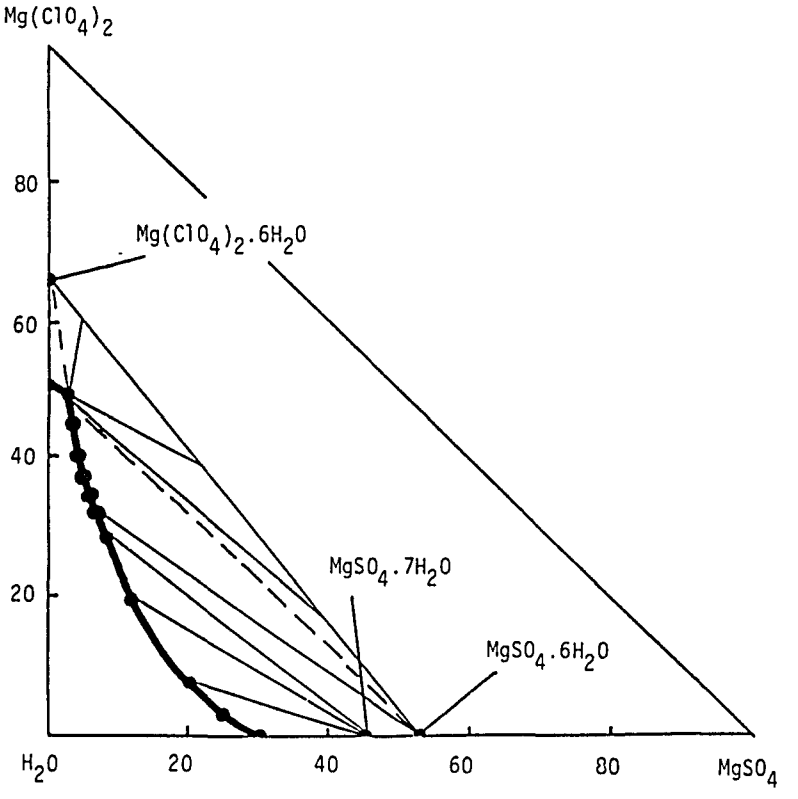
COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium sulfate; $MgSO_4$; [7487-88-9]	Leboshchina, V.I.
(2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1973, *120*, 47-53.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm shown below (mass %) consists of three branches of crystallization. The first branch refers to the crystallization of epsomite, $MgSO_4.7H_2O$. The second corresponds to the crystallization of $MgSO_4.6H_2O$ while the third branch shows the crystallization of $Mg(ClO_4)_2.6H_2O$. The point of conversion of the heptahydrate to the hexahydrate is not shown. The eutectic phase contains $Mg(ClO_4)_2.6H_2O$ and $MgSO_4.6H_2O$ crystals and the eutectic solution has the following composition:

50.62 mass % $Mg(ClO_4)_2$; 0.67 mass % $MgSO_4$; 48.71 mass % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium chloride; $MgCl_2$; [7786-30-3] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Water; H_2O; [7732-18-5]	Karnaukhov, A.S.; Kudryakova, S.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1966, *59*, 119-36.
VARIABLES: One temperature: 298.2 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$MgCl_2$-H_2O at 25.0°C

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
35.65	-	9.488	-	5.819	-	$MgCl_2.6H_2O$
34.77	2.02	9.405	0.233	5.777	0.143	"
32.56	5.30	8.964	0.622	5.503	0.382	"
31.00	7.53	8.633	0.895	5.330	0.549	"
29.24	10.96	8.355	1.336	5.136	0.821	"
25.78	15.24	7.494	1.890	4.591	1.158	"
25.14	16.35	7.365	2.043	4.513	1.252	"
23.22	18.77	6.874	2.370	4.204	1.450	"
22.90	19.85	6.858	2.536	4.201	1.553	"
22.69	19.85	6.777	2.529	4.147	1.548	$MgCl_2.6H_2O$ + $Mg(ClO_4)_2.6H_2O$
22.93	20.16	6.900	2.588	4.232	1.587	"
22.90	20.01	6.874	2.562	4.213	1.570	"
22.86	19.98	6.855	2.556	4.200	1.566	$Mg(ClO_4)_2.6H_2O$
22.46	20.16	6.718	2.572	4.111	1.574	"

[a] Editors' calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The isothermal method was used. Periods of equilibration were 20-70 h. Cl^- was determined mercurimetrically, Mg^{2+} by complexometric titration and ClO_4^- gravimetrically by nitron precipitation. Density and viscosity measurements were made.

SOURCE AND PURITY OF MATERIALS:

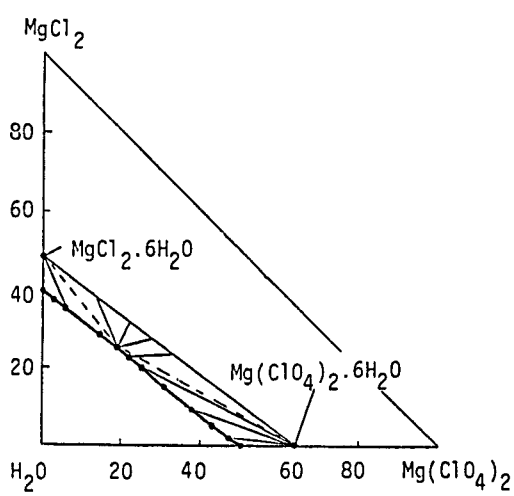
The salts were recrystallized twice. Purity: 95.58-99.75 %.

ESTIMATED ERROR:

Temperature: ±0.1°C.

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is shown below.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium chloride; $MgCl_2$; [7786-30-3]	Lepeshkhov, I.N.; Leboshchina,V.I.
(2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1966, *59*, 48-66.
(3) Water; H_2O; [7732-18-5]	
VARIABLES:	PREPARED BY:
One temperature: 298 K	E.S. Gryzlova
Composition	

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$MgCl_2$-H_2O at 25°C

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	49.90	-	7.441	-	4.462	$Mg(ClO_4)_2.6H_2O$
3.78	44.77	1.282	6.478	0.772	3.898	"
6.34	41.11	2.102	5.814	1.267	3.505	"
11.70	33.80	3.724	4.589	2.255	2.779	"
16.56	27.70	5.128	3.659	3.120	2.226	"
20.08	23.04	6.075	2.973	3.708	1.815	"
22.85	19.90	6.843	2.542	4.192	1.557	$Mg(ClO_4)_2.6H_2O$ + $MgCl_2.6H_2O$
22.84	19.85	6.834	2.534	4.186	1.552	$MgCl_2.6H_2O$
27.00	13.00	7.722	1.586	4.726	0.971	"
31.00	6.00	8.458	0.698	5.168	0.427	"
35.50	-	9.432	-	5.781	-	"

[a] Editors' calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal method was used. Experimental details were not given. Mg^{2+} was determined by titration with Trilon B using chrome blue black as indicator at pH 10-11, Cl^- by titration with $Hg_2(NO_3)_2$ in acidic medium with diphenylcarbazone as indicator, and ClO_4^- by difference. Viscosity, density and electrical conductivity measurements of the saturated solutions were made.	The salts were recrystallized.
	ESTIMATED ERROR:
	Temperature: ±0.1°C.
	REFERENCES:
	None.

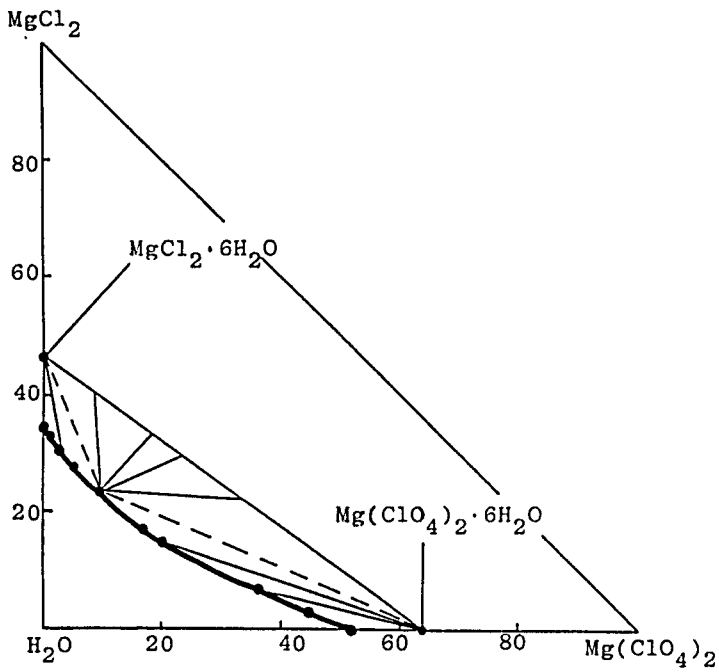
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium chloride; $MgCl_2$; [7786-30-3]	Lepeshkhov, I.N.; Leboshchina,V.I.
(2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1966, *59*, 48-66.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is given below. The eutectic composition is 9.80 % $Mg(ClO_4)_2$, 22.85 % $MgCl_2$ and 67.35 % H_2O.



COMPONENTS:

(1) Magnesium chloride; $MgCl_2$; [7786-30-3]

(2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Kudryakova, S.A.; Lepeshkov, I.N.

Sb. Tr. Yarosl. Gos. Ped. Inst. 1969, *66*, 40-50.

VARIABLES:

One temperature: 363 K

Composition

PREPARED BY:

I.S. Bodnya

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$MgCl_2$-H_2O at 90°C

Liquid phase composition						Solid
mass %		mol %[a]		molality[a]/mol kg^{-1}		phase[b]
(1)	(2)	(1)	(2)	(1)	(2)	
40.48	-	11.40	-	7.143	-	A
38.77	2.69	11.10	0.328	6.956	0.206	A
36.97	5.11	10.71	0.631	6.704	0.395	A
34.69	10.85	10.60	1.415	6.690	0.893	A
30.09	17.37	9.547	2.351	6.015	1.481	A
27.29	22.52	9.032	3.179	5.711	2.010	A
27.08	22.95	8.998	3.253	5.692	2.058	A + B
26.94	23.24	8.975	3.303	5.679	2.090	A + B
26.66	23.32	8.858	3.305	5.598	2.089	A + B
26.20	23.51	8.675	3.321	5.472	2.094	B
21.39	28.60	7.180	4.095	4.492	2.562	B
18.62	31.13	6.259	4.464	3.892	2.775	B
14.90	36.24	5.163	5.357	3.203	3.323	B
10.84	41.16	3.843	6.224	2.372	3.842	B
8.56	43.95	3.076	6.737	1.893	4.146	B
5.97	46.98	2.174	7.296	1.333	4.473	B
3.58	50.55	1.338	8.059	0.820	4.937	B
-	55.57	-	9.169	-	5.603	B

[a] Editors' calculations ; [b] A = $MgCl_2.6H_2O$; B = $Mg(ClO_4)_2.6H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The isothermal method was used. Mg^{2+} was determined volumetrically using Trilon B as indicator; ClO_4^- gravimetrically by nitron precipitation; and Cl^- mercurimetrically. The densities and viscosities of the saturated solutions were measured [1].

SOURCE AND PURITY OF MATERIALS:

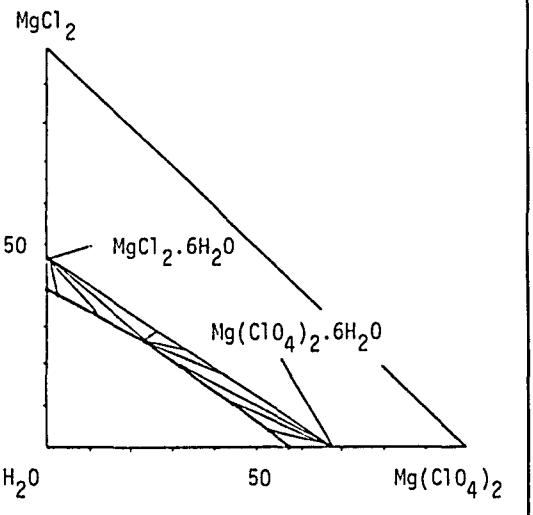
Not stated.

REFERENCES:

1. Copeland, L.E.; Bragg, P.H. *J. Phys. Chem.* 1954, *58*, 1070.

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is shown below.



COMPONENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]
(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]
(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Runov, N.N.; Zakharova, V.P.

Sb. Tr. Yarosl. Gos. Ped. Inst. 1970, *79*, 120-4.

VARIABLES:
One temperature: 298 K
Composition.

PREPARED BY:
E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility in the system $Mg(ClO_4)_2$-$Ca(ClO_4)_2$-H_2O at 25°C:

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
49.99	-	7.466	-	4.478	-	$Mg(ClO_4)_2.6H_2O$
46.40	3.44	6.914	0.479	4.144	0.287	"
38.97	10.27	5.752	1.416	3.440	0.847	"
34.51	16.08	5.215	2.270	3.129	1.362	"
29.15	22.59	4.497	3.255	2.706	1.959	"
24.58	28.03	3.853	4.104	2.324	2.475	"
18.77	35.26	3.021	5.301	1.829	3.210	"
7.77	51.07	1.374	8.436	0.846	5.192	"
3.32	59.03	0.632	10.50	0.395	6.561	"
1.32	63.50	0.266	11.95	0.168	7.553	"

[a] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Isothermal method. The sum of Ca^{2+} and Mg^{2+} ions was determined by complexometric titration with the indicator chrome blue black; Ca^{2+} with the indicator murexide (ref 1). The nature of the solid phase was determined by Schreinemakers' method of "residues". The density, viscosity and electric conductivity of saturated solutions were studied.

SOURCE AND PURITY OF MATERIALS:
Calcium perchlorate was prepared by reacting chemically pure calcium carbonate with perchloric acid and then recrystallizing the salt obtained. Magnesium perchlorate was recrystallized twice from the anhydrous salt.

ESTIMATED ERROR:
No details given.

REFERENCES:
1. Pribil, R. *Komplexone in der chemischen Analyse*, Berlin, Deutsch Verl. der Wissenschften, 1961.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Runov, N.N.; Zakharova, V.P.
(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	*Sb. Tr. Yarosl. Gos. Ped. Inst.* 1970, *79*, 120-4.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

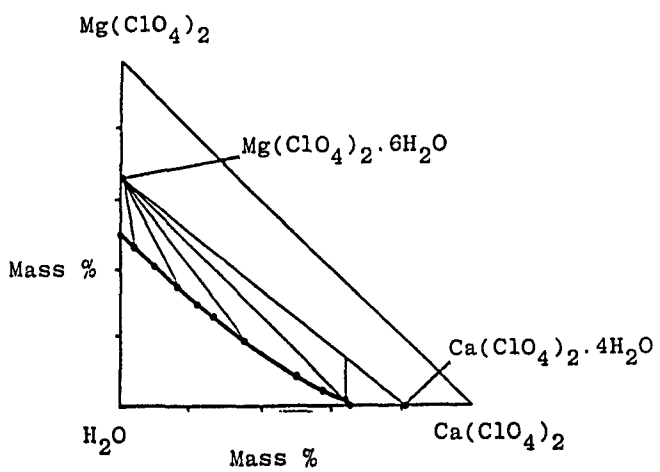
Solubility in the system $Mg(ClO_4)_2$-$Ca(ClO_4)_2$-H_2O at 25°C:

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
1.36	63.52	0.274	11.97	0.173	7.568	$Mg(ClO_4)_2.6H_2O$ + $Ca(ClO_4)_2.4H_2O$
1.38	63.54	0.279	11.98	0.176	7.57	$Ca(ClO_4)_2.4H_2O$
-	65.34	-	12.44	-	7.888	"

[a] Compiler's calculations.

COMMENTS/ADDITIONAL DATA:

The eutectic composition: 63.52 mass % $Ca(ClO_4)_2$,
1.35 mass % $Mg(ClO_4)_2$,
and 35.13 mass % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Lanthanum perchlorate; $La(ClO_4)_3$; [14017-46-0] (3) Water; H_2O; [7732-18-5]	Chernova, L.P. *Uch. Zap. Yarosl. Gos. Ped. Inst.* <u>1976</u>, *154*, 16-8.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: I.S. Bodnya

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$La(ClO_4)_3$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
49.80	-	7.413	-	4.444	-	A
44.04	7.04	6.737	0.550	4.033	0.329	A
36.19	15.21	5.601	1.202	3.336	0.716	A
26.02	28.92	4.343	2.464	2.587	1.468	A
20.02	36.74	3.485	3.264	2.074	1.943	A
11.57	45.99	2.063	4.186	1.221	2.478	A
3.63	58.01	0.714	5.823	0.424	3.458	A
0.40	65.10	0.087	7.207	0.052	4.315	A + B
0.55	64.90	0.119	7.175	0.071	4.296	A + B
0.35	65.07	0.076	7.190	0.045	4.303	A + B
-	66.22	-	7.473	-	4.483	B

[a] Editors' calculations.

[b] A = $Mg(ClO_4)_2.6H_2O$; B = $La(ClO_4)_3.9H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The solubility was determined by isothermal recrystallization. ClO_4^- was determined gravimetrically by nitron precipitation, La^{3+} by complexometric titration and Mg^{2+} by difference.	$La(ClO_4)_3$ was prepared by neutralizing 30 % $HClO_4$ with $La_2(CO_3)_3$. The solution was then evaporated, the mother liquor separated and the salt dried in a desiccator.
	ESTIMATED ERROR: Not stated.
	REFERENCES: Not stated.

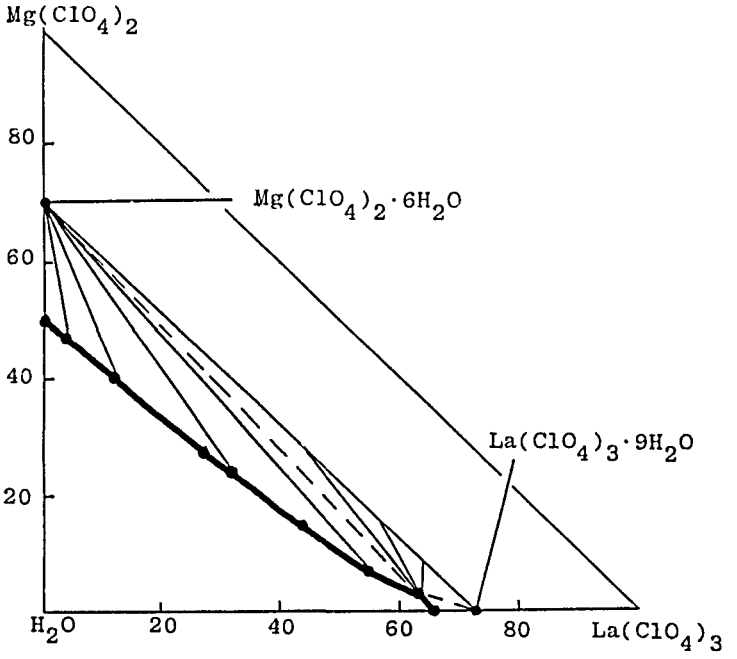
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Chernova, L.P.
(2) Lanthanum perchlorate; $La(ClO_4)_3$; [14017-46-0]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1976, *154*, 16-8.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is shown below. The eutectic composition is 0.45 % $Mg(ClO_4)_2$, 65.06 % $La(ClO_4)_3$ and 34.49 % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Cerium perchlorate; $Ce(ClO_4)_3$; [14017-47-1] (3) Water; H_2O; [7732-18-5]	Guseva, A.D.; Druzhinina, G.V. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1975, *144*, 81-6.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: I.S. Bodnya

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$Ce(ClO_4)_3$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
49.80	-	7.413	-	4.444	-	A
39.86	10.48	6.035	0.808	3.596	0.481	A
38.04	13.76	5.923	1.091	3.536	0.651	A
32.53	18.46	5.011	1.448	2.974	0.859	A
22.95	28.07	3.563	2.219	2.099	1.307	A
17.11	37.21	2.842	3.146	1.678	1.858	A
10.22	47.12	1.816	4.262	1.073	2.519	A
8.99	50.06	1.659	4.703	0.984	2.788	A
2.70	62.33	0.577	6.784	0.346	4.065	A + B
2.61	62.38	0.558	6.783	0.334	4.064	A + B
2.64	62.28	0.563	6.760	0.337	4.049	A + B
1.19	63.61	0.253	6.894	0.151	4.121	B
-	64.85	-	7.046	-	4.208	B

[a] Editors' calculations.

[b] A = $Mg(ClO_4)_2.6H_2O$; B = $Ce(ClO_4)_3.9H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The isothermal method was used. Ce^{3+} was determined by complexometric titration with EDTA using xylenol orange as indicator in the presence of urotropin. ClO_4^- was determined gravimetrically as nitron perchlorate.

SOURCE AND PURITY OF MATERIALS:

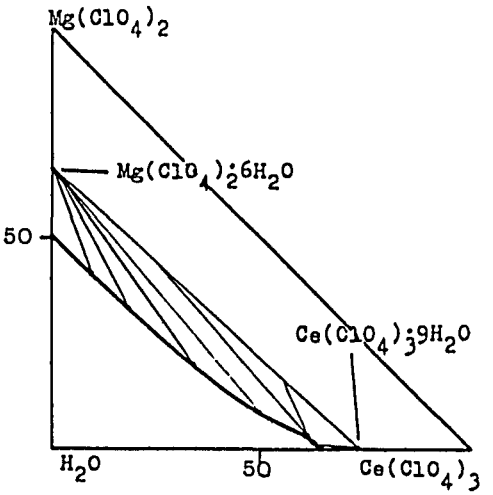
Not stated.

ESTIMATED ERROR:

Not stated.

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is shown below.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Guseva, A.D.
(2) Neodymium perchlorate; $Nd(ClO_4)_3$; [13498-06-1]	*Sb. Nauch. Tr. Yarosl. Gos. Ped. Inst.* 1982, *199*, 3-6.
(3) Water; H_2O; [7732-18-5]	
VARIABLES:	PREPARED BY:
Temperature: 298 K	E.S. Gryzlova
Composition	

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$Nd(ClO_4)_3$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
49.80	-	7.413	-	4.444	-	A
37.55	15.41	5.978	1.237	3.576	0.740	A
32.94	19.82	5.243	1.591	3.124	0.948	A
24.79	29.06	4.056	2.398	2.407	1.423	A
19.77	35.42	3.335	3.013	1.977	1.786	A
12.33	46.20	2.244	4.241	1.332	2.517	A
5.81	55.34	1.128	5.419	0.670	3.218	A
2.82	63.28	0.620	7.018	0.373	4.218	A + B
2.76	63.22	0.605	6.990	0.363	4.199	A + B
2.79	63.25	0.613	7.004	0.368	4.208	A + B
-	65.39	-	7.141	-	4.269	B

[a] Editors' calculations.

[b] A = $Mg(ClO_4)_2.6H_2O$; B = $Nd(ClO_4)_3.9H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Isothermal recrystallization. Equilibrium was reached in 40 h. Liquid and solid phases were analyzed by determining neodymium and perchlorate ions (ref. 1,2). Magnesium ion was determined by difference.	Not stated.
	ESTIMATED ERROR:
	Not stated.

REFERENCES:

1. Karnauchov, A.S.; Kulikova, A.A.; Ashimichina, T.J. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1975, *144*, 19-29.
2. Karnauchov, A.S.; Kulikova, A.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1975, *144*, 81-85.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Samarium perchlorate; $Sm(ClO_4)_3$; [13569-60-3] (3) Water; H_2O; [7732-18-5]	Guseva, A.D. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1978, *169*, 5-7.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$Sm(ClO_4)_3$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
49.80	-	7.413	-	4.444	-	A
42.98	8.39	6.616	0.642	3.960	0.385	A
24.97	26.05	3.873	2.010	2.284	1.185	A
13.02	44.39	2.314	3.924	1.370	2.323	A
4.81	58.98	0.996	6.077	0.595	3.630	A
2.87	63.24	0.632	6.926	0.379	4.159	A + B
2.83	63.27	0.623	6.928	0.374	4.159	A + B
-	64.98	-	6.933	-	4.135	B

[a] Editors' calculations.

[b] A = $Mg(ClO_4)_2.6H_2O$; B = $Sm(ClO_4)_3.9H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility was determined by isothermal recrystallization. Equilibrium was attained in 5 or 6 days. Analysis was made according to a previous technique [1].

SOURCE AND PURITY OF MATERIALS:

$Sm(ClO_4)_3$ was prepared by reacting 57 % $HClO_4$ (purity unstated) with samarium carbonate and stored in vacuum over P_2O_5 for 7-10 days.

ESTIMATED ERROR:

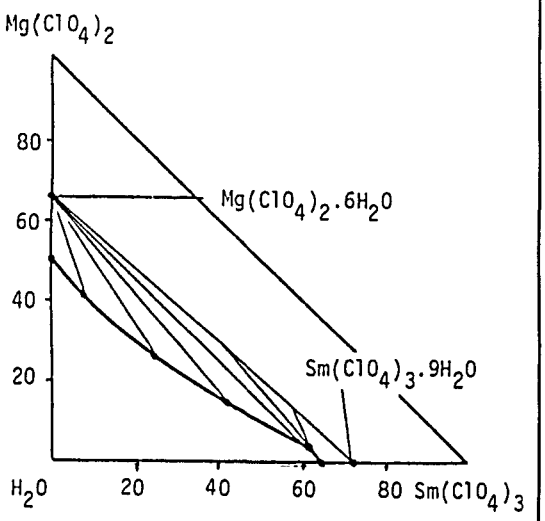
Not stated.

REFERENCES:

1. Guseva, A.D., *Sb. Tr.. Yarosl. Gos. Ped. Inst.* 1977, *164*, 23-6.

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) consists of two crystallization branches, one for each of the hydrates. The eutectic mixture contains 2.85 % $Mg(ClO_4)_2$, 63.26 % $Sm(ClO_4)_3$, and 33.89 % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Gadolinium perchlorate; $Gd(ClO_4)_3$; [14017-52-8] (3) Water; H_2O; [7732-18-5]	Andronovà, N.P.; Druzhinina, G.V. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1980, *185*, 9-12.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$Gd(ClO_4)_3$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
50.07	-	7.488	-	4.493	-	A
42.31	8.48	6.448	0.633	3.852	0.378	A
33.01	19.33	5.215	1.496	3.103	0.890	A
28.17	25.24	4.560	2.002	2.709	1.189	A
16.98	37.84	2.852	3.114	1.684	1.838	A
10.36	48.38	1.900	4.347	1.125	2.574	A
6.20	56.09	1.238	5.486	0.737	3.265	A
2.98	63.42	0.662	6.899	0.397	4.143	A + B
2.67	63.68	0.592	6.921	0.355	4.154	A + B
-	64.62	-	6.736	-	4.009	B

[a] Editors' calculations.

[b] A = $Mg(ClO_4)_2.6H_2O$; B = $Gd(ClO_4)_3.9H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal method was used. Equilibrium was attained in 12 h. Gd^{2+} was determined by complexometric titration; ClO_4^- gravimetrically as nitron perchlorate. The composition of the solid phases was determined by Schreinemakers' method of "residues".	$Gd(ClO_4)_3.9H_2O$ was prepared from the corresponding carbonate and and 57 % perchloric acid. The salts were purified by recrystallization and repeated washing with ether.
	ESTIMATED ERROR: Not stated.
	REFERENCES: None.

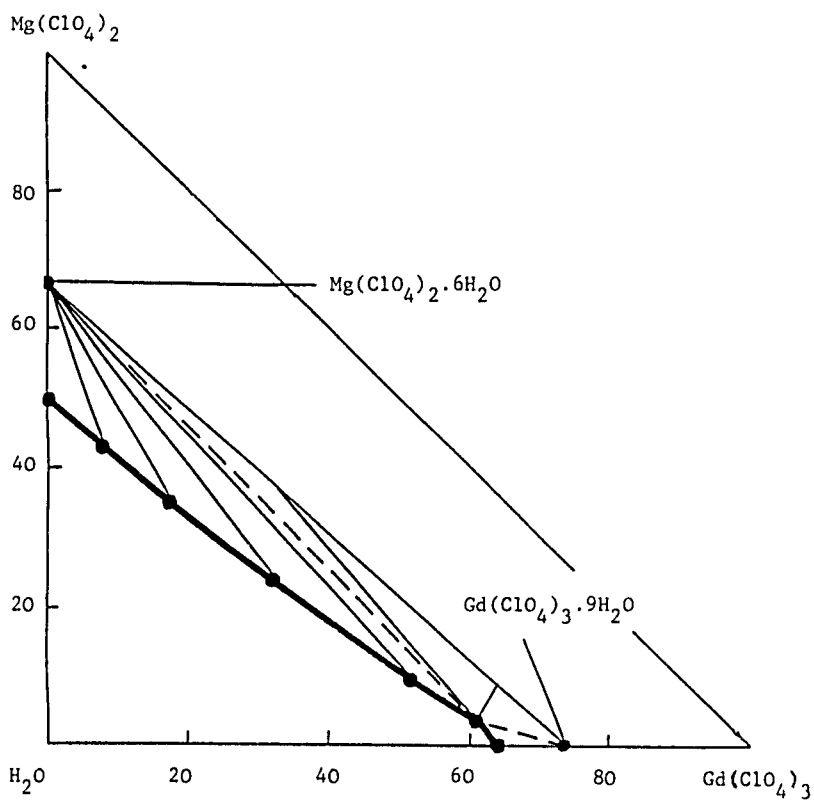
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Andronova, N.P.; Druzhinina, G.V.
(2) Gadolinium perchlorate; $Gd(ClO_4)_3$; [14017-52-8]	*Sb. Tr. Yarosl. Gos. Ped. Inst.* 1980, *185*, 9-12.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) produced below shows a simple eutectic. The strong salting-out effect of $Gd(ClO_4)_3$ can be attributed to the high heat of hydration of the Gd^{3+} cation.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Andronovà, N.P.
(2) Terbium perchlorate; $Tb(ClO_4)_3$; [14014-09-6]	*Sb. Tr. Yarosl. Gos. Ped. Inst.* 1979, *178*, 7-10.
(3) Water; H_2O; [7732-18-5]	
VARIABLES:	**PREPARED BY:**
One temperature: 298 K	E.S. Gryzlova
Composition	

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$Tb(ClO_4)_3$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
49.67	-	7.378	-	4.421	-	A
39.25	13.93	6.269	1.086	3.756	0.651	A
25.22	30.56	4.289	2.537	2.555	1.511	A
14.81	45.44	2.797	4.189	1.669	2.500	A
8.34	55.45	1.723	5.592	1.032	3.349	A
3.69	61.05	0.785	6.336	0.469	3.786	A
3.02	63.95	0.681	7.039	0.410	4.234	A + B
2.92	63.51	0.649	6.891	0.390	4.137	B
-	64.43	-	6.661	-	3.961	B

[a] Editors' calculations.

[b] A = $Mg(ClO_4)_2.6H_2O$; B = $Tb(ClO_4)_3.9H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The isothermal method was used. Analyses were made for Tb^{3+} and ClO_4^- ions.

SOURCE AND PURITY OF MATERIALS:

Not stated.

ESTIMATED ERROR:

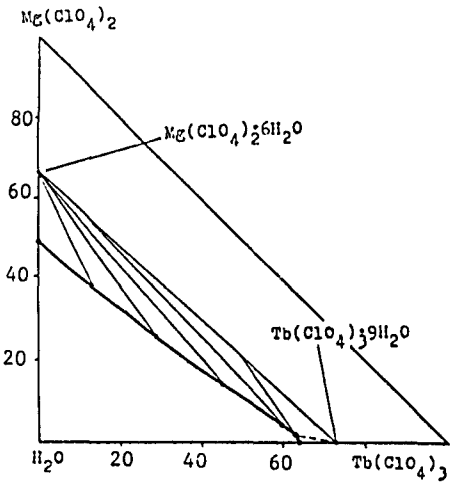
Not stated.

REFERENCES:

None.

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is shown below.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Lutetium perchlorate; $Lu(ClO_4)_3$; [14646-29-8] (3) Water; H_2O; [7732-18-5]	Andronova, N.P.; Pavlova, E.V. *Sb. Nauch. Tr. Yarosl. Gos. Ped. Inst.* 1982, *199*, 26-30.
VARIABLES: Temperature: 298 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$Lu(ClO_4)_3$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
49.67	-	7.378	-	4.421	-	A
35.00	16.85	5.473	1.243	3.257	0.739	"
24.82	26.19	3.853	1.917	2.270	1.129	"
23.93	29.52	3.894	2.265	2.303	1.340	"
15.70	40.74	2.732	3.343	1.615	1.976	"
4.34	56.37	0.838	5.135	0.495	3.031	"
2.91	59.50	0.586	5.649	0.347	3.344	"
2.93	61.59	0.621	6.159	0.370	3.667	A + B
2.98	61.76	0.635	6.210	0.379	3.701	A + B
1.04	64.27	0.226	6.572	0.134	3.914	B
-	64.78	-	6.543	-	3.886	B

[a] Editors' calculations.

[b] A = $Mg(ClO_4)_2.6H_2O$; B = $Lu(ClO_4)_3.9H_2O$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal method was used. ClO_4^- was determined gravimetrically by precipitation with nitron and Lu^{3+} was determined by titration with Trilon B.	Not stated.
	ESTIMATED ERROR: Not stated.
	REFERENCES: Not stated.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Carbamide (*urea*); CH_4N_2O; [57-13-6] (3) Water; H_2O; [7732-18-5]	Karnaukhov, A.S.; Runov, N.N.; Zakharova, V.P. *Zh. Neorg. Khim.* 1970, *15*, 2545-8; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1970, *15*, 1316-8.
VARIABLES: Temperature: 298 K Composition	PREPARED BY: C.C. Ho

EXPERIMENTAL VALUES:

Solubility in the system $Mg(ClO_4)_2$-CH_4N_2O-H_2O at 25°C

Liquid phase composition mol %		Solid phase
(1)	(2)	
-	100	CH_4N_2O
0.59	99.41	"
2.38	97.62	"
6.41	93.59	"
7.96	92.04	"
9.04	90.96	CH_4N_2O + $Mg(ClO_4)_2.6CH_4N_2O$
11.31	88.69	$Mg(ClO_4)_2.6CH_4N_2O$
15.10	84.90	"
17.29	82.71	"
27.89	72.11	"
30.30	69.70	"
43.94	56.06	$Mg(ClO_4)_2.4CH_4N_2O.2H_2O$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The solubility was measured by the isothermal saturation method. Equilibrium was attained after 70-140h. CH_4N_2O concentration was determined by the classical Kjeldahl method, Mg^{2+} ion by complexometry with chrome dark blue indicator (ref. 1). The solid phase was analysed by Schreinemakers' method (ref. 2).	"Analytical reagent" grade $Mg(ClO_4)_2$ and carbamide were recrystallized before use. Source not specified.
	ESTIMATED ERROR: Temperature: not stated. Solubility : not stated.
	REFERENCES: 1. Pribil, *"Komplexony v Chemicke analyse"* (Translated into Russian), Inostr. Lit., Moscow 1955, 154. 2. Schreinemakers, F.A., *Z. Phys. Khim.* 1894, *11*, 81.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Karnaukhov, A.S.; Runov, N.N.; Zakharova, V.P.
(2) Carbamide (*urea*); CH_4N_2O; [57-13-6]	*Zh. Neorg. Khim.* 1970, *15*, 2545-8; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1970, *15*, 1316-8.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility in the system $Mg(ClO_4)_2$-CH_4N_2O-H_2O at 25°C

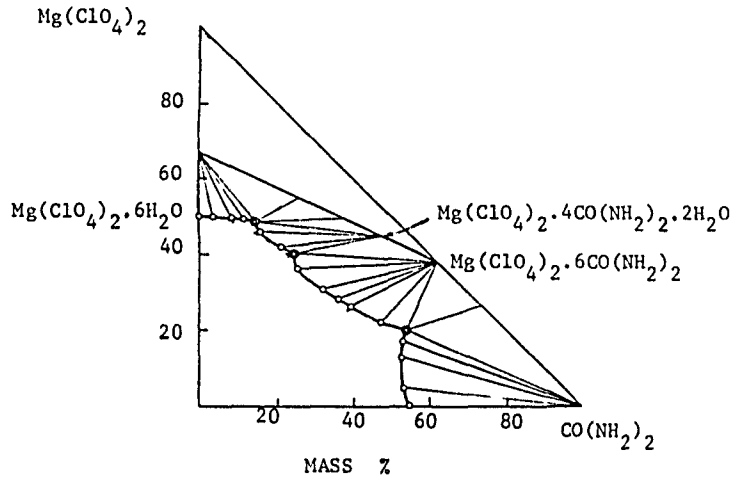
Liquid phase composition mol %		Solid phase
(1)	(2)	
47.35	52.65	$Mg(ClO_4)_2.4CH_4N_2O.2H_2O$ + $Mg(ClO_4)_2.6H_2O$
53.54	46.46	$Mg(ClO_4)_2.6H_2O$
80.31	19.69	"
100	-	"

COMMENTS/ADDITIONAL DATA:

The solubility curve consists of four branches, the extreme ones corresponding to the crystallization of the initial components, CH_4N_2O and $Mg(ClO_4)_2.6H_2O$. The longest branch belongs to the congruently soluble compound of magnesium perchlorate and carbamide. The rays connecting the compositions of the liquid phase and solid 'residues' meet on the hypotenuse of the triangle at a single point, showing the separation of the compound, $Mg(ClO_4)_2.6CH_4N_2O$. The crystals of this compound have the form of rectangular prisms and are stable in air. On reducing the concentration of carbamide, another complex crystallizes out: $Mg(ClO_4)_2.4CH_4N_2O.2H_2O$. Thus in saturated aqueous solutions of magnesium perchlorate at 25°C, the following equilibria exist:

$$[Mg(H_2O)_6]^{2+} + 4CH_4N_2O \rightleftharpoons [Mg(H_2O)_2(CH_4N_2O)_4]^{2+} + 4H_2O$$

$$[Mg(H_2O)_2(CH_4N_2O)_4]^{2+} + 2CH_4N_2O \rightleftharpoons [Mg(CH_4N_2O)_6]^{2+} + 2H_2O$$



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Karnaukhov, A.S.; Zakharova, V.P.
(2) Thiocarbamide (*thiourea*); CH_4N_2S; [62-56-6]	*Sb. Tr. Yarosl. Gos. Ped. Inst.* 1970, *78*, 122-6.
(3) Water; H_2O; [7732-18-5]	
VARIABLES:	**PREPARED BY:**
One temperature: 298.2 K	E.S. Gryzlova
Composition	

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$CS(NH_2)_2$-H_2O at 25.0°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	14.26	-	3.787	-	2.185	A
5.90	13.38	0.564	3.754	0.327	2.178	A
11.40	12.30	1.148	3.633	0.669	2.118	A
16.55	11.77	1.762	3.675	1.034	2.157	A
27.32	9.86	3.274	3.464	1.948	2.062	A
36.54	9.66	4.996	3.873	3.043	2.359	A
41.65	9.20	6.147	3.981	3.797	2.459	A
41.63	9.15	6.138	3.956	3.789	2.442	A + B
41.62	9.03	6.12	3.897	3.778	2.404	B
44.17	8.20	6.709	3.652	4.155	2.262	B
47.57	5.34	7.356	2.421	4.526	1.490	B
47.92	4.80	7.398	2.173	4.541	1.334	B + C
48.33	4.26	7.456	1.927	4.567	1.180	C
49.23	2.20	7.488	0.981	4.541	0.595	C
49.99	-	7.466	-	4.478	-	C

[a] Editors' calculations.

[b] A = $CS(NH_2)_2$; B = $Mg(ClO_4)_2.4CS(NH_2)_2.6H_2O$; C = $Mg(ClO_4)_2.6H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The isothermal method was used. Mg^{2+} was determined by titration with Trilon B and thiocarbamide was determined using Kjeldahl's method. The densities and viscosities of the saturated solutions were measured.

SOURCE AND PURITY OF MATERIALS:

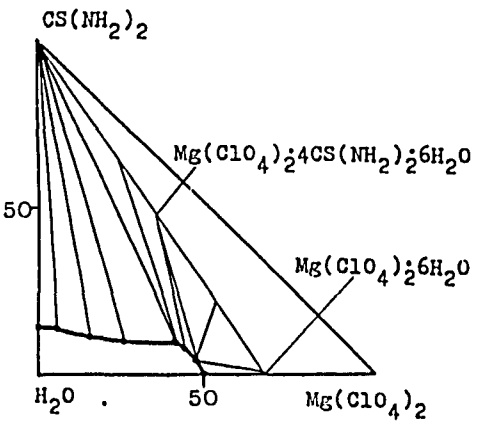
The salts were recrystallized twice.

ESTIMATED ERROR:

Temperature: ±0.1°C.

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is shown below. The eutectic contains 47.80 % $CS(NH_2)_2$, 35.00 % $Mg(ClO_4)_2$ and 17.20 % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Acetamide; C_2H_5NO; [60-35-5] (3) Water; H_2O; [7732-18-5]	Tarakanov, V.F. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1976, *154*, 37-9.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-C_2H_5NO-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
49.80	-	7.413	-	4.444	-	A
46.68	13.49	7.897	8.623	5.251	5.734	A
45.14	26.16	9.036	19.79	7.046	15.43	A
45.56	32.88	10.43	28.44	9.467	25.82	A + B
43.12	36.30	9.906	31.51	9.387	29.86	B
41.01	40.46	9.684	36.10	9.915	36.97	B + C
33.39	47.68	7.451	40.21	7.902	42.64	C
25.65	60.34	6.004	53.37	8.202	72.91	C
23.09	68.67	6.003	67.46	12.55	141.1	C + D
4.84	70.41	0.838	46.07	0.876	48.16	D
0.00	71.24	-	43.04	-	41.94	D

[a] Editors' calculations.

[b] A = $Mg(ClO_4)_2.6H_2O$; B = $Mg(ClO_4)_2.5CH_3CONH_2$; C = $Mg(ClO_4)_2.7CH_3CONH_2$; D = CH_3CONH_2.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubility was determined by isothermal recrystallization. The experimental details are not given. Mg^{2+} was determined by complexometric titration, acetamide by Kjeldahl's method and ClO_4^- gravimetrically as nitron perchlorate.

SOURCE AND PURITY OF MATERIALS:

Not stated.

ESTIMATED ERROR:

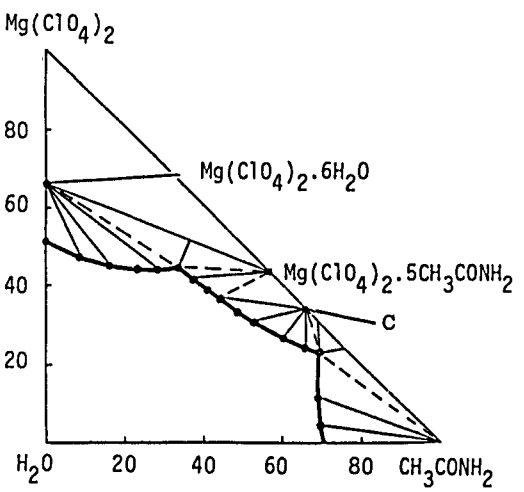
Not stated.

REFERENCES

None.

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is shown below.



(C = $Mg(ClO_4)_2.7CH_3CONH_2$)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Dimethylcarbamide (*dimethylurea*); $C_3H_8N_2O$; [1320-50-9] (3) Water; H_2O; [7732-18-5]	Karnaukhov, A.S.; Vasil'eva, S.I. Rylenkova, I.N. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1979, *178*, 43-8.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: E.S.Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$C_3H_8N_2O$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	26.29	-	6.797	-	4.048	A
7.85	27.90	0.898	8.081	0.547	4.928	A
11.96	30.83	1.497	9.776	0.937	6.116	A
11.99	31.44	1.513	10.05	0.950	6.308	A
13.05	32.18	1.688	10.54	1.067	6.668	A + B
13.60	29.71	1.719	9.512	1.075	5.948	B
13.65	29.57	1.723	9.458	1.077	5.911	B
15.38	27.97	1.951	8.990	1.216	5.604	B
15.71	27.56	1.993	8.856	1.241	5.514	B
16.48	28.12	2.129	9.202	1.333	5.761	B + C
17.38	27.45	2.256	9.026	1.411	5.647	B + C
19.20	25.27	2.490	8.301	1.549	5.165	C
22.32	22.35	2.920	7.406	1.807	4.584	C
28.50	18.11	3.873	6.234	2.392	3.850	C
31.77	16.48	4.445	5.841	2.750	3.614	C
34.54	15.17	4.962	5.521	3.077	3.424	C
34.93	15.76	5.093	5.822	3.174	3.627	C
37.41	15.31	5.651	5.859	3.545	3.675	C

[a] Editors' calculations.

[b] A = $C_3H_8N_2O$; B = $5C_3H_8N_2O.Mg(ClO_4)_2.H_2O$;
C = $4C_3H_8N_2O.Mg(ClO_4)_2.2H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal method was used. Mg^{2+} was determined by complexometric titration with EDTA using chrome blue black as indicator at pH 10-11. Dimethylurea was determined by Kjeldahl's method. Density, viscosity and and refractive index measurements were made.	Dimethylurea was of "chemically pure" grade and $Mg(ClO_4)_2$ was prepared from MgO and $HClO_4$.
REFERENCES: None.	ESTIMATED ERROR: Not stated.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Karnaukhov, A.S.; Vasil'eva, S.I. Rylenkova, I.N.
(2) Dimethylcarbamide (*dimethylurea*); $C_3H_8N_2O$; [1320-50-9]	*Sb. Tr. Yarosl. Gos. Ped. Inst.* 1979, *178*, 43-8.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility system $Mg(ClO_4)_2$-$C_3H_8N_2O$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
38.11	14.42	5.750	5.512	3.597	3.448	A
39.49	14.41	6.102	5.641	3.838	3.548	A
39.69	14.10	6.126	5.513	3.848	3.463	A
43.30	14.42	7.173	6.051	4.588	3.871	A
43.72	16.39	7.545	7.165	4.910	4.663	A
46.40	17.28	8.590	8.104	5.724	5.400	A
47.03	19.68	9.234	9.788	6.329	6.709	A + B
47.94	20.08	9.688	10.28	6.716	7.126	A + B
47.28	17.57	8.967	8.441	6.026	5.673	B
47.68	15.89	8.841	7.464	5.864	4.950	B
48.23	12.49	8.513	5.585	5.501	3.609	B
48.93	8.32	8.159	3.515	5.128	2.209	B
49.17	8.27	8.230	3.507	5.176	2.205	B
49.59	8.48	8.397	3.637	5.299	2.295	B
49.95	6.57	8.252	2.750	5.147	1.715	B
50.18	4.33	8.032	1.756	4.942	1.080	B
49.83	-	7.422	-	4.450	-	B

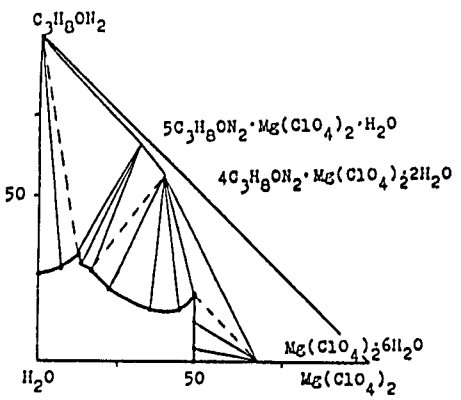
[a] Editors' calculations.

[b] A = $4C_3H_8N_2O.Mg(ClO_4)_2.2H_2O$; B = $Mg(ClO_4)_2.6H_2O$.

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm below (mass %) shows four branches of crystallization:

(i) $C_3H_8N_2O$; (ii) $Mg(ClO_4)_2.6H_2O$; (iii) $5C_3H_8N_2O.Mg(ClO_4)_2.H_2O$; and (iv) $4C_3H_8N_2O.Mg(ClO_4)_2.2H_2O$. The complex $5C_3H_8N_2O.Mg(ClO_4)_2.H_2O$ crystallizes within a narrow range of $Mg(ClO_4)_2$ concentrations.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Dimethylcarbamide (*dimethylurea*); $C_3H_8N_2O$; [1320-50-9] (3) Water; H_2O; [7732-18-5]	Vasil'eva, S.I.; Rylenkova, I.N. *Sb. Tr. Smolensk. Gos. Ped. Inst.* 1979, 7-15.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$C_3H_8N_2O$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	25.29	-	6.473	-	3.842	A
7.85	27.90	0.898	8.081	0.547	4.928	A
11.96	30.83	1.497	9.776	0.937	6.116	A
13.05	32.18	1.688	10.54	1.067	6.668	A + B
13.60	29.71	1.719	9.512	1.075	5.948	B
15.38	27.97	1.951	8.990	1.216	5.604	B
16.93	27.78	2.192	9.112	1.372	5.702	B + C
19.20	25.37	2.493	8.344	1.552	5.195	C
22.32	22.35	2.920	7.406	1.807	4.584	C
28.50	18.11	3.873	6.234	2.392	3.850	C
31.77	16.48	4.445	5.841	2.750	3.614	C
34.54	15.17	4.962	5.521	3.077	3.424	C
38.11	14.42	5.750	5.512	3.597	3.448	C
43.30	14.42	7.173	6.051	4.588	3.871	C
46.40	17.28	8.590	8.104	5.724	5.400	C
47.46	19.88	9.445	10.02	6.510	6.908	C + D
47.28	17.57	8.967	8.441	6.026	5.673	D
47.68	15.89	8.841	7.464	5.864	4.950	D
48.23	12.49	8.513	5.585	5.501	3.609	D
48.93	8.32	8.159	3.515	5.128	2.209	D
49.95	6.57	8.252	2.750	5.147	1.715	D
50.18	4.33	8.032	1.756	4.942	1.080	D
49.83	-	7.422	-	4.450	-	D

[a] Editors' calculations.

[b] A = $C_3H_8N_2O$; B = $5C_3H_8N_2O.Mg(ClO_4)_2.H_2O$;
C = $4C_3H_8N_2O.Mg(ClO_4)_2.2H_2O$; D = $Mg(ClO_4)_2.6H_2O$.

AUXILIARY INFORMATION	COMMENTS AND/OR ADDITIONAL DATA:
METHOD/APPARATUS/PROCEDURE: The isothermal method was used.	The two complexes, $X.5Y.H_2O$ and $X.4Y.2H_2O$ (X = $Mg(ClO_4)_2$, Y = $C_3H_8N_2O$), are salted out with $Mg(ClO_4)_2$. Probably, complexation is of the step-wise substitution type.
SOURCE AND PURITY OF MATERIALS: Not stated.	
ESTIMATED ERROR: Not stated.	

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Hexamethylenetetramine; $C_6H_{12}N_4$; [100-97-0] (3) Water; H_2O; [7732-18-5]	Karnaukhov, A.S.; Kosheleva, N.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1976, *154*, 62-6.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$C_6H_{12}N_4$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	46.47	-	10.04	-	6.192	A
1.60	36.80	0.194	7.116	0.116	4.261	A + B
2.12	24.60	0.223	4.126	0.130	2.395	B
3.00	16.50	0.292	2.559	0.167	1.462	B
3.76	12.24	0.353	1.832	0.201	1.039	B
5.49	7.49	0.501	1.089	0.283	0.614	B
8.09	5.08	0.741	0.741	0.417	0.417	B
10.21	3.75	0.943	0.552	0.532	0.311	B
16.29	2.20	1.582	0.340	0.895	0.193	B
22.30	1.04	2.290	0.170	1.303	0.097	B
29.52	1.42	3.326	0.255	1.915	0.147	B
38.42	1.24	4.876	0.251	2.853	0.147	B
49.48	1.29	7.480	0.311	4.503	0.187	B + C
49.65	1.28	7.527	0.309	4.533	0.186	B + C
49.65	-	7.372	-	4.418	-	C

[a] Editors' calculations.

[b] A = $C_6H_{12}N_4$; B = $Mg(ClO_4)_2.2C_6H_{12}N_4.8H_2O$;
C = $Mg(ClO_4)_2.6H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal method was used. Periods of equilibration varied from 15 to 20 days. ClO_4^- was determined gravimetrically by nitron precipitation; and hexamethylenetetramine by potentiometric titration. Schreinemakers' method was used to determine the composition of the solid phases. The densities and viscosities of the saturated solutions were measured.	Not stated. ESTIMATED ERROR: Not stated. REFERENCES: None.

(continued next page)

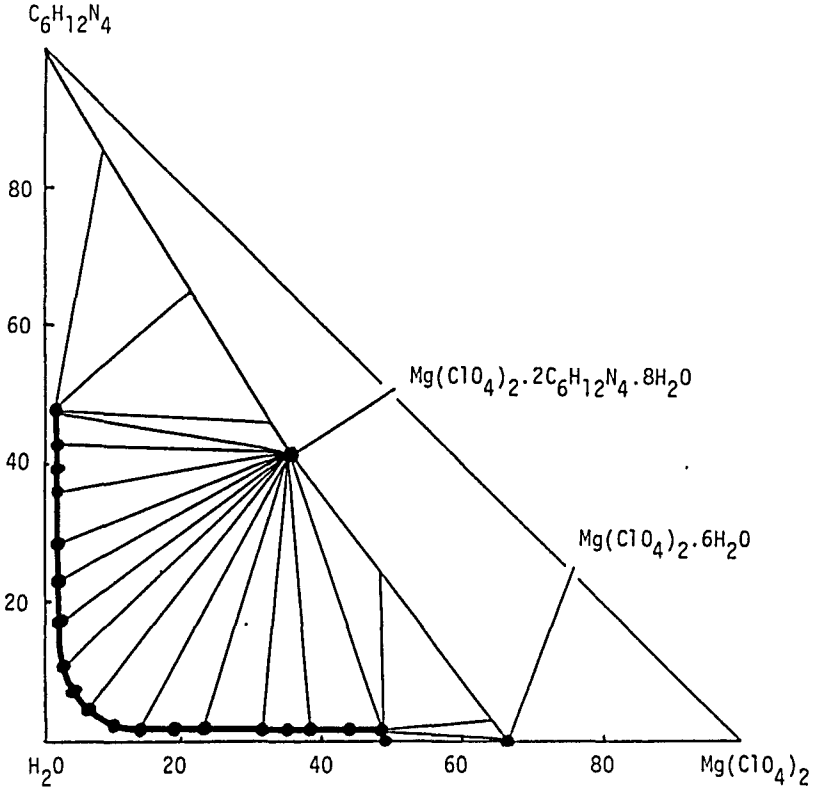
COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Karnaukhov, A.S.; Kosheleva, N.I.
(2) Hexamethylenetetramine; $C_6H_{12}N_4$; [100-97-0]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1976, *154*, 62-6.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is shown below. It has the following branches of crystallization:

$C_6H_{12}N_4$; $Mg(ClO_4)_2.2C_6H_{12}N_4.8H_2O$ and $Mg(ClO_4)_2.6H_2O$.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (3) Thiocarbamide; (*thiourea*); CH_4N_2S; [62-56-6] (4) Water; H_2O; [7732-18-5]	Zakharova, V.P. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1971, *95*, 98-100.
VARIABLES: One temperature: 298 K. Composition.	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the quaternary system $Mg(ClO_4)_2$-$Ca(ClO_4)_2$-CH_4N_2S-H_2O at 25°C:

Liquid phase composition									Solid[b]
mass %			mol %[a]			molality[a]/mol kg^{-1}			phase
(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	
41.63	-	10.15	13.47	-	4.106	9.068	-	2.765	A+B
9.46	39.35	10.65	3.74	6.204	5.271	2.451	4.062	3.451	A+B
1.09	56.30	10.72	0.53	10.92	6.526	0.359	7.387	4.416	A+B+C
-	59.98	10.44	-	12.36	6.756	-	8.485	4.637	A+C
0.79	57.54	8.08	0.374	10.85	4.78	0.247	7.168	3.16	B+C
47.92	-	5.20	15.86	-	2.15	10.74	-	1.46	B+D
40.44	8.31	4.95	13.73	1.12	2.10	9.174	0.751	1.40	B+D
10.23	44.55	4.93	4.140	7.184	2.50	2.667	4.627	1.61	B+D
1.60	58.51	6.58	0.765	11.14	3.93	0.504	7.350	2.60	D+B+C

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The solubility was studied with the method of nonvariant points. The phase diagram was made using the Gibbs-Roozeboom method.	Not stated.
	ESTIMATED ERROR: Not stated.
	REFERENCES:

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	Zakharova, V.P.
(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1971, *95*, 98-100.
(3) Thiocarbamide; (*thiourea*); CH_4N_2S; [62-56-6]	
(4) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility in the quaternary system $Mg(ClO_4)_2$-$Ca(ClO_4)_2$-CH_4N_2S-H_2O at 25°C:

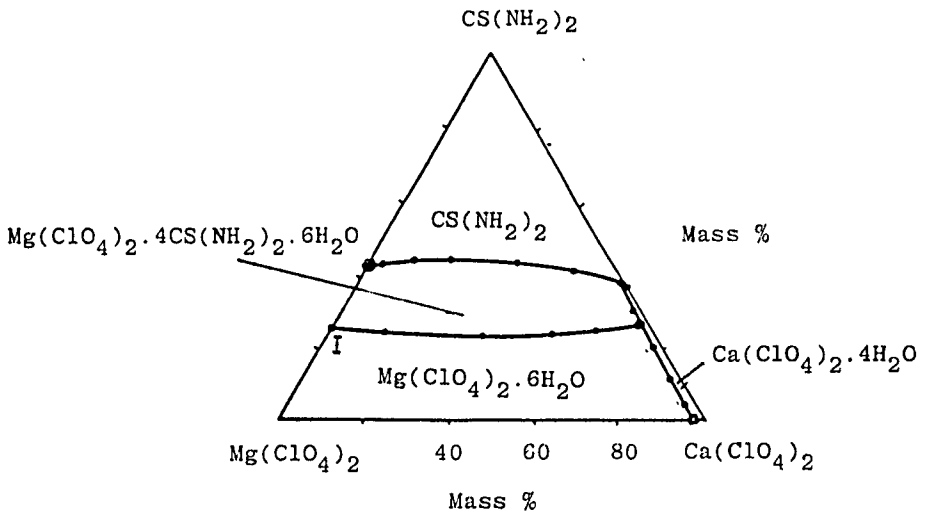
Liquid phase composition									Solid[b] phase
mass %			mol %[a]			molality[a]/mol kg^{-1}			
(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	
1.29	57.41	2.34	0.554	9.81	1.26	0.348	6.166	0.789	D+C
1.36	63.52	-	0.641	11.92	-	0.407	7.568	-	D+C

[a] Editor's calculations.

[b] A = CH_4N_2S B = $Mg(ClO_4)_2.4CH_4N_2S.6H_2O$
C = $Ca(ClO_4)_2.4H_2O$ D = $Mg(ClO_4)_2.6H_2O$

COMMENTS/ADDITIONAL DATA:

Two triple eutectic points were found: the solution at the first point was saturated with thiocarbamide, calcium perchlorate tetrahydrate and the compound $Mg(ClO_4)_2.4CH_4N_2S.6H_2O$; the solution at the second point was saturated with $Mg(ClO_4)_2.4CH_4N_2S.6H_2O$, calcium perchlorate tetrahydrate and magnesium perchlorate hexahydrate.



COMPONENTS:

(1) Lithium chromate: Li_2CrO_4; [14307-35-8]

(2) Lithium perchlorate; $LiClO_4$; [7791-03-9]

(3) Magnesium chromate; $MgCrO_4$; [13423-61-5]

(4) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]

(5) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Voronina, T.N.

Uch. Zap. Yasosl. Gos. Ped. Inst. 1970, *79*, 3-8.

VARIABLES:

One temperature: 298.2 K

Composition

PREPARED BY:

E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$MgCrO_4$-$LiClO_4$-Li_2CrO_4-H_2O at 25.0°C

Liquid phase composition								Solid Phase[b]
mass %				mol %[a]				
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
-	4.03	-	46.45	-	1.269	-	7.003	A + B
-	8.16	0.28	46.24	-	2.738	0.071	7.395	A + B
-	33.24	0.32	46.34	-	19.07	0.139	12.67	A + B
-	34.19	0.73	46.35	-	20.42	0.331	13.19	A + B + C
-	-	-	49.71	-	-	-	7.389	B + C
-	22.84	2.94	42.10	-	9.727	0.949	8.546	B + C
-	36.95	0.99	41.50	-	20.65	0.420	11.06	A + C
-	37.11	4.36	26.98	-	15.49	1.380	5.367	A + C
-	37.19	5.04	17.61	-	12.98	1.334	2.929	A + C
-	37.38	12.47	5.68	-	11.97	3.029	0.867	A + C
17.78	37.42	31.38	-	9.394	24.14	15.35	-	A + C
21.99	31.28	25.79	-	9.357	16.25	10.16	-	A + C
31.11	12.12	12.31	-	8.234	3.916	3.016	-	A + C

[a] Editors' calculations.

[b] A = $LiClO_4.3H_2O$; B = $Mg(ClO_4)_2.6H_2O$; C = $MgCrO_4.5H_2O$.

AUXILIARY INFORMATION

METHOD/PROCEDURE/APPARATUS:

The isothermal method was used. Periods of equilibration were 4-6 days. CrO_4^{2-} was determined iodimetrically, Mg^{2+} by titration with EDTA, Li^+ as lithium zinc uranyl acetate, and ClO_4^- by difference.

SOURCE AND PURITY OF MATERIALS:

The salts were recrystallized.

ESTIMATED ERROR:

Temperature: ±0.1°C.

REFERENCES:

None.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Lithium chromate: Li_2CrO_4; [14307-35-8]	Voronina, T.N.
(2) Lithium perchlorate; $LiClO_4$; [7791-03-9]	*Uch. Zap. Yasosl. Gos. Ped. Inst.* 1970, *79*, 3-8.
(3) Magnesium chromate; $MgCrO_4$; [13423-61-5]	
(4) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	
(5) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility system $Mg(ClO_4)_2$-$MgCrO_4$-$LiClO_4$-Li_2CrO_4-H_2O at 25.0°C

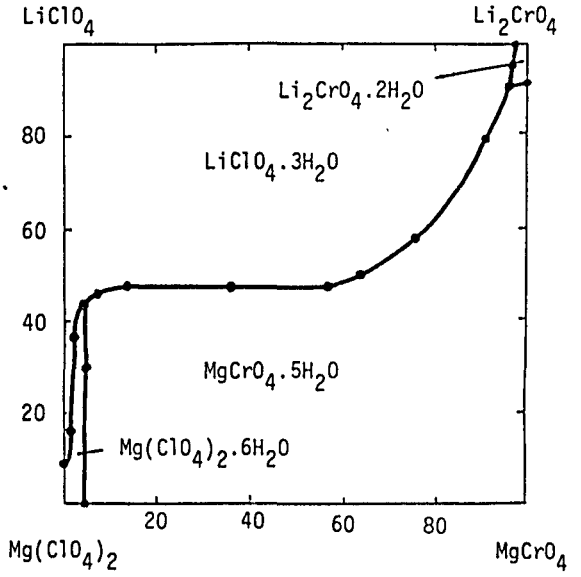
Liquid phase composition								Solid Phase[b]
mass %				mol %[a]				
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
34.40	2.45	0.88	-	7.062	0.614	0.167	-	A + C
44.27	1.83	4.79	-	10.93	0.552	1.095	-	A + C + D
44.52	-	4.83	-	10.75	-	1.080	-	C + D
46.80	2.75	1.76	-	11.62	0.833	0.404	-	A + D
47.17	1.56	-	-	11.27	0.455	-	-	A + D

[a] Editors' calculations.

[b] A = $LiClO_4.3H_2O$; C = $MgCrO_4.5H_2O$; D = $Li_2CrO_4.2H_2O$.

COMMENTS AND/OR ADDITIONAL DATA:

The Janecke diagram is shown below.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sodium chloride; NaCl; [7647-14-5] (2) Sodium perchlorate; $NaClO_4$; [7601-89-0] (3) Magnesium chloride; $MgCl_2$; [7786-30-3] (4) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (5) Water; H_2O; [7732-18-5]	Karnaukhov, A.S.; Kudryakova, S.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1966, *59*, 119-36.
VARIABLES: One temperature: 298.2 K Composition	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility system $Na^+,Mg^{2+}//ClO_4^-,Cl^- - H_2O$ at 25.0°C

Liquid phase composition							
mass %				mol %[a]			
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
0.34	-	35.44	-	0.148	-	9.441	-
0.43	-	34.53	2.60	0.191	-	9.426	0.303
0.61	-	31.06	7.15	0.277	-	8.665	0.851
0.56	-	30.27	9.20	0.259	-	8.598	1.115
0.61	-	29.73	10.59	0.226	-	8.557	1.300
0.48	-	28.90	11.43	0.225	-	8.320	1.404
0.69	-	27.42	14.12	0.331	-	8.068	1.772
0.92	-	25.81	16.45	0.448	-	7.713	2.097
1.02	-	20.75	17.93	0.476	-	5.950	2.193
0.81	-	22.93	20.44	0.402	-	6.991	2.658
-	-	22.81	20.01	-	-	6.839	2.559
1.70	-	19.64	22.95	0.848	-	6.013	2.997
1.65	-	16.73	22.67	0.789	-	4.911	2.838
1.88	-	14.26	28.06	0.945	-	4.399	3.692
2.06	-	12.44	31.96	1.074	-	3.982	4.364
3.13	-	8.76	37.54	1.716	-	2.948	5.389

[a] Editors' calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method of nonvariant points was used. Na^+ was determined gravimetrically as sodium zinc uranyl acetate, Mg^{2+} by complexometric titration, Cl^- mercurimetrically and ClO_4^- gravimetrically by nitron precipitation. Densities and viscosities of the saturated solutions were measured.

SOURCE AND PURITY OF MATERIALS:	ESTIMATED ERROR:
The salts were recrystallized. Purity: 95.58-99.75 %.	Temperature: ±0.1°C.
REFERENCES: None.	

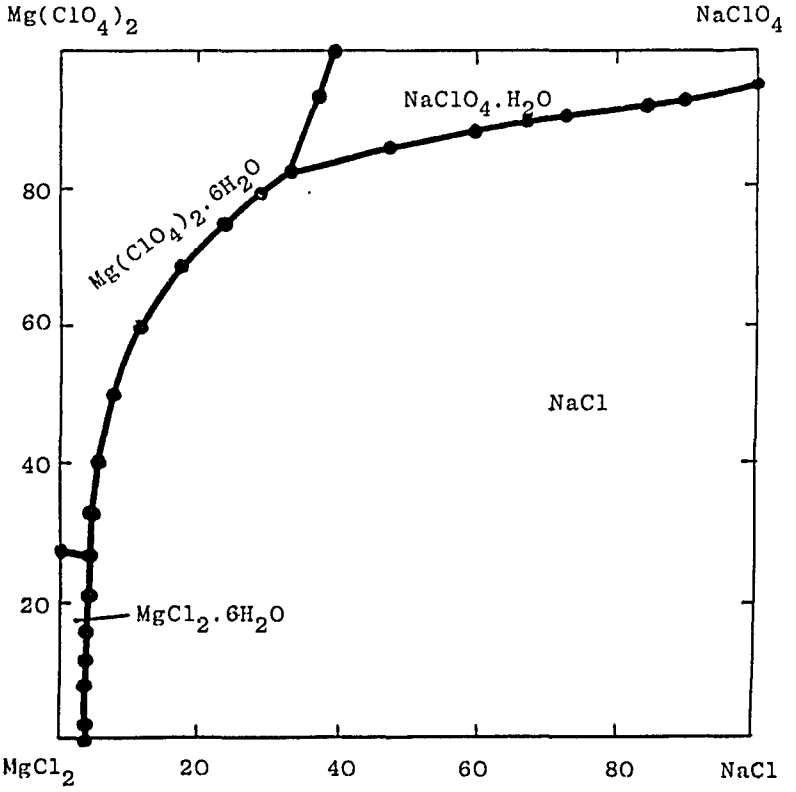
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sodium chloride; NaCl; [7647-14-5] (2) Sodium perchlorate; $NaClO_4$; [7601-89-0] (3) Magnesium chloride; $MgCl_2$; [7786-30-3] (4) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (5) Water; H_2O; [7732-18-5]	Karnaukhov, A.S.; Kudryakova, S.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1966, *59*, 119-36.

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The Janecke diagram is shown below.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sodium chloride: NaCl; [7647-14-5] (2) Sodium perchlorate; $NaClO_4$; [7601-89-0] (3) Magnesium chloride; $MgCl_2$; [7786-30-3] (4) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (5) Water; H_2O; [7732-18-5]	Kudryakova, S.A.; Lepeshkhov, I.N. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1969, *66*, 40-50.
VARIABLES: One temperature: 363 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$MgCl_2$-$NaClO_4$-NaCl-H_2O at 90°C

Liquid phase composition								Solid Phase[b]
mass %				mol %[a]				
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
0.63	-	28.93	16.17	0.317	-	8.938	2.131	A + B
0.69	-	26.79	19.51	0.355	-	8.467	2.630	A + B
0.69	-	25.29	22.76	0.366	-	8.237	3.162	A + B + C
1.14	-	19.35	31.32	0.642	-	6.690	4.619	A + C
1.60	-	12.98	39.38	0.945	-	4.708	6.093	A + C
3.65	-	5.54	48.69	2.333	-	2.174	8.149	A + C
0.54	5.62	-	52.82	0.360	1.787	-	9.212	A + C
3.34	19.51	-	38.19	2.241	6.248	-	6.709	A + C
2.39	23.59	-	32.89	1.535	7.232	-	5.531	A + C + D
2.24	25.45	-	27.68	1.346	7.300	-	4.355	A + D
1.85	39.20	-	23.23	1.298	13.13	-	4.268	A + D
1.44	47.72	-	18.77	1.081	17.10	-	3.691	A + D
1.33	52.62	-	13.94	0.991	18.71	-	2.719	A + D
1.22	57.46	-	9.19	0.902	20.27	-	1.779	A + D

[a] Editors' calculations.

[b] A = NaCl; B = $MgCl_2.6H_2O$; C = $Mg(ClO_4)_2.6H_2O$; D = $NaClO_4$.

AUXILIARY INFORMATION

METHOD/PROCEDURE/APPARATUS:

The isothermal method was used. The solubility was studied by the method of nonvariant points: to the saturated solution corresponding to the eutectic composition of ternary systems, a third salt was added until a new solid phase appeared. Mg^{2+} was determined with Trilon B; Na^+, by precipitation with zinc uranyl acetate, ClO_4^- gravimetrically by nitron precipitation, and Cl^- mercurimetrically.

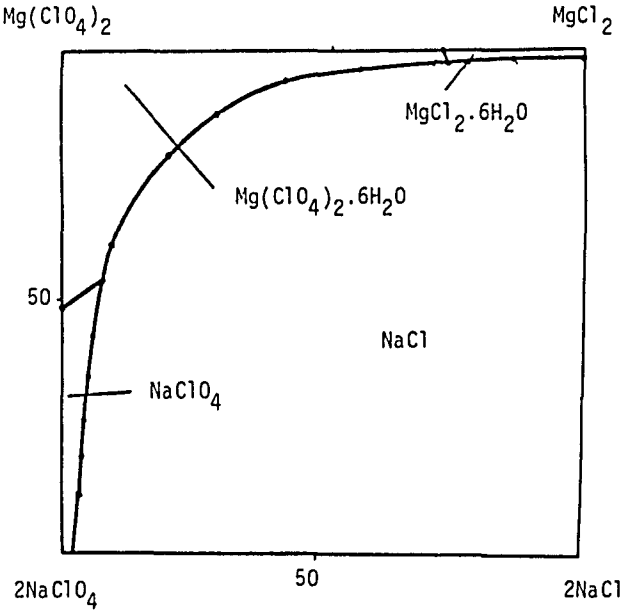
SOURCE AND PURITY OF MATERIALS:	ESTIMATED ERROR:
Not stated.	Not stated.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sodium chloride: NaCl; [7647-14-5] (2) Sodium perchlorate; $NaClO_4$; [7601-89-0] (3) Magnesium chloride; $MgCl_2$; [7786-30-3] (4) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (5) Water; H_2O; [7732-18-5]	Kudryakova, S.A.; Lepeshkhov, I.N. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1969, *66*, 40-50.

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:
The Janecke diagram is given below.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Potassium chloride; KCl; [14314-72-7] (2) Potassium perchlorate; $KClO_4$; [7778-74-7] (3) Magnesium chloride; $MgCl_2$; [7786-30-3] (4) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (5) Water; H_2O; [7732-18-5]	Troitskii, E.N. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1969, *66*, 23-33.
VARIABLES: One temperature: 298.15 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $K^+,Mg^{2+}//ClO_4^-,Cl^- - H_2O$ at 25.00°C

Liquid phase composition								Solid phase[b]
mass %				mol %[a]				
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
-	0.07	0.56	49.39	-	0.017	0.196	7.371	A + B
-	0.06	1.64	48.46	-	0.014	0.574	7.234	"
-	0.06	4.08	39.08	-	0.013	1.271	5.195	"
-	0.07	9.03	33.05	-	0.015	2.745	4.286	"
-	0.07	11.84	26.45	-	0.014	3.393	3.233	"
-	0.07	15.67	17.48	-	0.013	4.166	1.982	"
-	0.07	16.85	14.70	-	0.013	4.382	1.631	A + B + C
-	0.06	16.86	14.70	-	0.011	4.384	1.631	"
-	0.05	16.85	14.72	-	0.009	4.382	1.633	"
-	0.01	24.38	6.27	-	0.002	6.195	0.680	B + C
-	0.04	25.44	5.18	-	0.007	6.455	0.561	"
0.76	0.22	35.31	-	0.260	0.041	9.463	-	B + C + D
0.57	0.24	35.31	-	0.195	0.044	9.446	-	"
0.76	0.21	35.31	-	0.260	0.039	9.462	-	"
3.60	0.02	26.70	-	1.151	0.003	6.682	-	B + D + E
3.43	0.01	26.35	-	1.090	0.002	6.558	-	"
3.60	0.01	26.35	-	1.146	0.002	6.569	-	"
3.98	0.01	25.16	-	1.256	0.002	6.217	-	B + E
5.70	0.01	21.43	-	1.759	0.002	5.179	-	"
7.23	0.01	18.97	-	2.207	0.002	4.536	-	"
10.89	0.03	14.32	-	3.285	0.005	3.383	-	"
15.63	0.03	9.40	-	4.692	0.005	2.209	-	"
22.65	0.03	3.57	-	6.850	0.005	0.845	-	"
25.87	0.03	0.91	-	7.851	0.005	0.216	-	A + B
-	0.09	-	49.54	-	0.022	-	7.353	B + E
-	-	22.80	20.04	-	-	6.838	2.564	A + C
0.11	-	35.55	-	0.037	-	9.462	-	C + D
3.40	-	26.79	-	1.085	-	6.696	-	D + F
25.04	1.45	-	-	7.587	0.236	-	-	A + F

[a] Editors' calculations.

[b] A = $Mg(ClO_4)_2.6H_2O$; B = $KClO_4$; C = $MgCl_2.6H_2O$;
D = $KCl.MgCl_2.H_2O$ (carnallite) ; E = m(KCl).n($KClO_4$) ; F = KCl.

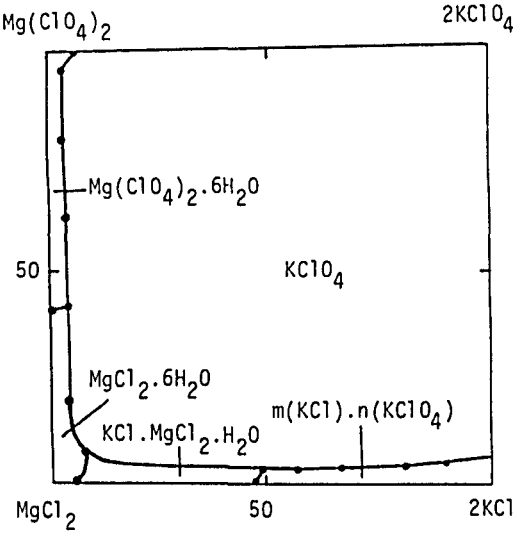
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Potassium chloride; KCl; [14314-72-7] (2) Potassium perchlorate; $KClO_4$; [7778-74-7] (3) Magnesium chloride; $MgCl_2$; [7786-30-3] (4) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (5) Water; H_2O; [7732-18-5]	Troitskii, E.N. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1969, *66*, 23-33.

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The Janecke diagram below shows five crystallization fields.



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The isothermal method was used. K^+ was determined gravimetrically by the tetraphenylborate method, Mg^{2+} by titration with Trilon B, ClO_4^- gravimetrically by nitron precipitation and Cl^- mercurimetrically. The composition of the solid phase was confirmed by X-ray powder analysis and the true solid phase was determined by Schreinemakers' method. The density, viscosity and refractive index of the saturated solutions were measured.

SOURCE AND PURITY OF MATERIALS:	ESTIMATED ERROR:
Not stated.	Temperature: ±0.05°C.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium nitrate; $Mg(NO_3)_2$; [10377-60-3]	Karnaukhov, A.S; Bitokov, V.T.
(2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *79*, 51-6.
(3) Ammonium nitrate; NH_4NO_3; [6484-52-2]	
(4) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	
(5) Water; H_2O; [7732-18-5]	
VARIABLES:	**PREPARED BY:**
One temperature: 298.2 K	N.A. Kozyreva
Composition	

EXPERIMENTAL VALUES:

Solubility system $NH_4^+,Mg^{2+}//ClO_4^-,NO_3^-$-$H_2O$ at 25.0°C

mass%				mol %[a]				Solid phase[b]
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
-	-	63.55	6.18	-	-	29.41	2.142	A + B
3.16	-	59.07	5.45	0.841	-	26.49	1.832	"
13.59	-	47.89	3.84	3.533	-	20.98	1.260	"
18.266	-	43.16	3.41	4.747	-	18.90	1.119	"
19.73	-	41.62	3.29	5.123	-	18.21	1.078	"
29.30	-	31.98	3.12	7.707	-	14.17	1.036	"
31.94	-	29.30	3.00	8.417	-	13.01	0.998	A + B + C
32.95	-	30.00	-	8.481	-	13.01	-	A + C
34.95	-	25.19	2.88	9.067	-	11.01	0.943	B + C
35.49	-	22.12	2.48	8.775	-	9.213	0.774	"
37.07	-	14.09	2.34	8.301	-	5.315	0.661	"
41.39	-	10.26	2.25	9.384	-	3.919	0.644	B + C + D
39.31	-	11.98	-	8.536	-	4.382	-	C + D
40.06	-	6.71	2.53	8.488	-	2.395	0.677	B + D
41.55	-	4.16	2.73	8.720	-	1.471	0.723	"
42.01	-	3.72	3.06	8.868	-	1.323	0.815	B + D + E
40.40	-	5.41	-	8.151	-	1.839	-	D + E
40.80	-	0.61	3.69	8.185	-	0.206	0.935	B + E
41.01	2.66	-	3.42	8.496	0.366	-	0.894	"
41.66	5.52	-	2.416	8.991	0.792	-	0.658	"
41.82	7.03	-	2.031	9.223	1.030	-	0.565	"
40.374	12.11	-	1.142	9.353	1.864	-	0.334	"
35.36	19.01	-	0.777	8.455	3.020	-	0.234	"
31.10	25.82	-	0.802	7.827	4.318	-	0.254	"
27.01	31.68	-	0.761	7.055	5.498	-	0.251	"
24.45	35.35	-	0.777	6.547	6.289	-	0.263	"
22.89	37.64	-	0.777	6.230	6.807	-	0.267	"
20.05	34.67	-	0.653	4.875	5.601	-	0.200	B + E + F
21.17	31.03	-	-	4.863	4.737	-	-	E + F
18.47	36.55	-	0.700	4.525	5.950	-	0.216	B + F
14.05	41.82	-	0.537	3.500	6.923	-	0.169	"
9.57	47.17	-	0.467	2.430	7.959	-	0.150	"
3.70	49.17	-	0.350	0.877	7.743	-	0.105	"
-	49.64	-	0.190	-	7.391	-	0.054	"

[a] Editors' calculations.

[b] A = NH_4NO_3 ; B = NH_4ClO_4 ; C = $2NH_4NO_3.5Mg(NO_3)_2.6H_2O$;
D = $NH_4NO_3.5Mg(NO_3)_2.6H_2O$; E = $Mg(NO_3)_2.6H_2O$; F = $Mg(ClO_4)_2.6H_2O$.

(continued next page)

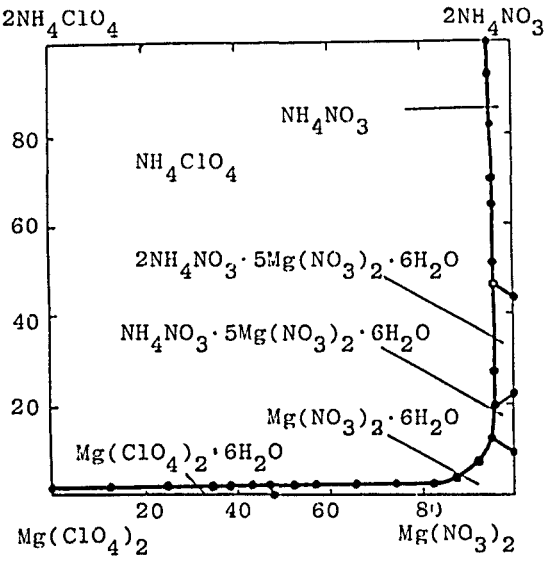
COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium nitrate; $Mg(NO_3)_2$; [10377-60-3] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Ammonium nitrate; NH_4NO_3; [6484-52-2] (4) Ammonium perchlorate; NH_4ClO_4; [7790-98-9] (5) Water; H_2O; [7732-18-5]	Karnaukhov, A.S; Bitokov, V.T. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *79*, 51-6.

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The Janecke diagram below shows six crystallization fields. The following equilibrium is appreciably shifted towards the formation of NH_4ClO_4:

$$Mg(ClO_4)_2 + 2NH_4NO_3 \rightleftharpoons 2NH_4ClO_4 + Mg(NO_3)_2$$



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The isothermal method was used. Periods of equilibration were 6-8 days. Mg^{2+} was determined by complexometric titration with the indicator chrome blue black at pH 11-12; NH_4^+ by distilling off NH_3 into a saturated solution of boric acid and titrating with H_2SO_4; NO_3^- also as NH_3 by preliminary reduction using Devarda's alloy; ClO_4^- by difference. The density and viscosity of the saturated solutions were measured.

SOURCE AND PURITY OF MATERIALS:	ESTIMATED ERROR:
Not stated.	Temperature: ±0.1°C.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium sulfate; $MgSO_4$; [7487-88-9] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Ammonium sulfate; $(NH_4)_2SO_4$; [10043-02-4] (4) Ammonium perchlorate; NH_4ClO_4; [7790-98-9] (5) Water; H_2O; [7732-18-5]	Lepeshkov, I.N.; Leboshchina, V.I. *Sb. Nauch. Tr. Vladimir Politekh. Inst.* 1969, *7*, 115-20.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility system $NH_4^+, Mg^{2+}//ClO_4^-, SO_4^{2-}-H_2O$ at 25°C

mass%				mol %[a]				Solid phase[b]
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
-	-	40.79	3.04	-	-	8.941	0.749	A + B
0.22	-	40.42	3.22	0.053	-	8.863	0.794	A + B + C
0.26	-	42.89	-	0.062	-	9.321	-	B + C
0.25	-	40.83	3.09	0.060	-	8.837	0.761	A + B + C
0.32	-	35.92	4.12	0.073	-	7.509	0.969	A + C
0.67	-	22.65	7.92	0.137	-	4.221	1.660	"
0.94	-	16.45	9.67	0.183	-	2.920	1.931	"
1.87	-	8.35	13.51	0.351	-	1.427	2.597	"
3.42	-	4.26	14.69	0.632	-	0.717	2.781	"
5.69	-	1.80	15.52	1.058	-	0.305	2.957	"
8.15	0.19	-	15.29	1.526	0.019	-	2.932	"
8.36	0.64	-	14.72	1.567	0.065	-	2.827	"
8.75	2.05	-	12.94	1.642	0.208	-	2.489	"
10.23	4.15	-	10.90	1.956	0.428	-	2.136	"
11.23	5.05	-	9.57	2.163	0.525	-	1.888	"
12.84	6.15	-	7.24	2.486	0.642	-	1.436	"
17.61	6.30	-	5.43	3.531	0.681	-	1.116	A + C + D
26.45	-	2.27	-	5.240	-	0.410	-	C + D
21.65	2.50	-	4.60	4.298	0.268	-	0.936	"
17.61	6.30	-	5.43	3.531	0.681	-	1.116	A + C + D
14.73	9.68	-	4.92	2.963	1.050	-	1.014	A + D
9.01	17.74	-	4.11	1.859	1.974	-	0.869	"
8.45	18.72	-	3.85	1.748	2.088	-	0.816	"
6.58	22.20	-	3.40	1.385	2.519	-	0.733	"
4.60	27.23	-	2.79	1.002	3.199	-	0.623	"
3.42	31.10	-	2.38	0.770	3.775	-	0.549	"
3.00	34.62	-	1.97	0.702	4.369	-	0.472	"
2.32	45.00	-	1.43	0.626	6.550	-	0.395	"
1.31	42.78	-	0.95	0.334	5.877	-	0.248	A + D + E
1.49	42.43	-	-	0.373	5.734	-	-	D + E
1.31	42.78	-	0.95	0.334	5.877	-	0.248	A + D + E
0.83	49.14	-	-	0.230	7.328	-	-	E + F
0.75	48.29	-	0.74	0.207	7.172	-	0.209	"
-	49.70	-	0.19	-	7.408	-	0.054	A + F
0.27	49.70	-	0.68	0.076	7.497	-	0.195	"
0.75	48.29	-	0.74	0.207	7.172	-	0.209	A + E + F

[a] Editors' calculations.

[b] A = NH_4ClO_4 ; B = $(NH_4)_2SO_4$; C = $(NH_4)_2SO_4.MgSO_4.6H_2O$;
D = $MgSO_4.7H_2O$; E = $MgSO_4.6H_2O$; F = $Mg(ClO_4)_2.6H_2O$.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium sulfate; $MgSO_4$; [7487-88-9] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Ammonium sulfate; $(NH_4)_2SO_4$; [10043-02-4] (4) Ammonium perchlorate; NH_4ClO_4; [7790-98-9] (5) Water; H_2O; [7732-18-5]	Lepeshkov, I.N.; Leboshchina, V.I. *Sb. Nauch. Tr. Vladimir Politekh. Inst.* 1969, *7*, 115-20.

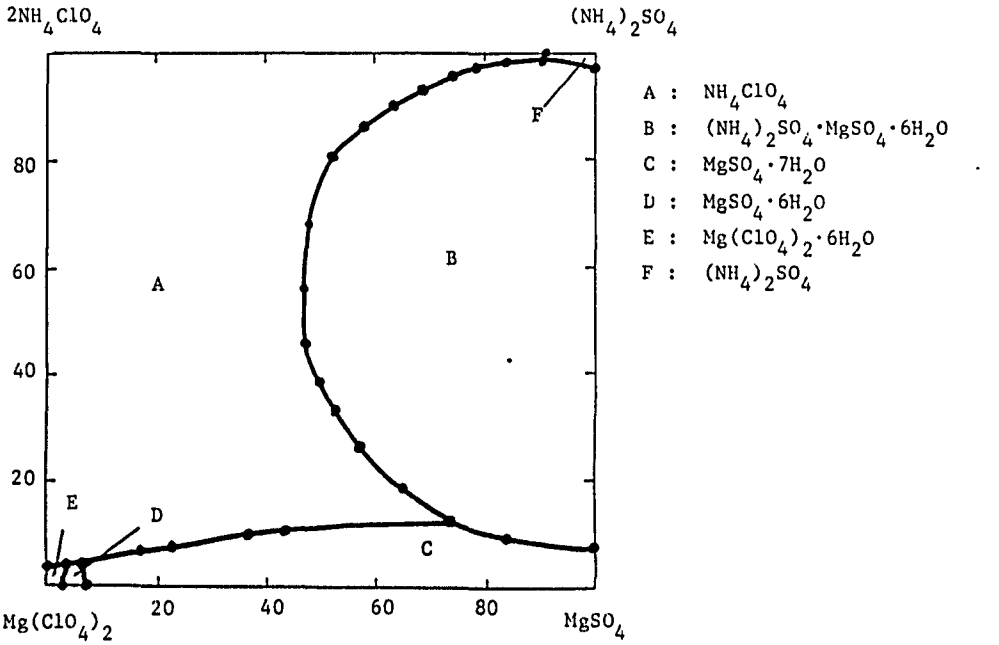
EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The Janecke diagram below shows six crystallization fields. The equilibrium of the following exchange reaction is shifted to the right:

$$Mg(ClO_4)_2 + (NH_4)_2SO_4 \rightleftharpoons 2NH_4ClO_4 + MgSO_4$$

Ammonium perchlorate is salted out from solution with all the salts of the system.



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The isothermal method was used. Details of saturation are not given. Mg^{2+} was determined by titration with EDTA; NH_4^+ by distilling NH_3 into boric acid solution and titration with H_2SO_4; SO_4^{2-} was determined as $BaSO_4$; ClO_4^-, with nitron.

SOURCE AND PURITY OF MATERIALS:	ESTIMATED ERROR:
The salts were recrystallized.	Not stated.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium sulfate; $MgSO_4$; [7487-88-9] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Lanthanum sulfate; $La_2(SO_4)_3$; [10099-60-2] (4) Lanthanum perchlorate; $La(ClO_4)_3$; [14017-46-0] (5) Water; H_2O; [7732-18-5]	Chernova, L.P. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1979, *176*, 13-8.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: T. Mioduski

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$MgSO_4$-$La(ClO_4)_3$-$La_2(SO_4)_3$-H_2O at 25°C

Liquid phase composition								Solid Phase[b]
mass %				mol %[a]				
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
1.05	48.80	-	-	0.290	7.261	-	-	A + C
-	-	0.29	65.42	-	-	0.024	9.233	B + D
-	0.45	-	65.06	-	0.096	-	9.132	C + D
24.31	-	1.90	-	4.696	-	0.078	-	A + B

[a] Editors' calculations ; [b] A = $MgSO_4.7H_2O$; B = $La_2(SO_4)_3.9H_2O$; C = $Mg(ClO_4)_2.6H_2O$; D = $La(ClO_4)_3.9H_2O$.

AUXILIARY INFORMATION

METHOD/PROCEDURE/APPARATUS:	SOURCE AND PURITY OF MATERIALS:
The isothermal recrystallization method was used. No information is given on the criterion for ascertaining equilibrium. SO_4^{2-} and ClO_4^- were determined gravimetrically as $BaSO_4$ and nitron perchlorate, respectively. La^{3+} was separated from Mg^{2+} at pH 9.2 by precipitation with $(NH_4)_2CO_3$ and the $La_2(CO_3)_3$ precipitate was washed with 50 cm^3 distilled water and dissolved in 0.5 mol dm^{-3} HCl. La^{3+} was determined by titration with Complexone III at pH 5 using the indicator xylenol orange. Mg^{2+} was determined by titration with Complexone III using "chrome acid dark blue" indicator.	Nothing specified.
	ESTIMATED ERROR: Not stated.
	REFERENCES: None.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium sulfate; $MgSO_4$; [7487-88-9]	Chernova, L.P.
(2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	*Sb. Tr. Yarosl. Gos. Ped. Inst.* 1979, *176*, 13-8.
(3) Lanthanum sulfate; $La_2(SO_4)_3$; [10099-60-2]	
(4) Lanthanum perchlorate; $La(ClO_4)_3$; [14017-46-0]	
(5) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

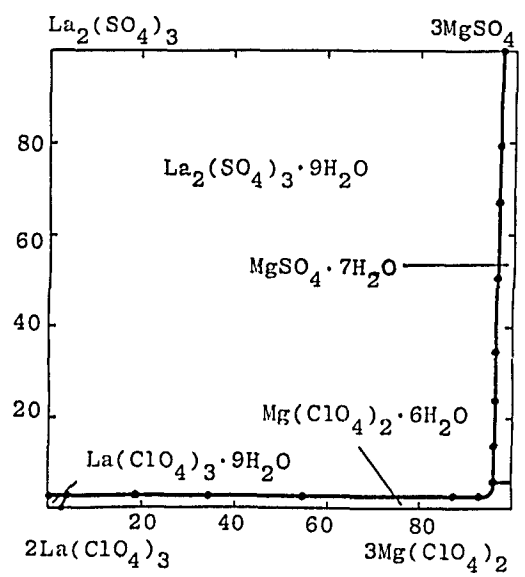
Solubility system $Mg(ClO_4)_2$-$MgSO_4$-$La(ClO_4)_3$-$La_2(SO_4)_3$-H_2O at 25°C

Liquid phase composition								Solid Phase[b]
mass %				mol %[a]				
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
21.49	6.35	1.10	-	4.299	0.685	0.047	-	A + B
17.96	10.95	1.14	-	3.654	1.202	0.049	-	A + B
20.51	35.42	0.77	-	6.233	5.804	0.050	-	A + B
5.25	26.77	0.22	-	1.111	3.056	0.010	-	A + B
3.71	32.19	0.18	-	0.828	3.873	0.009	-	A + B
1.72	38.22	0.13	-	0.407	4.875	0.007	-	A + B
0.63	47.91	0.33	-	0.171	7.018	0.019	-	A + B + C
0.73	49.06	0.12	-	0.202	7.311	0.007	-	A + B + C
0.61	49.08	0.19	-	0.169	7.312	0.011	-	A + B + C
-	46.72	0.08	3.98	-	7.087	0.005	0.399	B + C
-	40.92	0.57	8.59	-	6.150	0.034	0.853	B + C
-	26.49	0.07	29.49	-	4.486	0.005	3.300	B + C
-	18.48	0.68	40.26	-	3.372	0/049	4.853	B + C
-	8.46	0.43	48.14	-	1.477	0.030	5.55	B + C
-	1.81	0.10	64.62	-	0.394	0.009	9.298	B + C + D

[a] Editors' calculations ; [b] A = $MgSO_4.7H_2O$; B = $La_2(SO_4)_3.9H_2O$; C = $Mg(ClO_4)_2.6H_2O$; D = $La(ClO_4)_3.9H_2O$.

COMMENTS AND/OR ADDITIONAL DATA:

The Janecke diagram is shown below.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium chloride: $MgCl_2$; [7786-30-3] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Cerium chloride; $CeCl_3$; [7790-86-5] (4) Cerium perchlorate; $Ce(ClO_4)_3$; [14017-47-1] (5) Water; H_2O; [7732-18-5]	Guseva, A.D. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1976, *154*, 27-30.
VARIABLES: One temperature: 298.2 K Composition	PREPARED BY: T. Mioduski

EXPERIMENTAL VALUES:

Solubility system $Mg(ClO_4)_2$-$MgCl_2$-$Ce(ClO_4)_3$-$CeCl_3$-H_2O at 25°C

Liquid phase composition								Solid Phase[b]
mass %				mol %[a]				
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
27.09	-	12.04	-	7.665	-	1.316	-	A + B
26.99	-	6.08	8.26	7.910	-	0.688	0.526	A + B
25.10	0.224	-	18.40	7.685	0.029	-	1.223	A + B
18.22	12.50	-	18.21	6.383	1.808	-	1.341	A + B + C
20.68	14.56	-	11.51	6.654	1.998	-	0.804	B + C
22.85	19.90	-	-	6.843	2.542	-	-	B + C
16.30	8.74	-	24.76	5.607	1.282	-	1.849	A + C
13.16	4.60	-	33.35	4.688	0.699	-	2.579	A + C
8.66	5.68	-	40.49	3.349	0.937	-	3.400	A + C
6.83	0.67	-	55.33	3.168	0.133	-	5.573	A + C

[a] Editors' calculations.

[b] A = $CeCl_3.7H_2O$; B = $MgCl_2.6H_2O$; C = $Mg(ClO_4)_2.6H_2O$.

AUXILIARY INFORMATION

METHOD/PROCEDURE/APPARATUS:

The analytical method was used. To the saturated solutions at the eutonic points of the ternary systems the respective third salt was added until the new solid phase appeared. Equilibrium was reached in 4-6 days. ClO_4^- was determined gravimetrically with nitron. Cl^- was determined by mercurimetric titration using diphenylcarbazone indicator. Ce^{3+} was determined by complexometric titration using xylenol orange indicator. Mg^{2+} was found by difference.

SOURCE AND PURITY OF MATERIALS:	ESTIMATED ERROR:
Nothing stated.	Not stated.
REFERENCES: None.	

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium chloride: $MgCl_2$; [7786-30-3]	Guseva, A.D.
(2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1976, *154*, 27-30.
(3) Cerium chloride; $CeCl_3$; [7790-86-5]	
(4) Cerium perchlorate; $Ce(ClO_4)_3$; [14017-47-1]	
(5) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility system $Mg(ClO_4)_2$-$MgCl_2$-$Ce(ClO_4)_3$-$CeCl_3$-H_2O at 25°C

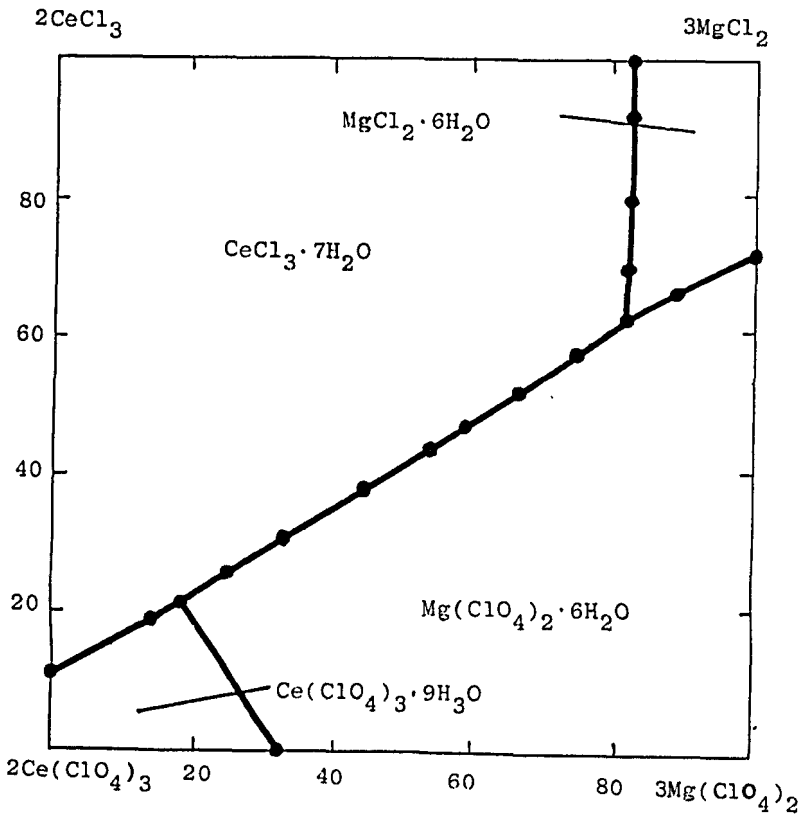
Liquid phase composition								Solid Phase[b]
mass %				mol %[a]				
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
5.38	0.48	-	65.11	3.107	0.118	-	8.165	A + B + C
3.97	-	1.14	55.62	1.772	-	0.197	5.391	A + C
-	2.89	-	62.39	-	0.622	-	6.833	B + C
-	-	3.99	58.13	-	-	0.719	5.889	A + C

[a] Editors' calculations.

[b] A = $CeCl_3.7H_2O$; B = $Mg(ClO_4)_2.6H_2O$; C = $Ce(ClO_4)_3.9H_2O$.

COMMENTS AND/OR ADDITIONAL DATA:

The Janecke diagram is shown below. The system is of the eutonic type and no double salts are observed.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium chloride; $MgCl_2$; [7786-30-3] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Ammonium chloride; NH_4Cl; [12125-02-9] (4) Ammonium perchlorate; NH_4ClO_4; [7790-98-9] (5) Water; H_2O; [7732-18-5]	Lepeshkhov, I.N.; Leboshchina, V.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1966, *59*, 48-66.
VARIABLES: One temperature: 298.2 K Composition	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility system $NH_4^+, Mg^{2+} // ClO_4^-, Cl^- - H_2O$ at 25.0°C

Liquid phase composition								Solid phase[b]
mass %				mol %[a]				
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
-	-	26.20	5.48	-	-	11.32	1.077	A + B
3.904	-	22.827	4.34	0.947	-	9.854	0.853	"
5.24	-	21.29	4.051	1.268	-	9.169	0.794	"
9.37	-	17.234	3.159	2.264	-	7.413	0.619	"
12.90	-	14.75	2.35	3.139	-	6.388	0.463	"
15.87	-	12.74	1.77	3.890	-	5.559	0.352	"
18.73	-	9.59	1.459	4.590	-	4.183	0.290	"
20.64	-	8.73	1.296	5.113	-	3.849	0.260	A + B + C
21.22	-	8.69	-	5.212	-	3.799	-	A + C
20.62	-	8.72	1.28	5.106	-	3.843	0.257	A + B + C
22.59	-	5.77	1.43	5.577	-	2.535	0.286	B + C
23.65	-	4.26	1.49	5.831	-	1.870	0.298	"
25.90	-	1.62	2.11	6.436	-	0.717	0.425	"
25.34	4.95	-	1.30	6.497	0.541	-	0.270	"
22.688	11.595	-	0.501	6.087	1.327	-	0.109	"
21.808	14.276	-	0.364	5.990	1.673	-	0.081	"
35.69	-	0.086	-	9.511	-	0.041	-	C + D
31.139	6.25	-	0.32	8.572	0.734	-	0.071	"
27.18	11.93	-	0.416	7.717	1.445	-	0.096	"
21.808	14.276	-	0.364	5.990	1.673	-	0.081	B + C + D
23.14	18.53	-	0.468	6.862	2.344	-	0.112	B + D + E
22.85	19.85	-	-	6.838	2.534	-	-	D + E
23.14	18.53	-	0.468	6.862	2.344	-	0.112	B + D + E
-	49.64	-	0.190	-	7.391	-	0.054	B + E
2.28	44.15	-	0.323	0.753	6.220	-	0.086	"
4.60	42.03	-	0.332	1.518	5.915	-	0.089	"
6.97	38.99	-	0.345	2.265	5.406	-	0.091	"
10.13	35.16	-	0.319	3.238	4.794	-	0.083	"
18.45	25.58	-	0.460	5.710	3.377	-	0.115	"
22.72	19.93	-	0.428	6.835	2.557	-	0.104	"
23.12	18.45	-	0.469	6.846	2.331	-	0.112	B + D + E

[a] Editors' calculations.

[b] A = NH_4Cl ; B = NH_4ClO_4 ; C = $NH_4Cl.MgCl_2.6H_2O$;
D = $MgCl_2.6H_2O$; E = $Mg(ClO_4)_2.6H_2O$.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium chloride; $MgCl_2$; [7786-30-3] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Ammonium chloride; NH_4Cl; [12125-02-9] (4) Ammonium perchlorate; NH_4ClO_4; [7790-98-9] (5) Water; H_2O; [7732-18-5]	Lepeshkhov, I.N.; Leboshchina, V.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1966, *59*, 48-66.

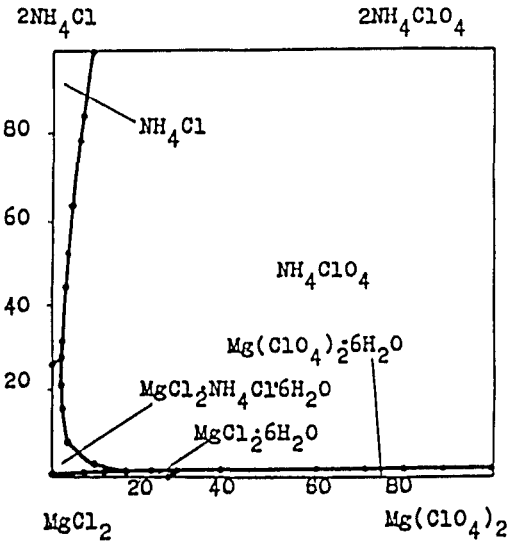
EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The Janecke diagram for the system is given here. It shows five crystallization fields and three triple points. The following equilibrium

$$Mg(ClO_4)_2 + 2NH_4Cl \rightleftharpoons 2NH_4ClO_4 + MgCl_2$$

is shifted to the right.



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The method of nonvariant points was used. Mg^{2+} was determined by titration with Trilon B using chrome blue black as indicator at pH 10-11; NH_4^+ by titration as NH_3 in the presence of neutralized formalin; Cl^- by titration with $Hg_2(NO_3)_2$ in acid solution with the indicator diphenylcarbazone, and ClO_4^- by difference.	The salts were recrystallized. ESTIMATED ERROR: Temperature: $\pm 0.1^{\circ}C$. REFERENCES: None.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium chloride; $MgCl_2$; [7786-30-3] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Ammonium chloride; NH_4Cl; [12125-02-9] (4) Ammonium perchlorate; NH_4ClO_4; [7790-98-9] (5) Water; H_2O; [7732-18-5]	Leboshchina, V.I. *Uch. Zap. Vladimir Gos. Ped. Inst.* 1971, *37*, 1-6.
VARIABLES: One temperature: 323.2 K Composition	**PREPARED BY:** N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility system $NH_4^+,Mg^{2+}//ClO_4^-,Cl^--H_2O$ at 50.0°C

Liquid phase composition								Solid phase[b]
mass %				mol %[a]				
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
-	-	29.70	9.70	-	-	13.88	2.063	A + B
2.48	-	27.27	9.68	0.654	-	12.81	2.070	"
5.80	-	24.07	8.04	1.513	-	11.18	1.700	"
11.38	-	18.90	6.57	2.963	-	8.758	1.386	"
14.50	-	16.29	5.34	3.763	-	7.524	1.123	"
17.69	-	14.04	3.82	4.578	-	6.468	0.801	"
18.99	-	12.80	3.13	4.891	-	5.868	0.653	"
20.71	-	11.38	2.08	5.303	-	5.186	0.432	A + B + C
20.86	-	12.50	-	5.277	-	5.628	-	B + C
20.52	-	11.75	1.88	5.248	-	5.349	0.390	A + B + C
21.18	-	10.33	2.86	5.448	-	4.730	0.596	A + C
22.13	-	8.50	2.93	5.663	-	3.872	0.608	"
23.42	-	6.66	3.15	5.994	-	3.034	0.653	"
26.90	-	1.55	4.17	6.913	-	0.709	0.868	"
27.29	2.93	-	3.63	7.161	0.328	-	0.772	"
27.07	7.52	-	1.83	7.360	0.872	-	0.403	"
24.97	12.85	-	1.03	7.044	1.546	-	0.235	A + C + D
24.89	19.48	-	0.55	7.665	2.559	-	0.137	"
37.10	-	0.14	-	10.05	-	0.068	-	C + D
34.91	3.76	-	0.52	9.742	0.448	-	0.118	"
24.89	19.48	-	0.55	7.665	2.559	-	0.137	A + C + D
24.46	23.49	-	0.60	7.971	3.265	-	0.158	A + D + E
22.69	22.60	-	-	7.058	3.000	-	-	D + E
22.46	23.49	-	0.60	7.120	3.176	-	0.154	A + D + E
-	51.72	-	0.97	-	8.085	-	0.288	A + E
1.42	53.58	-	0.91	0.550	8.857	-	0.286	"
2.80	48.42	-	0.85	1.009	7.444	-	0.248	"
6.25	43.05	-	0.79	2.162	6.354	-	0.222	"
7.43	43.60	-	0.75	2.640	6.607	-	0.216	"
16.65	27.26	-	0.67	5.175	3.614	-	0.169	"
19.88	23.68	-	0.54	6.101	3.100	-	0.134	"
22.46	23.49	-	0.60	7.120	3.176	-	0.154	A + D + E

[a] Editors' calculations.

[b] A = NH_4ClO_4 ; B = NH_4Cl ; C = $NH_4Cl.MgCl_2.6H_2O$; D = $MgCl_2.6H_2O$; E = $Mg(ClO_4)_2.6H_2O$.

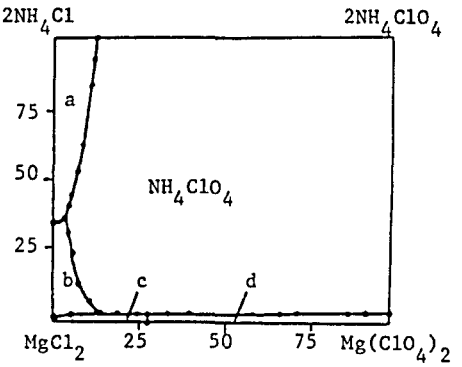
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Magnesium chloride; $MgCl_2$; [7786-30-3] (2) Magnesium perchlorate; $Mg(ClO_4)_2$; [10034-81-8] (3) Ammonium chloride; NH_4Cl; [12125-02-9] (4) Ammonium perchlorate; NH_4ClO_4; [7790-98-9] (5) Water; H_2O; [7732-18-5]	Leboshchina, V.I. *Uch. Zap. Vladimir Gos. Ped. Inst.* 1971, *37*, 1-6.

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The Janecke diagram given below shows five crystallization fields. The NH_4ClO_4 field occupies 90.97 % of the diagram since NH_4ClO_4 is is salted out with all the components of the system.



a : NH_4Cl
b : $NH_4Cl \cdot MgCl_2 \cdot 6H_2O$
c : $MgCl_2 \cdot 6H_2O$
d : $Mg(ClO_4)_2 \cdot 6H_2O$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal method was used. The conditions of saturation were not stated. NH_4^+ was determined by distilling NH_3 into boric acid and then titrating with H_2SO_4; Mg^{2+} was determined by complexometric titration and Cl^- mercurimetrically.	Not stated. ESTIMATED ERROR: Temperature: $\pm 0.1^{\circ}C$. REFERENCES: None.

COMPONENTS:	EVALUATOR:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	I.N. Lepeshkov and N.A. Kozyreva
(2) Water; H_2O; [7732-18-5]	Institute of General and Inorganic Chemistry, USSR Academy of Sciences

CRITICAL EVALUATION:

Binary Systems

Solubility data for $Ca(ClO_4)_2$ - H_2O binary systems were reported in reference (1) and 17 others (see separate evaluation following this). In references (2,3) solubility data for calcium perchlorate hexahydrate over the temperature range 273-323K were reported. The eutectic composition of the $Ca(ClO_4)_2.4H_2O$-ice mixture was reported (4) to be 38.5 mass % $Ca(ClO_4)_2$, as suggested from the position of the maximum on the specific conductivity isotherms and of the zero point on the isotherms of the derivative of this property in terms of the concentration.

Solubilities of $Ca(ClO_4)_2$ in methanol, ethanol, 1-propanol, 2-methyl-1-propanol, 1-butanol, acetone, ethyl acetate and diethyl ether at 298.15K were reported by only one group of workers (1). Similarly, there was only one report (4) of the solubility of calcium perchlorate in hydrazine at 298.15K.

Ternary Systems

The solubility isotherm (5) at 298 K for $Ca(ClO_4)_2$ in the $Ca(ClO_4)_2$-$HClO_4$-H_2O system shows a deep minimum after which the solubility increases with perchloric acid concentration again when the solid phase is $Ca(ClO_4)_2.4H_2O$, as shown in Fig. 1(a). Fig. 1(b) shows similar minima (6) for temperatures 273 K and 323 K.

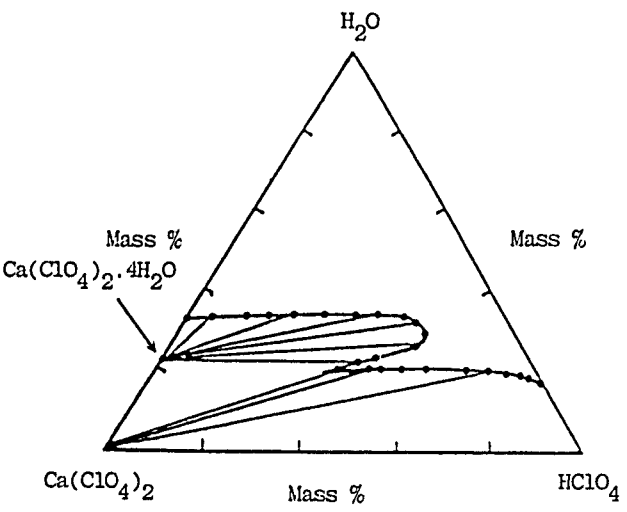


Figure 1(a). Soly isotherm for the system $Ca(ClO_4)_2$-$HClO_4$-H_2O at 298 K.

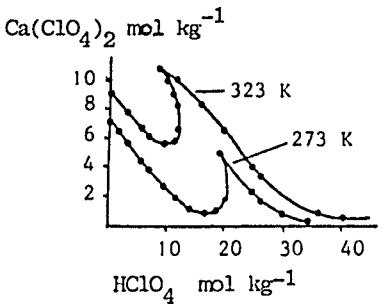


Figure 1(b). Soly isotherms at 273 K and 323 K.

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	I.N. Lepeshkov and N.A. Kozyreva
(2) Water; H_2O; [7732-18-5]	Institute of General and Inorganic Chemistry, USSR Academy of Sciences

CRITICAL EVALUATION: (continued)

Systems involving organic compounds : Among the systems with organic compounds as one of the components, the simplest is that involving thiocarbamide (7). At 298K, the following eutectic composition (mass %: 58.71 $Ca(ClO_4)_2$, 10.44 $CS(NH_2)_2$, 30.85 H_2O) was reported (7), with no coordination compounds formed. For the systems involving dimethylurea (8,9) at 298 K, the compounds $Ca(ClO_4)_2.4C_3H_8ON_2$ and $Ca(ClO_4)_2.3C_3H_8ON_2$ have been reported to be strongly salted out by calcium perchlorate. The system $Ca(ClO_4)_2$-urea-H_2O has a more complex character (10), its isotherm at 298K showing five crystallization branches as a result of the formation of additional solid compounds $Ca(ClO_4)_2.6CO(NH_2)_2$, $Ca(ClO_4)_2.4CO(NH_2)_2$, and $Ca(ClO_4)_2.2CO(NH_2)_2.2H_2O$. The former is congruently soluble while the latter two are incongruently soluble. For $Ca(ClO_4)_2$-hexamethylenetetramine-water, the formation of solid phases of $Ca(ClO_4)_2.2C_6H_{12}N_4.6H_2O$ and $Ca(ClO_4)_2.3C_6H_{12}N_4$ were reported (11).

Systems involving only calcium salts :

In the ternary aqueous systems with $Ca(NO_3)_2$, $CaCrO_4$ or $CaCl_2$ as the other solute at 298K, the crystallization isotherms in each case showed a branch corresponding to $Ca(ClO_4)_2.4H_2O$ which did not convert to the anhydrous phase (12-19). Calcium nitrate and calcium chloride gave two branches of crystallization each, corresponding to their respective hydrates $Ca(NO_3)_2.4H_2O$, $Ca(NO_3)_2.2H_2O$, $CaCl_2.4H_2O$ and $CaCl_2.2H_2O$. The tentative eutectic compositions of these systems are presented in Table 1.

Table 1. Eutectic compositions of ternary systems involving calcium salts only at different temperatures.

System	T/K	Eutectic composition mass %		Reference
(1) (2)		(1)	(2)	
$Ca(ClO_4)_2$-$Ca(NO_3)_2$-H_2O	298	45.23	30.89	12
$Ca(ClO_4)_2$-$Ca(NO_3)_2$-H_2O	298	44.64	30.89	13
$Ca(ClO_4)_2$-$Ca(NO_3)_2$-H_2O	323	33.48	47.60	14
$Ca(ClO_4)_2$-$CaCrO_4$-H_2O	298	65.14	0.10	15
$Ca(ClO_4)_2$-$CaCrO_4$-H_2O	313	66.90	0.02	16
$Ca(ClO_4)_2$-$CaCl_2$-H_2O	313	54.40	14	18

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	I.N. Lepeshkov and N.A. Kozyreva
(2) Water; H_2O; [7732-18-5]	Institute of General and Inorganic Chemistry, USSR Academy of Sciences

CRITICAL EVALUATION: (continued)

Systems involving alkali metal and ammonium perchlorates :

Calcium perchlorate does not form new phases with $LiClO_4$ at 298K and at the eutectic point (mass %: 48.35 $Ca(ClO_4)_2$, 8.89 $LiClO_4$) $LiClO_4.3H_2O$ and $Ca(ClO_4)_2.4H_2O$ crystallize (20). Three crystallization fields were found for the system $Ca(ClO_4)_2$-$NaClO_4$-H_2O at 313K (18). The solid phases were $Ca(ClO_4)_2.4H_2O$, $NaClO_4$ and $NaClO_4.H_2O$. The eutectic composition, in mass %, was 65.10% $Ca(ClO_4)_2$ and 6.13% $NaClO_4$. Calcium perchlorate was found to have a stronger salting-out effect on sodium perchlorate (21) than lithium perchlorate.

Systems involving alkaline earth metal perchlorates:

The eutectic composition for the system $Ca(ClO_4)_2$-$Mg(ClO_4)_2$-H_2O at 298K was reported (22) to be, in terms of mass %, 63.52% $Ca(ClO_4)_2$ and 1.35% $Mg(ClO_4)_2$, where $Ca(ClO_4)_2.4H_2O$ and $Mg(ClO_4)_2.6H_2O$ formed the solid phases in equilibrium.

Systems involving perchlorates of lanthanides:

The systems involving $Ce(ClO_4)_3$, $Sm(ClO_4)_3$ and $Tb(ClO_4)_3$ form eutectic mixtures at 298K where $Ca(ClO_4)_2.4H_2O$ crystallized out in equilibrium with the nanohydrates of the corresponding lanthanide perchlorate. The tentative eutectic compositions for these systems at 298K are given in Table 2.

Table2 Eutectic compositions of ternary systems involving lanthanides at 298K.

System		Eutectic composition mass %		Reference
(1)	(2)	(1)	(2)	
$Ca(ClO_4)_2$-$Ce(ClO_4)_3$-H_2O		24.20	43.07	(23)
$Ca(ClO_4)_2$-$Sm(ClO_4)_3$-H_2O		23.94	43.28	(24)
$Ca(ClO_4)_2$-$Tb(ClO_4)_3$-H_2O		20.42	43.40	(25)

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	I.N. Lepeshkov and N.A. Kozyreva
(2) Water; H_2O; [7732-18-5]	Institute of General and Inorganic Chemistry, USSR Academy of Sciences

CRITICAL EVALUATION: (continued)

QUATERNARY SYSTEMS

The formation of $Mg(ClO_4)_2.4CS(NH_2)_2.6H_2O$ in the system $Ca(ClO_4)_2$-$Mg(ClO_4)_2$-$CS(NH_2)_2$-H_2O at 298K was reported (26). There were more complex compounds formed in the $Ca(ClO_4)_2$-$LiClO_4$-$C_6H_{12}N_4$-H_2O system (27), viz. $LiClO_4.2C_6H_{12}N_4.4H_2O$, $LiClO_4.C_6H_{12}N_4.3H_2O$, $Ca(ClO_4)_2.4C_6H_{12}N_4.6H_2O$ and $Ca(ClO_4)_2.2C_6H_{12}N_4.6H_2O$, as solid phases. Complex compounds containing more hexamethylenetetramine molecules per molecule of mineral salt were reported to be more readily soluble.

From the study of the quaternary reciprocal salt system $2NH_4^+$, Ca^{2+} || $2ClO_4^-$, CrO_4^{2-} $-H_2O$ at 313K, the following crystallization fields were identified (17) : $CaCrO_4.H_2O$, NH_4ClO_4, $NH_4ClO_4.(NH_4)_2CrO_4$, $(NH_4)_2CrO_4$, and $2(NH_4)_2CrO_4.3CaCrO_4$.

For the system $2NH_4^+$, Ca^{2+} || $2ClO_4^-$, $2NO_3^-$ $-H_2O$ at 298K, the equilibrium of the exchange reaction (13),

$$Ca(ClO_4)_2 + 2NH_4NO_3 \rightleftharpoons Ca(NO_3)_2 + 2NH_4ClO_4$$

is strongly shifted to the right. The formation of the following compounds, $NH_4NO_3.5Ca(NO_3)_2.10H_2O$ and $NH_4NO_3.Ca(NO_3)_2.3H_2O$ have also been reported (13).

REFERENCES

1. Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1923, *45*, 286.
2. Lilich, L.S.; Mogilev, M.E. *Zh. Obshchei Khim.* 1956, *26*, 312.
3. Lilich, L.S.; Dzhurinskii, B.F. *Zh. Obshchei Khim.* 1956, *26*, 1549.
4. Sakk, Zh.G.; Rosolovskii, V.Ya. *Zh. Neorg. Khim.* 1972, *17*, 1783.
5. Lilich, L.S.; Kurbanova, Z.I.; Chernykh, L.V. *Zh. Neorg. Khim.* 1972, *17*, 812.
6. Lilich, L.S.; Chernykh, L.V., Shalygin, V.M. *Zh. Neorg. Khim.* 1963, *8*, 2773.
7. Zakharova, V.P.; Runov, N.N. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *78*, 107.

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	I.N. Lepeshkov and N.A. Kozyreva
(2) Water; H_2O; [7732-18-5]	Institute of General and Inorganic Chemistry, USSR Academy of Sciences.

CRITICAL EVALUATION: (continued)

8. Karnaukhov, A.S.; Vasil'eva, S.I.; Rylenkova, I.N. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1978, *169*, 22.
9. Vasil'eva, S.I., Rylenkova, I.N. *Fiz. Khim. Issled. Neorg. Org. Soed.* 1979, 7.
10. Zakharova, V.P.; Runov, N.N. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1973, *120*, 89.
11. Karnaukhov, A.S.; Kosheleva, N.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1975, *135*, 60.
12. Vasil'eva, S.I.; Karnaukhov, A.S. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1972, *103*, 7.
13. Vasil'eva, S.I.; Lepeshkov, I.N. *Zh. Neorg. Khim.* 1973, *18*, 819.
14. Vasil'eva, S.I.; Rylenkova, I.N. *Fiz. Khim. Issled. Neorg. Org. Soed.* 1976, 23.
15. Karnaukhov, A.S.; Orekhov, O.L. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1969, *66*, 72; 1970, *78*, 3.
16. Lepeshkov, I.N.; Vasil'eva, S.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *78*, 74.
17. Karnaukhov, A.S.; Vasil'eva, S.I. *Zh. Neorg. Khim.* 1970, *15*, 2499.
18. Ivanov, S.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1969, *66*, 82.
19. Latysheva, V.A.; Andreeva, I.N. *Zh. Neorg. Khim.* 1968, *13*, 2080.
20. Ivanov, S.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1971, *95*, 11.
21. Lilich, L.S.; Ovtrakht, N.V. *Vestn. LGU, Ser. Fiz. Khim.* 1965, *10*, 115.
22. Runov, N.N.; Zakharova, V.P. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *79*, 120.
23. Rybina, T.V.; Druzhinina, G.V. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1977, *164*, 74.
24. Guseva, A.D. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1980, *185*, 3.
25. Komissarova, V.I.; Andronova, N.P. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1978, *169*, 18.
26. Zakharova, V.P. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1971, *95*, 98.
27. Kosheleva, N.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1978, *169*, 124.

COMPONENTS:	EVALUATOR:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	C.Y. Chan
(2) Water; H_2O; [7732-18-5]	Department of Chemistry University of Malaya Kuala Lumpur, Malaysia
	January, 1988

CRITICAL EVALUATION:

Solubility of calcium perchlorate in water

Table 1 summarizes values of the solubility of $Ca(ClO_4)_2$ in water in mass % as reported by various research groups. Only two groups (1,17) gave an indication of the precision of their solubility analyses, in both cases about ±0.05% of the soly value. All reported that the solid phase in equilibrium with saturated solution was $Ca(ClO_4)_2.4H_2O$.

Table 1. Data for the solubility of $Ca(ClO_4)_2$ in water from various sources. In each case the reported solid phase was $Ca(ClO_4)_2.4H_2O$ [15627-86-8].

T/K	mass % $Ca(ClO_4)_2$	Source
298.15	65.35	Willard and Smith (1)
298	65.40	Lilich and Ovtrakht (2)
"	65.20	Karnaukhov and Orekhov (3)
"	65.38	Zakharova and Runov (4)
"	65.34	Runov and Zakharova (5)
"	65.50	Ivanov (6)
"	65.46	Vasil'eva and Karnaukhov (7)
"	65.46	Vasil'eva and Lepeshkov (8)
"	65.50	Karnaukhov and Kosheleva (9)
"	65.57	Rybina and Druzhinina (10)
"	65.64	Karnaukhov et al (11)
298.15	66.16	Lilich and Dzhurinsky (12)
298	65.90	Komissarova and Andronova (13)
"	65.77	Guseva (14)
313	68.40	Ivanov (15)
"	68.48	Lepeshkov and Vasil'eva (16)
"	68.48	Lilich and Kurbanova (17)
313.15	67.97	Lilich and Dzhurinsky (12)
323.15	69.42	Lilich and Dzhurinsky (12)
323	68.51	Lilich and Kurbanova (17)
"	69.96	Vasil'eva and Rylenkova (18)
273.15	62.67	Lilich and Kurbanova (17)
"	62.92	Lilich and Dzhurinsky (12)

Data from ref.(1-11) gave a mean mass % value of 65.44 for the solubility of calcium perchlorate in water at 298K with a standard deviation of

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	C.Y. Chan
(2) Water; H_2O; [7732-18-5]	Department of Chemistry University of Malaya Kuala Lumpur, Malaysia
	January, 1988

CRITICAL EVALUATION: (continued)

0.12%, and these include Willard and Smith's value which appears to be the most precise of those listed in Table 1. The data from ref.(12-14) are rejected based on the usual statistical analysis grounds. The mean soly value at 313K is 68.45% $Ca(ClO_4)_2$ with a std. dev. of 0.04%, the value from ref.(12) being somewhat lower than the others (15-17) and has been rejected. For 323K (12,17,18), the mean mass % soly value is 69.30% $Ca(ClO_4)_2$ with a std. dev. of 0.73%. The mean of the two reported values (12,17) at 273.15K is 62.80%.

Based on the treatment described in the INTRODUCTION to this volume and used in previous evaluations of soly data of the other alkaline earth perchlorates, Lilich and Dzhurinsky's data for the temperature range 273 - 323K are combined with the data as given in Table 1 to obtain the best-fit equations, Eq.(1) with solubility in terms of mol fraction x and Eq.(2) with solubility in terms of molality m. Recommended and tentative smoothed values of the solubilities of calcium perchlorate in water at selected temperatures, calculated using these equations, are presented in Table 2.

$$F(x) = 1609.5\ (T/\mathrm{K})^{-1} + 7.000\ \ln(T/\mathrm{K}) - 53.604 \qquad (1)$$

where $F(x) = \ln[x^{\nu}(1-x)^{n}/(1 + (\nu-1)x)^{n+\nu}]$, $\nu = 3$ and $n = 4$.
The regression coefficient obtained in the the multilinear regression analysis is 0.985 and the average percentage difference between calculated and observed values is 1.1% .

$$F(m) = 535.5\ (T/\mathrm{K}) + 2.3298\ \ln(T/\mathrm{K}) - 13.829 \qquad (2)$$

where $F(m) = \ln m - (1 + n/\nu)\ln(\nu m M_W + 1)$, M_W = molar mass of water.
The regression coefficient is also 0.985 and the average percentage difference between calculated and observed values is 1.2% .

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	C.Y. Chan
(2) Water; H_2O; [7732-18-5]	Department of Chemistry University of Malaya Kuala Lumpur, Malaysia
	January, 1988

CRITICAL EVALUATION: (continued)

Table 2. Recommended and tentative smoothed solubility data for calcium perchlorate in water at selected temperatures. Solid phase is $Ca(ClO_4)_2 \cdot 4H_2O$.

t/°C	T/K	Soly/mol %	Soly/mol kg^{-1}	Status
0.00	273.15	11.33	7.094	tentative
5.00	278.15	11.54	7.238	"
10.00	283.15	11.76	7.401	"
15.00	288.15	12.02	7.583	"
20.00	293.15	12.30	7.787	"
25.00	298.15	12.49	7.922	recommended
30.00	303.15	12.98	8.276	tentative
35.00	308.15	13.38	8.571	"
40.00	313.15	13.83	8.909	"
45.00	318.15	14.36	9.306	"
50.00	323.15	14.98	9.782	"

REFERENCES :

1. Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1923, *45*, 286.
2. Lilich, L.S.; Ovtrakht, N.V. *Vestn. LGU, Ser. Fiz. Khim.* 1965, *10(2)*, 115.
3. Karnaukhov, A.S.; Orekhov, O.L. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1969, *66*, 72; 1970, *78*, 3.
4. Zakharova, V.P.; Runov, N.N. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *78*, 107.
5. Runov, N.N.; Zakharova, V.P. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1970, *79*, 120; *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1973, 120, *89*.
6. Ivanov, S.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1971, *95*, 11.
7. Vasil'eva, S.I.; Karnaukhov, A.S. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1972, *103*, 7.

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	C.Y. Chan
(2) Water; H_2O; [7732-18-5]	Department of Chemistry University of Malaya Kuala Lumpur, Malaysia
	January, 1988

CRITICAL EVALUATION: (continued)

8. Vasil'eva, S.I.; Lepeshkov, I.N. *Russ. J. Inorg. Chem. (Engl. Transl.)* 1973, *18*, 429.
9. Karnaukhov, A.S.; Kosheleva, N.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1975, *135*, 60.
10. Rybina, T.V.; Druzhinina, G.V. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1977, *169*, 22.
11. Karnaukhov, A.S.; Vasil'eva, S.I.; Rylenkova, I.N. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1978, *169*, 22.
12. Lilich, L.S.; Dzhurinsky, B.F. *Zhur. Obshchei Khim.* 1956, *26*, 1549; *J. Gen. Chem. USSR (Engl. Transl.)* 1956, *26*, 1733.
13. Komissarova, V.I.; Andronova, N.P. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1978, *169*, 18.
14. Guseva, A.D. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1980, *185*, 3.
15. Ivanov, S.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1969, *66*, 82.
16. Lepeshkov, I.V.; Vasil'eva, S.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *78*, 74.
17. Lilich, L.S.; Kurbanova, Z.I. *Zh. Neorg. Khim.* 1972, *17*, 812; *Russ. J. Inorg. Chem. (Engl. Transl.)* 1972, *17*, 424.
18. Vasil'eva, S.I.; Rylenkova, I.N. *Khimich. Fiz.-khim. Issled. Neorg. Org. Soyed. Smol.* 1976, 23.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [17477-36-6]	Lilich, L.S.; Dzhurinsky, B.F.
(2) Water; H_2O; [7732-18-5]	*Zhur. Obshchei Khim.* 1956, *26*, 1549-53; **J. Gen. Chem. USSR (Engl. Transl.)* 1956, *26*, 1733-7.
VARIABLES: Temperature: 273 - 323 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of calcium perchlorate in water at various temperatures :

t/°C	0	5	10	15	20	25	30
s/ mol kg^{-1}	7.10	7.29	7.51	7.67	7.91	8.18	8.46
mol % [b]	11.34	11.61	11.92	12.14	12.47	12.84	13.23

t/°C	35	40	45	50
s/ mol kg^{-1}	8.76	8.88	9.29	9.50
mol % [b]	13.63	13.79	14.34	14.61

[a] Solid phase/phases not specified. [b] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solid perchlorate, presumably hydrated (compiler), was stirred continuously with water in the soly apparatus (sketch given in original paper) in a Hoppler ultra-thermostat. Solution samples were suction-filtered and forced into small weighed glass containers with the help of a rubber bulb-and-tube arrangement. Samples were analysed for Ca by the sulfate method (ref.1). The time required for attainment of equilibrium was 1-4h, determined by successive withdrawal of samples at various time interval for analysis. Solid samples were withdrawn with a glass sieve and pressed with filter paper between metal plates heated or cooled to approx. the temp. of determination. The weighed samples were then analysed for Ca.

SOURCE AND PURITY OF MATERIALS:

(1) was prepared by saturating perchloric acid with analytically pure grade calcium oxide, followed by 2-3 recrystallizations from solution. Purity of the acid and sources of chemicals not given.

ESTIMATED ERROR:

Not available.

REFERENCES:

1. Kolthoff, I.M.; Lundell, E.V. *Quantitative Analysis* (State Chemical Press 1948), 772.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [17477-36-6] (2) Water; H_2O; [7732-18-5]	Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1923, *45*, 286-96.
VARIABLES: One temperature: 298.15 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of calcium perchlorate in water at 25.00°C :

mass %	g/100 cm^3 sln.	mol %	mol dm^{-3}	mol kg^{-1}	sat. sln. density/g cm^{-3}
65.35	112.34	12.45[b]	4.701[b]	7.892[b]	1.7191

[a] The solid phase was a mixture of the anhydrous salt and its tetrahydrate, $Ca(ClO_4)_2.4H_2O$.
[b] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
A sat. sln. of the salt was prepared at a temperature slightly above 25°C and sealed together with about 1 g of the anhydrous salt in a solubility tube, capacity 18-20 cm^3. This tube was then rotated end-over-end in the thermostat bath at 25.00°C for 24-48h and stood vertically to allow the solids to settle. Samples of the clear sat. sln. were then analysed for solute content by an evaporation-to-dryness method using Pt crucibles. The salt was dried to constant wt. at 250°C in a current of air dried with P_2O_5. Duplicate soly. determinations were made, those analyses in which chloride (from thermal decomposition) was found present being rejected.
The equilibrium solid phase was a mixture of the anhydrous salt and its hydrate.

SOURCE AND PURITY OF MATERIALS:
Hydrated (1) was prepared from twice-recrystallized calcium nitrate and purified $HClO_4$ (ref.1). Anhyd. (1) obtained by heating the hydrate to const. wt. at 250°C.

ESTIMATED ERROR:
Precision in temp. was ±0.01°C; precision in soly. about ±0.05% .

REFERENCES:
1. Willard, H.H. *J. Am. Chem. Soc.* 1912, *34*, 1480.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (2) Hydrogen peroxide; H_2O_2; [7722-84-1]	Titova, K.V.; Kolmakova, E.I.; Rosolovskii, V.Ya. *Zh. Neorg. Khim.* 1986, *31*, 3213-5; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1986, *31*, 1846-7.
VARIABLES: One temperature: 273 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

The solubility[a] of calcium perchlorate in hydrogen peroxide at 0°C :

g(1)/ 100 g(2)	mass %	mol %	molality/ mol kg^{-1}
97.7	49.42	12.21	4.088

[a] Mass %, mol % and molality values calculated by compiler.

The solid phase was reported as $Ca(ClO_4)_2.2H_2O_2$. Analysis gave the following mass % values : Ca 12.7% , ClO_4 63.3% and H_2O_2 21.3%. The corresponding theoretical values are Ca 13.05%, ClO_4 64.79% and H_2O_2 22.15% for the solid $Ca(ClO_4)_2.2H_2O_2$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
No details of saturation method were given. Solubility equilibrium was established in 1-1.5 h. The concentration of the solutions did not change noticeably during the next 3h but after that slow decomposition of peroxide began. The concentrations of perchlorate in the sat. solutions were determined by gravimetric analysis using nitron as the agent for precipitation. H_2O_2 was analysed by permanganate titration.	The anhydrous perchlorate was prepared by heating the hydrate in vacuum (source not given). Samples that showed no water I.R. absorption bands in the range 1620-1635 cm^{-1} were used. The H_2O_2 was 99.8% ± 0.2% pure.
	ESTIMATED ERROR: Not stated.
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (2) *Alcohols*: (A) Methanol (*methyl alcohol*); CH_4O; [67-56-1] (B) Ethanol (*ethyl alcohol*); C_2H_6O; [64-17-5] (C) 1-Propanol (*n-propyl alcohol*); C_3H_8O; [71-23-8] (D) 1-Butanol (*n-butyl alcohol*); $C_4H_{10}O$; [71-36-3] (E) 2-Methyl-1-propanol (*iso-butyl alcohol*); $C_4H_{10}O$; [78-83-1]	Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1923, *45*, 286-96.
VARIABLES: One temperature: 298.15 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of calcium perchlorate in various alcohols at 25.00°C, the solid phase being the anhydrous salt :

soly in :	methanol	ethanol	1-propanol	1-butanol	2-methyl-1-propanol
mass %	70.36	62.44	59.17	53.17	36.29
g/100 cm^3 sln.	113.68	89.551	81.690	68.419	39.567
mol %[a]	24.14	24.27	26.71	26.04	15.01
mol dm^{-3} [a]	4.758	3.747	3.418	2.863	1.656
mol kg^{-1} [a]	9.933	6.956	6.064	4.751	2.384

[a] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
A sat. sln. of the salt was prepared at a temperature slightly above 25°C and sealed together with about 1 g of the anhydrous salt in a solubility tube, capacity 18-20 cm^3. This tube was then rotated end-over-end in the thermostat bath at 25.00°C for 24-48h	Hydrated (1) was prepared from twice-recrystallized calcium nitrate and purified $HClO_4$ (ref.1). Anhyd. (1) obtained by heating hydrate to const. wt. at 250°C. Alcohols purified by fract. distillation after refluxing with Ca.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (2) *Alcohols*: (A) Methanol (*methyl alcohol*); CH_4O; [67-56-1] (B) Ethanol (*ethyl alcohol*); C_2H_6O; [64-17-5] (C) 1-Propanol (*n-propyl alcohol*); C_3H_8O; [71-23-8] (D) 1-Butanol (*n-butyl alcohol*); $C_4H_{10}O$; [71-36-3] (E) 2-Methyl-1-propanol (*iso-butyl alcohol*); $C_4H_{10}O$; [78-83-1]	Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1923, *45*, 286-96.

EXPERIMENTAL VALUES:(continued)

	methanol	ethanol	1-propanol	1-butanol	2-methyl-1-propanol
sat. sln. density/g cm^{-3}	1.6155	1.4342	1.3806	1.2868	1.0903
pure solvent density/g cm^{-3}	0.78705	0.78515	0.7989	0.8059	0.7981

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:(continued)
and stood vertically to allow the solids to settle. Samples of the clear sat. sln. were then analysed for solute content by an evaporation-to-dryness method using Pt crucibles. The salt was dried to constant wt. at 250°C in a current of air dried with P_2O_5. Duplicate soly determinations were made, those analyses in which chloride (from thermal decomposition) was found present being rejected.

ESTIMATED ERROR:
Precision in temp. was ±0.01°C.
soly precision probably about ± 0.1% (compiler).

REFERENCES:
1. Willard, H.H. *J. Am. Chem. Soc.* 1912, *34*, 1480.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13450-97-0]	Willard, H.H.; Smith, G.F.
(2) Acetone; C_3H_6O; [67-64-1]	*J. Am. Chem. Soc.* 1923, *45*, 286-96.
VARIABLES:	PREPARED BY:
One temperature: 298.15 K	C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of calcium perchlorate in acetone at 25.00°C :

mass %	g/100 cm^3 sln.	mol %	mol dm^{-3}	mol kg^{-1}	sat. sln. density/g cm^{-3}
38.18	43.812	13.05[b]	1.833[b]	2.584[b]	1.1475

[a] The solid phase was the anhydrous salt.

[b] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A sat. sln. of the salt was prepared at a temperature slightly above 25°C and sealed together with about 1 g of the anhydrous salt in a solubility tube, capacity 18-20 cm^3. This tube was then rotated end-over-end in the thermostat bath at 25.00°C for 24-48h and stood vertically to allow the solids to settle. Samples of the clear sat. sln. were then analysed for solute content by an evaporation-to-dryness method using Pt crucibles. The salt was dried to constant wt. at 250°C in a current of air dried with P_2O_5. Duplicate soly determinations were made, those analyses in which chloride (from thermal decomposition) was found present being rejected.

SOURCE AND PURITY OF MATERIALS:

Hydrated (1) was prepared from twice-recrystallized calcium nitrate and purified $HClO_4$ (ref.1). Anhyd. (1) obtained by heating the hydrate to const. wt. at 250°C. (2) was purified by refluxing with KOH and fractional distillation. Density of (2) at 25°C was 0.7852 g cm^{-3}; b.p. was 56.16-56.51 °C .

ESTIMATED ERROR:

Precision in temp. was ± 0.01°C . Soly precision probably about ± 0.1% (compiler).

REFERENCES:

1. Willard, H.H. *J. Am. Chem. Soc.* 1912, *34*, 1480.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13450-97-0]	Willard, H.H.; Smith, G.F.
(2) 1,1'-oxybis-ethane (*diethyl ether*); $C_4H_{10}O$; [60-29-7]	*J. Am. Chem. Soc.* 1923, *45*, 286-96.
VARIABLES:	PREPARED BY:
One temperature: 298.15 K	C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of calcium perchlorate in diethyl ether at 25.00°C :

mass %	g/100 cm^3 sln.	mol %	mol dm^{-3}	mol kg^{-1}	sat. sln. density/g cm^{-3}
0.26	0.1846	0.081[b]	0.00772[b]	0.0109[b]	0.7098

[a] The solid phase was the anhydrous salt.

[b] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A sat. sln. of the salt was prepared at a temperature slightly above 25°C and sealed together with about 1 g of the anhydrous salt in a solubility tube, capacity 18-20 cm^3. This tube was then rotated end-over-end in the thermostat bath at 25.00°C for 24-48h and stood vertically to allow the solids to settle. Samples of the clear sat. sln. were then analysed for solute content by an evaporation-to-dryness method using Pt crucibles. The salt was dried to constant wt. at 250°C in a current of air dried with P_2O_5. Duplicate soly determinations were made, those analyses in which chloride (from thermal decomposition) was found present being rejected.

SOURCE AND PURITY OF MATERIALS:

Hydrated (1) was prepared from twice-recrystallized calcium nitrate and purified $HClO_4$ (ref.1). Anhyd. (1) obtained by heating the hydrate to const. wt. at 250°C. (2) was purified by refluxing with P_2O_5 and fractional distillation. Density of (2) at 25°C was 0.7081g cm^{-3}.

ESTIMATED ERROR:

Precision in temp. was ± 0.01°C .

REFERENCES:

1. Willard, H.H. *J. Am. Chem. Soc.* 1912, *34*, 1480.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13450-97-0] (2) Hydrazine; N_2H_4; [302-01-2]	Sakk, Zh.G.; Rosolovskii, V.Ya. *Zh. Neorg. Khim.* 1972, *17*, 1783-4; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1972, *17*, 927-8.
VARIABLES: One temperature: 298.2 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

The solubility of calcium perchlorate in hydrazine at 25.0°C was reported as 86.8 g(1)/100 g(2). The corresponding mol % and molality values calculated by the compiler are 10.43% and 3.630 mol kg^{-1} , respectively. The solid phase was presumably the anhydrous salt, (compiler).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
4-6 g of the salt and 8-11 cm^3 of hydrazine were thermostated at 25°C for 7-8 h with continuous stirring in a vessel isolated from atmospheric moisture. Samples for analysis were removed by drawing solution and part of the solid phase into a vessel fitted with a porosity no.4 filter at reduced pressure. After separating the phases, the solution was analysed for hydrazine. Methods of analysis not given. Replicate soly determinations were made.	The methods of purification of the perchlorate and of preparation of hydrazine were as described in ref.1 . Salt purity was about 99.5 - 99.9% .
	ESTIMATED ERROR: Precision in temp. was ±0.01°C; Absolute error in soly value was 0.4% .
	REFERENCES: 1. Rosolovskii, V.Ya.; Sakk, Zh.G. *Zh. Neorg. Khim.* 1970, *15*, 2262 .

COMPONENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]
(2) Perchloric acid; $HClO_4$; [7601-90-3]
(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Lilich, L.S.; Kurbanova, Z.I.; Chernykh, L.V.

Zh. Neorg. Khim. 1972, *17*, 812-16; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1972, *17*, 424-6.

VARIABLES:
Temperatures: 273.0 and 323.0 K
Composition

PREPARED BY:
C.C. Ho

EXPERIMENTAL VALUES:

Solubility in the system $Ca(ClO_4)_2$-$HClO_4$-H_2O at 0.0°C :

Liquid phase composition						Solid
mass %		mol % [a]		molality[a]/mol kg^{-1}		phase
(1)	(2)	(1)	(2)	(1)	(2)	
62.67	-	11.23	-	7.025	-	$Ca(ClO_4)_2.4H_2O$
57.89	5.25	10.35	2.233	6.572	1.418	"
48.50	13.18	8.246	5.331	5.296	3.424	"
35.61	25.38	5.805	9.842	3.820	6.476	"
23.93	36.67	3.776	13.76	2.541	9.265	"
16.75	44.60	2.635	16.69	1.813	11.49	"
10.05	52.35	1.587	19.66	1.118	13.86	"
6.80	59.02	1.132	23.38	0.832	17.19	"
7.73	60.60	1.351	25.20	1.021	19.05	"
16.52	56.54	3.249	26.46	2.566	20.89	"
21.11	52.83	4.286	25.52	3.390	20.18	"
26.23	49.07	5.574	24.80	4.444	19.78	"

[a] Compiler's calculation.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The solubility was measured by the isothermal saturation method. Equilibrium was reached after 8-10h. Ca^{2+} in the liquid and solid phases was determined by titration with a soln of Trilon B using Erichrome Black as indicator, $HClO_4$ by titrating H^+ with borax soln against methyl red as indicator. The composition of the solid phase was found by Schreinemakers' method.

SOURCE AND PURITY OF MATERIALS:
"Chemically pure" grade of perchloric acid and "pure" grade of calcium carbonate were used to prepare the perchlorate which was recrystallized three times before use.

ESTIMATED ERROR:
Temp.: precision ±0.1°C at 0° and 50°C
Analyses: relative error ±0.05%

REFERENCES:

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	Lilich, L.S.; Kurbanova, Z.I.; Chernykh, L.V.
(2) Perchloric acid; $HClO_4$; [7601-90-3]	*Zh. Neorg. Khim.* 1972, *17*, 812-16; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1972, *17*, 424-6.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility in the system $Ca(ClO_4)_2$-$HClO_4$-H_2O at 0.0°C :

Liquid phase composition						Solid
mass %		mol % [a]		molality[a] /mol kg^{-1}		phase
(1)	(2)	(1)	(2)	(1)	(2)	
29.81	46.15	6.502	23.94	5.189	19.11	$Ca(ClO_4)_2.4H_2O$ + $Ca(ClO_4)_2$
13.98	61.60	2.886	30.25	2.396	25.11	$Ca(ClO_4)_2$
9.19	65.84	1.849	31.51	1.540	26.25	"
4.04	71.98	0.819	34.71	0.705	29.88	"
2.31	75.59	0.486	37.83	0.437	34.05	"
-	77.81	-	38.61	-	34.91	"

Solubility in the system $Ca(ClO_4)_2$-$HClO_4$-H_2O at 50.0°C :

Liquid phase composition						Solid
mass %		mol % [a]		molality[a]/mol kg^{-1}		phase
(1)	(2)	(1)	(2)	(1)	(2)	
68.51	-	14.09	-	9.104	-	$Ca(ClO_4)_2.4H_2O$
55.61	12.64	10.97	5.933	7.329	3.963	"
51.81	16.34	10.10	7.575	6.807	5.107	"
44.71	23.80	8.614	10.91	5.941	7.523	"
41.20	27.58	7.909	12.59	5.522	8.794	"
40.42	29.75	7.974	13.96	5.670	9.928	"
40.17	31.70	8.219	15.43	5.975	11.22	"
44.65	30.08	9.891	15.85	7.394	11.85	"
47.72	28.45	11.06	15.68	8.379	11.88	"
50.53	25.46	11.76	14.10	8.806	10.56	"
54.50	22.57	13.22	13.02	9.946	9.798	"
57.18	20.05	14.05	11.72	10.51	8.765	$Ca(ClO_4)_2.4H_2O$ + $Ca(ClO_4)_2$
53.08	25.56	13.36	15.31	10.40	11.91	$Ca(ClO_4)_2$
43.88	25.13	8.524	11.61	5.925	8.072	"
35.18	43.26	8.295	24.27	6.828	19.97	"
18.15	59.15	3.946	30.59	3.346	25.94	"
10.58	67.37	2.283	34.59	2.008	30.41	"
4.32	74.60	0.936	38.46	0.858	35.23	"
3.28	77.69	0.745	41.95	0.721	40.64	"
2.86	80.11	0.682	45.45	0.703	46.83	"
0.69	85.80	0.180	53.15	0.214	63.22	"

[a] Compiler's calculations.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [17477-36-6] (2) Perchloric acid; $HClO_4$; [7601-90-3] (3) Water; H_2O; [7732-18-5]	Lilich, L.S.; Chernykh, L.V. Shalygin, V.M. *Zh. Neorg. Khim.* 1963, *8*, 91-4; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1971, *16*, 1453-6.
VARIABLES: One temperature: 298.15 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

Composition of the solubility system $Ca(ClO_4)_2$-$HClO_4$-H_2O at 25.00°C :

Liquid phase composition						Solid phase
mass %		mol % [a]		molality[a]/ mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
62.83	3.52	12.139	1.618	7.813	1.041	$Ca(ClO_4)_2.4H_2O$
57.89	8.37	11.019	3.790	7.180	2.469	"
52.98	12.90	9.879	5.722	6.497	3.764	"
52.60	13.25	9.793	5.868	6.445	3.862	"
48.68	17.11	8.962	7.493	5.954	4.979	"
47.45	18.37	8.713	8.025	5.809	5.350	"
42.84	22.44	7.694	9.587	5.163	6.434	"
42.52	22.85	7.644	9.772	5.138	6.568	"
40.50	25.00	7.263	10.67	4.912	7.213	"
40.33	25.03	7.210	10.64	4.872	7.193	"
37.94	27.54	6.758	11.67	4.599	7.942	"
34.78	30.50	6.124	12.78	4.192	8.744	"
13.75	33.83	1.741	10.19	1.098	6.424	"
28.90	36.27	5.007	14.95	3.472	10.37	"
27.81	37.78	4.844	15.65	3.382	10.93	"
24.20	41.78	4.210	17.29	2.977	12.22	"

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Various mixtures of the three components were vigorously stirred for 4-6h which was the time required for saturation equilibrium, as established from constancy of liquid phase composition. The water thermostat was maintained at 25.00±0.01°C. (2) was analysed by potentiometric titration with borax and Ca with disodium EDTA. The solid phase was determined using Schreinemakers' method. No other details of saturation method and analysis given.	(1) was obtained by dissolving either calcium carbonate or oxide in perchloric acid, recrystallized and then dehydrated by heating to 250°C in a vacuum (10-15 torr). Anhy. (2) was distilled from $KClO_4$ and conc. H_2SO_4 . 72% (2) was obtained by distilling the 65% acid in a vacuum. Sources of starting materials not given.
	ESTIMATED ERROR: Temperature: ± 0.01°C
	REFERENCES:

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [17477-36-6]	Lilich, L.S.; Chernykh, L.V. Shalygin, V.M.
(2) Perchloric acid; $HClO_4$; [7601-90-3]	*Zh. Neorg. Khim.* 1963, *8*, 91-4; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1971, *16*, 1453-6.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Composition of the solubility system $Ca(ClO_4)_2$-$HClO_4$-H_2O at 25.00°C :

Liquid phase composition						Solid phase
mass %		mol % [a]		molality[a]/ mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
33.29	32.16	5.860	13.47	4.032	9.266	$Ca(ClO_4)_2.4H_2O$
21.78	44.46	3.785	18.38	2.700	13.11	"
20.92	45.90	3.669	19.15	2.638	13.77	"
18.48	48.79	3.249	20.41	2.363	14.84	"
17.61	50.19	3.121	21.16	2.288	15.52	"
17.54	50.83	3.143	21.67	2.320	16.00	"
17.64	51.28	3.196	22.10	2.375	16.42	"
17.73	51.63	3.241	22.45	2.421	16.77	"
18.35	51.94	3.423	23.05	2.584	17.40	"
18.43	52.07	3.454	23.21	2.614	17.57	"
23.05	49.92	4.607	23.73	3.568	18.38	"
27.05	47.52	5.666	23.68	4.451	18.60	"
31.88	44.29	7.032	23.24	5.598	18.50	"
36.38	40.96	8.374	22.43	6.718	17.99	"
40.56	38.16	9.806	21.95	7.976	17.85	"
40.90	38.70	10.134	22.81	8.389	18.88	"
40.48	38.33	9.807	22.09	7.994	18.01	$Ca(ClO_4)_2$
36.67	42.24	8.795	24.10	7.276	19.94	"
35.91	42.63	8.510	24.03	7.002	19.77	"
34.48	41.46	7.624	21.81	5.997	17.15	"
32.31	46.17	7.556	25.69	6.282	21.36	"
31.06	47.36	7.223	26.20	6.023	21.85	"
30.96	47.28	7.165	26.03	5.954	21.63	"
26.71	51.76	6.134	28.28	5.191	23.93	"
22.06	55.79	4.917	29.59	4.167	25.07	"
13.25	64.92	2.898	33.77	2.540	29.60	"
10.35	68.54	2.283	35.96	2.052	32.32	"
9.80	68.39	2.122	35.23	1.880	31.21	"
7.23	70.64	1.542	35.84	1.367	31.77	"
7.00	71.37	1.510	36.61	1.354	32.85	"
5.48	73.64	1.197	38.28	1.098	35.11	"
4.44	74.27	0.958	38.12	0.873	34.73	"
3.60	75.96	0.790	39.68	0.737	36.99	"
2.02	78.28	0.449	41.42	0.429	39.55	"
2.22	78.15	0.495	41.45	0.473	39.63	"
2.45	77.98	0.547	41.44	0.523	39.66	"
-	79.41	-	40.88	-	38.39	$HClO_4.H_2O$
-	79.12	-	40.46	-	37.72	"

[a] Compiler's calculations.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [17477-36-6]	Lilich, L.S.; Chernykh, L.V. Shalygin, V.M.
(2) Perchloric acid; $HClO_4$; [7601-90-3]	*Zh. Neorg. Khim.* 1963, *8*, 91-4;
(3) Water; H_2O; [7732-18-5]	*Russ. J. Inorg. Chem. (Engl. Transl.)* 1971, *16*, 1453-6.

EXPERIMENTAL VALUES:(continued)

COMMENTS AND/OR ADDITIONAL DATA

The solubility isotherm of this system at 25.00°C is given in Figure 1. The results suggest that as the perchloric acid concentration in the solution is increased, the hydrated calcium perchlorate solid phase is dehydrated. The solid phase changes sharply from $Ca(ClO_4)_2.4H_2O$ to the anhydrous salt.

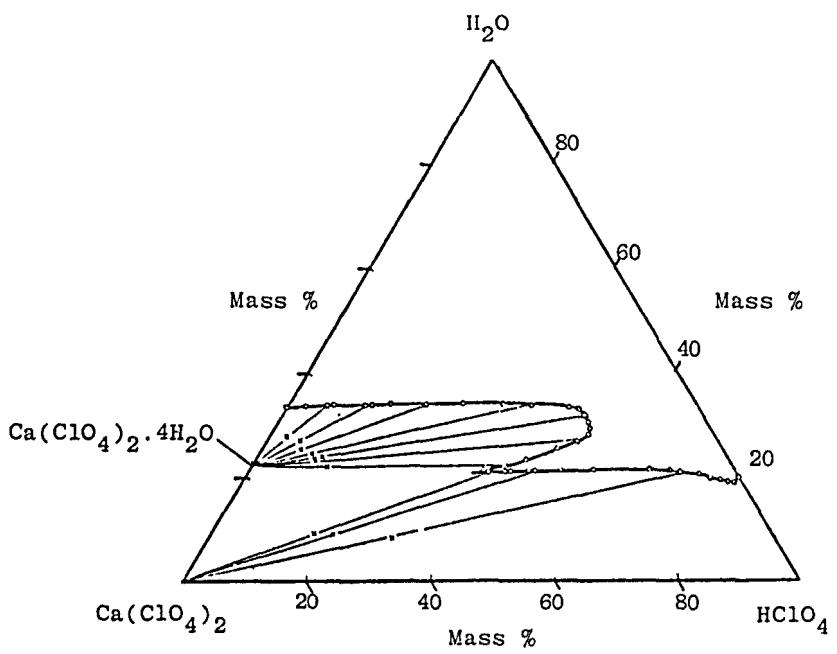


Figure 1. Solubility isotherm of the system $Ca(ClO_4)_2$-$HClO_4$-H_2O at 298.15 K.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Lithium perchlorate; $LiClO_4$; [7791-03-9] (2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (3) Water; H_2O; [7732-18-5]	Ivanov, S.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1971, *95*, 11-13
VARIABLES: One temperature: 298 K Composition.	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the system $LiClO_4$-$Ca(ClO_4)_2$-H_2O at 25°C :

Liquid phase composition						Solid[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		phase
(1)	(2)	(1)	(2)	(1)	(2)	
37.52	-	9.230	-	5.644	-	A
29.56	11.73	7.748	1.369	4.733	0.836	A
14.24	31.58	4.089	4.037	2.470	2.439	A
10.18	39.44	3.130	5.398	1.899	3.276	A
8.89	48.35	3.14	7.608	1.954	4.731	A + B
3.26	52.71	1.14	8.183	0.696	5.009	B
0.00	65.50	0.00	12.52	0.00	7.944	B

[a] Compiler's calculations.

[b] A = $LiClO_4.3H_2O$; B = $Ca(ClO_4)_2.4H_2O$

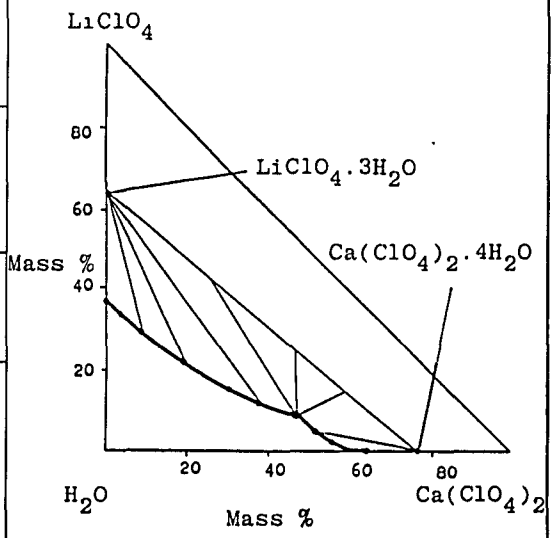
AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Isothermal method. Conditions of saturation were not given. Chemical, thermographic and X-ray powder analyses were employed.

SOURCE AND PURITY OF MATERIALS:
Not stated.

ESTIMATED ERROR:
Not stated.

REFERENCES:



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sodium perchlorate; $NaClO_4$; [7601-89-0]	Lilich, L.S.; Ovtrakht, N.V.
(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	*Vestn. LGU, Ser. Fiz. Khim.* 1965, *10*, 115-9.
(3) Water; H_2O; [7732-18-5]	
VARIABLES:	**PREPARED BY:**
One temperature: 298 K	N.A. Kozyreva
Composition.	

EXPERIMENTAL VALUES:

Solubility in the system $NaClO_4$-$Ca(ClO_4)_2$-H_2O at 25°C:

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	65.40	-	12.47	-	7.909	$Ca(ClO_4)_2.4H_2O$
1.92	64.14	0.72	12.38	0.462	7.908	"
3.28	62.91	1.24	12.15	0.792	7.786	"
5.61	61.76	2.17	12.22	1.404	7.920	"
5.82	61.47	2.24	12.13	1.453	7.864	"
5.84	61.47	2.25	12.14	1.459	7.868	"
6.01	61.26	2.31	12.08	1.500	7.832	"
6.45	61.16	2.50	12.15	1.626	7.901	$NaClO_4$
6.77	60.30	2.59	11.82	1.679	7.662	"
9.15	57.59	3.46	11.15	2.247	7.245	"
13.50	51.48	4.858	9.491	3.148	6.151	"
13.77	51.17	4.948	9.421	3.208	6.107	"
15.71	48.36	5.518	8.703	3.571	5.632	$NaClO_4.H_2O$
17.16	46.73	5.989	8.356	3.881	5.415	"
17.32	46.90	6.087	8.445	3.954	5.485	"
18.16	45.72	6.326	8.160	4.106	5.297	"
23.13	39.56	7.789	6.825	5.063	4.437	"
35.68	27.02	11.77	4.568	7.813	3.031	"
44.94	18.59	14.86	3.150	10.06	2.133	"
53.88	11.15	18.13	1.922	12.58	1.334	"
67.79	-	23.64	-	17.19	-	"

[a] Compiler's calculations.

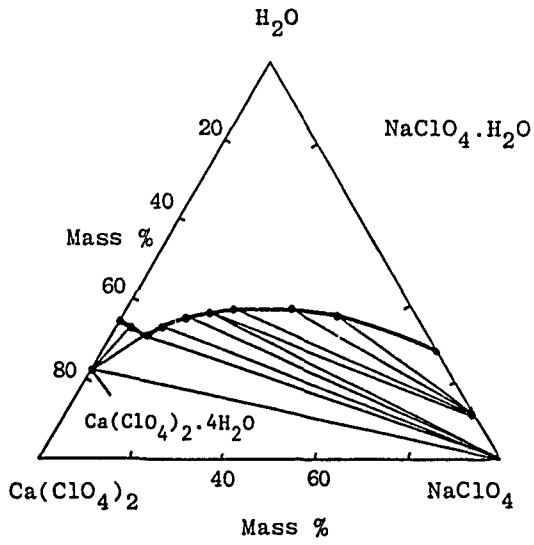
AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal. Equilibrium attained in 3-4h. ClO_4^- was determined by the ion-exchange method using a KU-2 resin; Ca^{2+} by complexometric titration. The composition of the solid phase was determined by Schreinemakers' method of residues.

SOURCE AND PURITY OF MATERIALS:

Not stated.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sodium perchlorate; $NaClO_4$; [7601-89-0] (2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (3) Water; H_2O; [7732-18-5]	Ivanov, S.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* <u>1969</u>, *66*, 82-95.
VARIABLES: One temperature: 313 K Composition.	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the system $NaClO_4$-$Ca(ClO_4)_2$-H_2O at 40°C:

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	68.40	-	14.03	-	9.057	$Ca(ClO_4)_2.4H_2O$
2.50	67.00	1.02	14.06	0.669	9.192	"
6.00	64.98	2.54	14.08	1.689	9.370	"
6.40	65.08	2.74	14.28	1.833	9.548	$Ca(ClO_4)_2.4H_2O$ + $NaClO_4$
6.23	65.14	2.66	14.25	1.777	9.516	" "
5.90	64.90	2.48	13.99	1.650	9.300	" "
6.10	65.30	2.61	14.30	1.742	9.554	" "
6.15	65.20	2.63	14.26	1.753	9.523	$NaClO_4$
10.30	59.80	4.219	12.55	2.813	8.369	"
13.20	55.90	5.241	11.37	3.489	7.570	"
15.20	50.04	5.486	9.253	3.571	6.024	"
20.17	45.70	7.320	8.497	4.827	5.603	"
23.04	42.20	8.202	7.697	5.413	5.080	"
29.82	35.00	10.40	6.251	6.923	4.163	"
36.05	31.71	13.28	5.986	9.132	4.116	"

[a] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Isothermal method. Solubility equilibria required 3-5 days. The solid phases were studied thermographically. The densities, viscosities and refractive indexes of the saturated solutions were measured.	Not stated.
	ESTIMATED ERROR: Not stated.
	REFERENCES:

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sodium perchlorate; $NaClO_4$; [7601-89-0]	Ivanov, S.A.
(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1969, *66*, 82-95.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

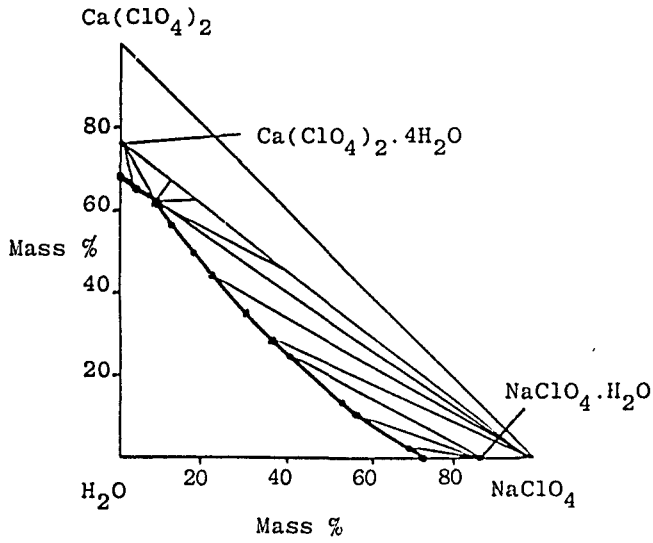
Solubility in the system $NaClO_4$-$Ca(ClO_4)_2$-H_2O at 40°C:

Liquid phase composition						Solid
mass %		mol %[a]		molality[a]/mol kg^{-1}		phase
(1)	(2)	(1)	(2)	(1)	(2)	
40.60	26.70	14.68	4.947	10.14	3.417	$NaClO_4.H_2O$
47.10	19.80	16.69	3.595	11.62	2.503	"
53.70	14.05	19.17	2.570	13.60	1.823	"
59.40	8.90	21.26	1.63	15.30	1.175	"
66.07	4.14	24.41	0.78	18.11	0.582	"
70.87	-	26.36	-	19.87	-	"

[a] Compiler's calculations.

COMMENTS/ADDITIONAL DATA:

The isotherm shows the branches of crystallization of $Ca(ClO_4)_2.4H_2O$, $NaClO_4$ and $NaClO_4.H_2O$. The eutectic composition (in mass %) consists of 65.10 % $Ca(ClO_4)_2$, 6.13 % $NaClO_4$, and 28.77 % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9] (3) Water; H_2O; [7732-18-5]	Ivanov, S.A.; Orekhov, O.L. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *78*, 203-10.
VARIABLES: One temperature: 298.2 K Composition.	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the system $Ca(ClO_4)_2$-NH_4ClO_4-H_2O at 25.0°C

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	18.62	-	3.39	-	1.947	NH_4ClO_4
5.23	14.92	0.478	2.772	0.274	1.590	"
11.76	11.28	1.114	2.174	0.639	1.248	"
17.04	8.29	1.663	1.646	0.955	0.945	"
28.44	4.06	3.051	0.886	1.763	0.512	"
33.39	2.00	3.733	0.455	2.162	0.263	"
40.18	1.36	4.909	0.338	2.876	0.198	"
45.53	1.06	6.021	0.285	3.567	0.169	"
54.79	0.84	8.493	0.265	5.167	0.161	"
55.12	0.68	8.57	0.215	5.218	0.131	NH_4ClO_4 + $Ca(ClO_4)_2.4H_2O$
54.69	0.59	8.43	0.18	5.117	0.112	" "
54.82	0.73	8.49	0.23	5.161	0.140	" "
55.09	0.44	8.53	0.14	5.184	0.084	$Ca(ClO_4)_2.4H_2O$
65.19	-	12.37	-	7.836	-	"

[a] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Isothermal method. Details of saturation method were not given. NH_4^+ was determined by distilling off NH_3 into a solution of boric acid and then titrated with 0.1M H_2SO_4; Ca^{2+} was determined by titration with Trilon B at pH 10-11 with indicator chrome blue black; ClO_4^- by difference. The densities, viscosities and electrical conductivities of the saturated solutions were measured.	Calcium perchlorate was prepared by saturating 30% perchloric acid with calcium carbonate (analytical grade); it was purified by recrystallization. Chemically pure ammonium perchlorate was further purified by recrystallisation.
	ESTIMATED ERROR: Precision: ±0.1°C in temperature

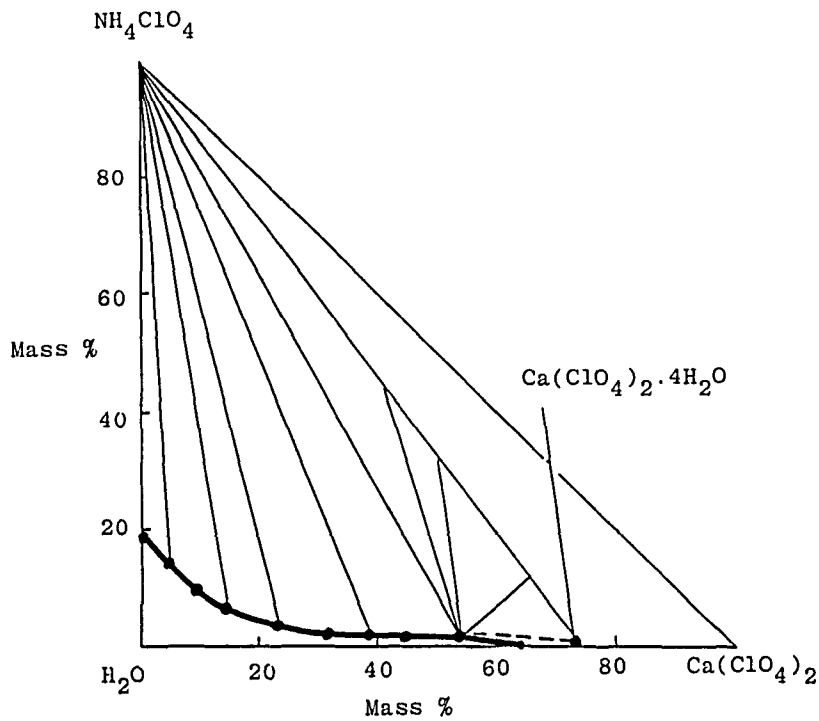
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	Ivanov, S.A.; Orekhov, O.L.
(2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *78*, 203-10.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS/ADDITIONAL DATA:

The solubility isotherm is given below. The phase diagram consists of branches of crystallisation of NH_4ClO_4 and $Ca(ClO_4)_2.4H_2O$. Calcium perchlorate has a strong salting-out effect on ammonium perchlorate. The eutectic composition : 54.89 mass % $Ca(ClO_4)_2$; 0.67 mass % NH_4ClO_4 ; and 44.44 mass % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9] (3) Water; H_2O; [7732-18-5]	Lepeshkov, I.N.; Vasil'eva, S.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *78*,74-81.
VARIABLES: One temperature: 313 K. Composition.	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the system $Ca(ClO_4)_2$-NH_4ClO_4-H_2O at 40°C :

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	26.60	-	5.264	-	3.085	NH_4ClO_4
3.64	22.45	0.353	4.435	0.206	2.585	"
6.76	20.04	0.664	4.002	0.386	2.330	"
11.34	16.86	1.136	3.436	0.661	1.999	"
18.14	12.20	1.876	2.566	1.090	1.491	"
25.49	8.25	2.767	1.822	1.610	1.060	"
32.41	5.65	3.744	1.328	2.189	0.776	"
42.10	3.05	5.426	0.800	3.212	0.473	"
47.12	2.09	6.498	0.586	3.882	0.350	"
57.43	1.11	9.420	0.370	5.796	0.228	"
62.41	1.09	11.37	0.404	7.155	0.254	"
67.36	1.01	13.78	0.420	8.911	0.272	NH_4ClO_4 + $Ca(ClO_4)_2.4H_2O$
67.51	0.87	13.81	0.362	8.934	0.234	" "
67.48	0.94	13.82	0.392	8.941	0.253	" "
67.31	1.08	13.77	0.449	8.910	0.291	" "
68.48	-	14.07	-	9.091	-	$Ca(ClO_4)_2.4H_2O$

[a] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Isothermal method. Equilibrium was reached in 7-10 days. Ca^{2+} was determined by titrating with Trilon B using the indicator chrome blue black at pH 10-11. NH_4^+ by distilling off NH_3 into H_3BO_3 solution and then titrating with 0.1M H_2SO_4; ClO_4^- was determined by difference. The densities, viscosities and electrical conductivities of the saturated solutions were measured.	Calcium perchlorate was prepared from $CaCO_3$ with further recrystallisation from solution.
	ESTIMATED ERROR: Not stated.
	REFERENCES:

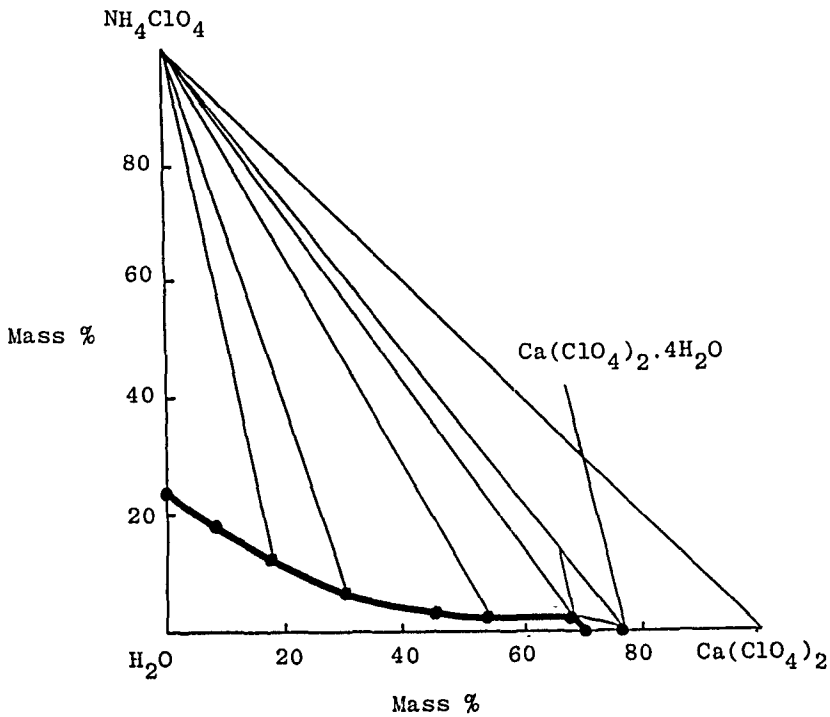
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	Lepeshkov, I.N.; Vasil'eva, S.I.
(2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *78*, 74-81.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS/ADDITIONAL DATA:

The solubility isotherm is given below. The phase diagram consists of branches of crystallization of NH_4ClO_4 and $Ca(ClO_4)_2.4H_2O$. Calcium perchlorate has a strong salting-out effect on ammonium perchlorate. The eutectic composition : 67.42 mass % $Ca(ClO_4)_2$; 0.97 mass % NH_4ClO_4 and 31.61 mass % H_2O.



COMPONENTS:
(1) Calcium chromate; $CaCrO_4$; [13765-19-0];
(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]
(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Karnaukhov, A.S.; Orekhov, O.L.

Uch. Zap. Yarosl. Gos. Ped. Inst. 1970, *78*, 3-19.

VARIABLES:
One temperature: 298.2 K
Composition.

PREPARED BY:
I.S. Bodnya

EXPERIMENTAL VALUES:

Solubility in the system $CaCrO_4$-$Ca(ClO_4)_2$-H_2O at 25.0 °C :

Liquid phase composition						Solid[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		phase
(1)	(2)	(1)	(2)	(1)	(2)	
10.40	-	1.322	-	0.744	-	A
10.13	0.25	1.288	0.021	0.724	0.012	A
7.52	2.12	0.950	0.175	0.533	0.098	A
5.71	7.44	0.748	0.637	0.421	0.358	A
3.82	19.58	0.562	1.880	0.320	1.070	A
2.21	31.29	0.369	3.413	0.213	1.969	A
1.16	34.21	0.199	3.829	0.115	2.215	A
0.31	43.52	0.060	5.515	0.035	3.242	A
0.26	55.01	0.061	8.479	0.037	5.146	A
0.18	60.97	0.048	10.57	0.030	6.567	A
0.10	64.98	0.029	12.30	0.018	7.786	A + B
0.10	65.03	0.029	12.32	0.018	7.804	A + B
0.10	65.01	0.029	12.31	0.018	7.797	A + B
0.10	65.08	0.029	12.35	0.018	7.821	A + B

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Isothermal method. Details of saturation method were not given. Ca^{2+} was determined by titration with Trilon B in an ammonia solution in the presence of the indicator chrome blue black at pH 10-11; CrO_4^{2-} iodimetrically; ClO_4^- by difference. The density, viscosity, electric conductivity and refractive index were measured. Solid phases were studied by chemical, thermogravimetric, and X-ray powder analysis; microphotographing was carried out. Solid phases were determined by Schreinemakers' method of residues .

SOURCE AND PURITY OF MATERIALS:
Not stated.

ESTIMATED ERROR:
Temp.: precision ±0.1 °C

REFERENCES:

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium chromate; $CaCrO_4$; [13765-19-0];	Karnaukhov, A.S.; Orekhov, O.L.
(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *78*, 3-19
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility in the system $CaCrO_4$-$Ca(ClO_4)_2$-H_2O at 25°C :

Liquid phase composition						Solid[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		phase
(1)	(2)	(1)	(2)	(1)	(2)	
0.10	65.12	0.029	12.37	0.018	7.835	A + B
0.10	65.15	0.029	12.38	0.018	7.845	A + B
-	65.20	-	12.38	-	7.840	B

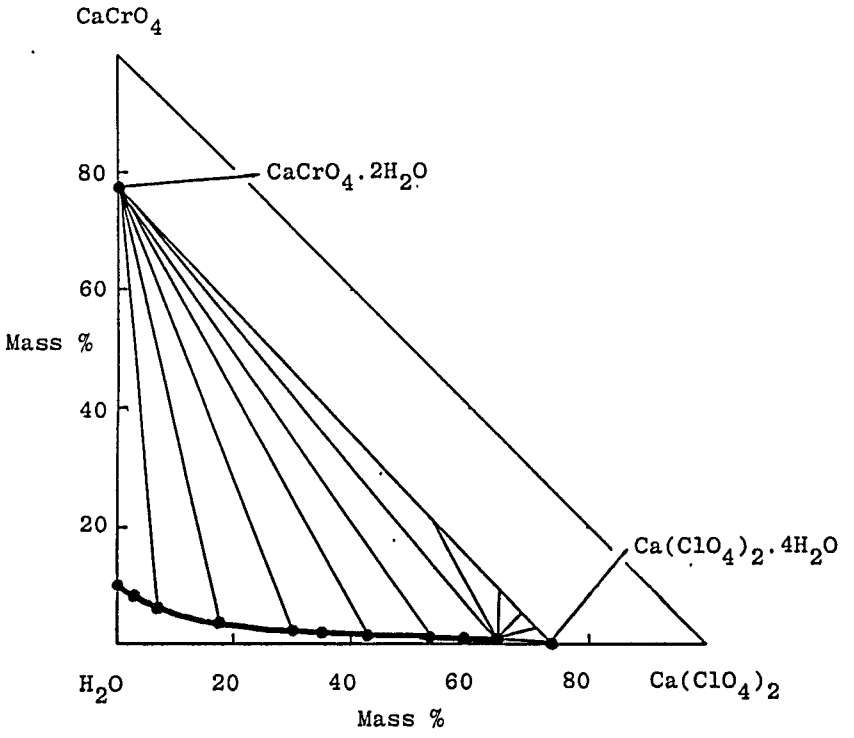
[a] Compiler's calculations.

[b] A = $CaCrO_4.2H_2O$; B = $Ca(ClO_4)_2.4H_2O$

COMMENTS/ADDITIONAL DATA:

The eutectic composition (mass %): 0.10 % $CaCrO_4$, 65.14 % $Ca(ClO_4)_2$, 34.76 % H_2O.

The phase diagram for this system is shown below.



COMPONENTS:

(1) Calcium chromate; $CaCrO_4$; [13765-19-0]

(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Lepeshkov, I.N.; Vasil'eva, S.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *78*, 74-81.

Karnaukhov, A.S.; Vasil'eva, S.I. *Zh. Neorg. Khim.* 1970, *15*, 2499-2503; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1970, *15*, 1293-5.

VARIABLES:

One temperature: 313.0 K

Composition.

PREPARED BY:

N.A. Kozyreva and C.C. Ho

EXPERIMENTAL VALUES:

Solubility in the system $CaCrO_4$-$Ca(ClO_4)_2$-H_2O at 40.0°C :

Liquid phase composition						Solid
mass %		mol %[a]		molality[a]/mol kg^{-1}		phase
(1)	(2)	(1)	(2)	(1)	(2)	
5.44	-	0.660	-	0.369	-	$CaCrO_4.H_2O$
4.14	3.91	0.515	0.318	0.288	0.178	"
2.86	9.54	0.372	0.811	0.209	0.456	"
1.53	18.37	0.216	1.696	0.122	0.960	"
0.50	25.75	0.076	2.563	0.043	1.461	"
0.09	35.54	0.015	3.995	0.009	2.310	"
0.06	42.40	0.011	5.262	0.007	3.083	"
0.03	45.65	0.006	5.957	0.004	3.517	"
0.08	51.16	0.018	7.328	0.011	4.390	"
0.05	59.92	0.013	10.14	0.008	6.264	"

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method. Equilibrium was reached in 7-10 days. Ca^{2+} was determined by Trilon B titration with the indicator chrome blue black at pH 10-11; CrO_4^{2-} was determined iodimetrically; ClO_4^- by difference. The densities, viscosities and electrical conductivities of the saturated solutions were measured.

SOURCE AND PURITY OF MATERIALS:

Calcium perchlorate was prepared from $CaCO_3$ and recrystallized twice from solution. Calcium chromate was purified by recrystallization.

ESTIMATED ERROR:

Temp.: ±0.1°C.

Soly.: nothing specified.

REFERENCES:

None.

(continued next page)

COMPONENTS:

(1) Calcium chromate; $CaCrO_4$; [13765-19-0]

(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Lepeshkov, I.N.; Vasil'eva, S.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *78*, 74-81.

Karnaukhov, A.S.; Vasil'eva, S.I. *Zh. Neorg. Khim.* 1970, *15*, 2499-2503; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1970, *15*, 1293-5.

EXPERIMENTAL VALUES: (continued)

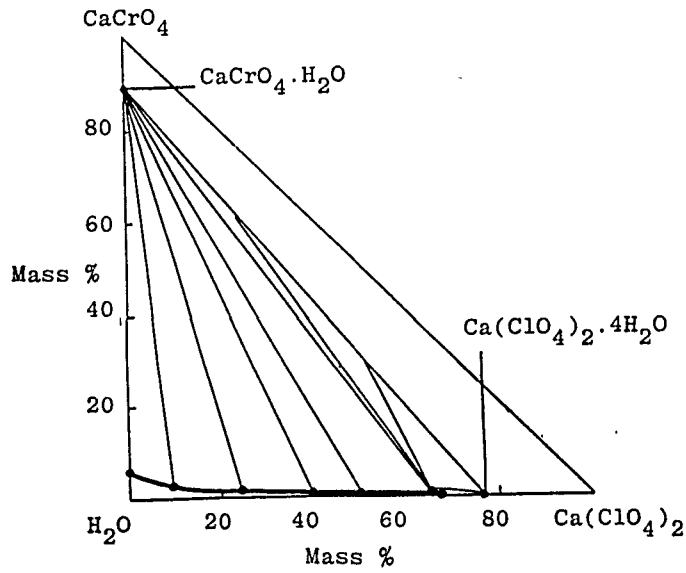
Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
0.02	66.78	0.006	13.17	0.004	8.417	$CaCrO_4.H_2O$ + $Ca(ClO_4)_2.4H_2O$
0.03	67.01	0.009	13.29	0.006	8.507	" "
0.01	66.91	0.003	13.23	0.002	8.464	" "
-	68.48	-	14.07	-	9.091	$Ca(ClO_4)_2.4H_2O$

[a]Compiler's calculations.

COMMENTS/ADDITIONAL DATA:

The isotherm consists of the branches of crystallization of $Ca(ClO_4)_2.4H_2O$ and $CaCrO_4.H_2O$. The eutectic composition: 66.90 mass % $Ca(ClO_4)_2$; 0.02 mass % $CaCrO_4$; 33.08 mass % H_2O.

Calcium perchlorate has a strong salting-out effect on calcium chromate.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium nitrate; $Ca(NO_3)_2$; [10124-37-5] (2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (3) Water; H_2O; [7732-18-5]	Vasil'eva, S.I.; Karnaukhov, A.S. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1972, *103*, 7-12.
VARIABLES: One temperature: 298 K Composition.	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the system $Ca(NO_3)_2$-$Ca(ClO_4)_2$-H_2O at 25°C:

Liquid phase composition						Solid[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		phase
(1)	(2)	(1)	(2)	(1)	(2)	
58.14	-	13.23	-	8.464	-	A
49.81	11.68	12.19	1.96	7.882	1.269	A
38.03	31.83	11.37	6.54	7.690	4.419	B
34.65	36.29	10.69	7.68	7.267	5.225	B
33.62	41.24	11.56	9.73	8.150	6.864	B
30.89	44.64	10.86	10.78	7.693	7.634	B + C
31.43	45.27	11.44	11.31	8.221	8.130	B + C
30.26	45.79	10.81	11.23	7.700	8.000	B + C
13.01	56.36	3.934	11.70	2.589	7.699	C
-	65.46	-	12.50	-	7.930	C

[a] Compiler's calculations.

[b] A = $Ca(NO_3)_2.4H_2O$; B = $Ca(NO_3)_2$; C = $Ca(ClO_4)_2.4H_2O$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Isothermal method. Equilibrium was reached in 5-8 days. Ca^{2+} was determined by complexometric titration with Trilon B with the indicator chrome blue black at pH 10-11; NO_3^- by Devarda's method. The composition of solid phases was determined graphically by Schreinemakers' method of residues . The density and viscosity of saturated solutions were determined.	Not stated.
	ESTIMATED ERROR: Not stated.
	REFERENCES:

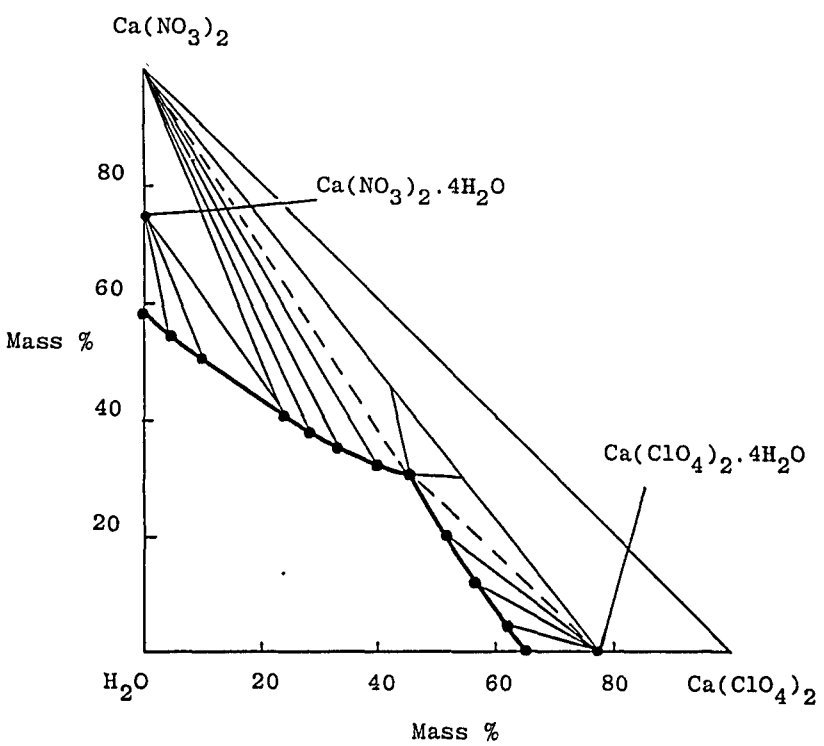
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium nitrate; $Ca(NO_3)_2$; [10124-37-5]	Vasil'eva, S.I.; Karnaukhov, A.S.
(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1972, *103*, 7-12.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

Calcium nitrate tetrahydrate crystallizes from solutions of the system in which $Ca(ClO_4)_2$ concentration is lower than 31.83 mass %. When $Ca(ClO_4)_2$ concentration exceeds 45.29 mass % the solid phase of the system consists of calcium perchlorate tetrahydrate. The average mass % composition of the eutectic solution consists of 45.23 % $Ca(ClO_4)_2$; 30.89 % $Ca(NO_3)_2$; 23.88 % H_2O. The solubility isotherm for this system is given below.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium nitrate; $Ca(NO_3)_2$; [10124-37-5]	Vasil'eva S.I.; Lepeshkov, I.N.
(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	*Zh. Neorg. Khim.* 1973, *18*, 819-22; **Russ. J. Inorg. Chem.* (Engl. Transl.) 1973, *18*, 429-31.
(3) Water; H_2O; [7732-18-5]	
VARIABLES:	PREPARED BY:
One temperature: 298 K	K.H. Khoo
Composition	

EXPERIMENTAL VALUES:

Solubility in the system $Ca(ClO_4)_2$-$Ca(NO_3)_2$-H_2O at 25°C

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
58.14	-	13.23	-	8.464	-	$Ca(NO_3)_2.4H_2O$
54.77	5.40	13.00	0.880	8.380	0.567	"
49.81	11.68	12.19	1.963	7.882	1.269	"
44.76	18.71	11.47	3.291	7.467	2.143	"
41.26	24.34	11.11	4.501	7.310	2.961	"
39.58	28.73	11.38	5.669	7.612	3.794	"
38.03	31.83	11.37	6.535	7.690	4.419	$Ca(NO_3)_2$
34.65	36.29	10.69	7.685	7.267	5.225	"
34.11	40.29	11.56	9.379	8.120	6.586	"
33.62	41.24	11.56	9.733	8.150	6.864	"
30.89	44.64	10.86	10.78	7.693	7.634	$Ca(NO_3)_2$ + $Ca(ClO_4)_2.4H_2O$
31.43	45.27	11.44	11.31	8.221	8.130	"
30.36	45.79	10.88	11.27	7.758	8.034	"
21.49	51.51	7.097	11.68	4.851	7.983	$Ca(ClO_4)_2.4H_2O$
13.01	56.36	3.934	11.70	2.589	7.699	"
5.730	61.64	1.660	12.26	1.070	7.905	"
-	65.46	-	12.50	-	7.930	"

[a] Compiler's calculations.

COMMENTS AND/OR ADDITIONAL DATA:

Calcium nitrate tetrahydrate is dehydrated by calcium perchlorate.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The solubility was determined by the isothermal saturation method. Ca^{2+} was analysed by complexometric titration with Trilon B using chrome azurol S as indicator at pH 10-11, NO_3^- by Devarda's method [1], and ClO_4^- by difference.	Not stated.
ESTIMATED ERROR:	REFERENCES:
Not stated.	1. Charlot, G. *Les methods de la chimie analytique. Analyse minerale*; **Izd. Khimiya* (Russ. Transl.) 1965, 554.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium nitrate; $Ca(NO_3)_2$; [10124-37-5] (2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (3) Water; H_2O; [7732-18-5]	Vasil'eva, S.I.; Rylenkova, I.N. *Khim. i Fiz.-khim. Issled. Neorg. Org. Soed. Smolensk* 1976, 23-5.
VARIABLES: One temperature: 323 K Composition.	PREPARED BY: E.S. Gryzlova; N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the system $Ca(NO_3)_2$-$Ca(ClO_4)_2$-H_2O at 50°C :

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	69.96	-	14.93	-	9.745	$Ca(ClO_4)_2.4H_2O$
5.47	62.99	1.63	12.87	1.057	8.357	"
11.72	59.48	3.722	12.97	2.480	8.642	"
16.75	55.56	5.454	12.42	3.686	8.396	"
19.92	53.24	6.619	12.15	4.523	8.300	"
25.09	47.11	8.077	10.41	5.500	7.091	"
35.98	38.41	12.17	8.921	8.562	6.276	"
47.15	33.73	19.29	9.474	15.03	7.382	$Ca(ClO_4)_2.4H_2O$ + $Ca(NO_3)_2$
47.54	32.53	18.91	8.884	14.54	6.830	" "
48.11	34.17	20.65	10.07	16.55	8.069	" "

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Isothermal method. Periods of equilibration were from 5 to 7 days. NO_3^- was determined by the Devarda method (ref 1); Ca^{2+} by complexometric titration with Trilon B using chrome blue black as an indicator at pH 10 or 11 (ref 1).	Not stated.
	ESTIMATED ERROR: Not stated.
	REFERENCES: 1. Hillebrand, W.F. and Lundell, G.E.F. *Applied Inorganic Analysis*, (2nd ed., Wiley, 1963).

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium nitrate; $Ca(NO_3)_2$; [10124-37-5]	Vasil'eva, S.I.; Rylenkova, I.N.
(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	*Khim. i Fiz.-khim. Issled. Neorg. Org. Soed. Smolensk* 1976, 23-5.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility in the system $Ca(NO_3)_2$-$Ca(ClO_4)_2$-H_2O at 50°C :

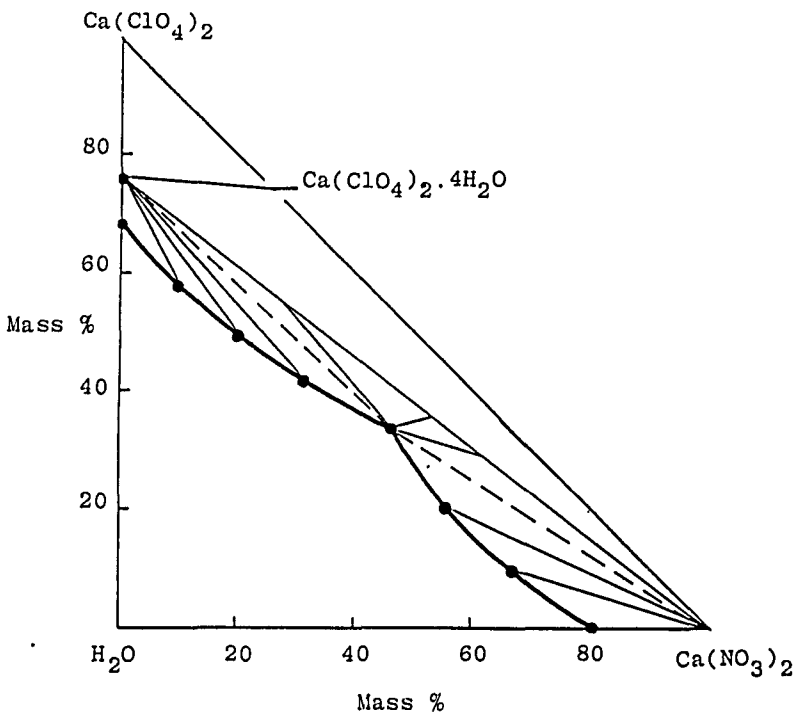
Liquid phase composition						Solid
mass %		mol %[a]		molality[a]/mol kg^{-1}		phase
(1)	(2)	(1)	(2)	(1)	(2)	
57.68	18.97	20.35	4.596	15.05	3.400	$Ca(NO_3)_2$
67.15	10.51	24.17	2.597	18.32	1.969	"
70.58	8.46	26.40	2.17	20.52	1.69	"
79.24	-	29.53	-	23.26	-	"

[a] Compilers' calculations.

COMMEMTS AND/OR ADDITIOAL DATA:

The solubility isotherm shows two branches of crystallization. The first branch corresponds to $Ca(ClO_4)_2.4H_2O$ crystallization. The second branch corresponds to $Ca(NO_3)_2$ crystallization.

The eutectic composition (in mass %) was reported as follows : 33.48 % $Ca(ClO_4)_2$, 47.60 % $Ca(NO_3)_2$, and 18.92 % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium chloride; $CaCl_2$; [10043-52-4]	Ivanov, S.A.
(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1969, *66*, 82-95
(3) Water; H_2O; [7732-18-5]	
VARIABLES:	PREPARED BY:
One temperature: 313 K	N.A. Kozyreva
Composition.	

EXPERIMENTAL VALUES:

Solubility in the system $CaCl_2$-$Ca(ClO_4)_2$-H_2O at 40°C:

Liquid phase composition						Solid[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		phase
(1)	(2)	(1)	(2)	(1)	(2)	
53.14	-	15.55	-	10.22	-	A
51.86	2.41	15.49	0.334	10.22	0.221	A
50.13	5.01	15.25	0.708	10.07	0.467	A
46.87	10.12	14.81	1.485	9.819	0.985	A
45.11	12.30	14.40	1.824	9.543	1.208	B
40.26	19.46	13.54	3.038	9.006	2.022	B
36.31	24.55	12.57	3.947	8.359	2.625	B
33.60	29.17	12.15	4.899	8.132	3.279	B
29.42	34.58	11.01	6.009	7.363	4.019	B
24.19	41.02	9.392	7.396	6.265	4.934	B
18.13	49.79	7.589	9.680	5.092	6.494	B
14.37	53.82	6.106	10.62	4.070	7.080	B
14.22	54.20	6.078	10.76	4.057	7.182	B + C
14.16	54.61	6.106	10.94	4.085	7.317	B + C
14.00	54.40	5.984	10.80	3.992	7.204	B + C
14.06	54.48	6.030	10.85	4.027	7.246	B + C
13.98	54.05	5.923	10.63	3.940	7.074	B + C

[a] Compiler's calculation.

[b] A = $CaCl_2.4H_2O$; B = $CaCl_2.2H_2O$; C = $Ca(ClO_4)_2.4H_2O$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Isothermal method. Equilibrium was attained in 3-5 days. Thermographic studies of solid phases were carried out. The density, viscosity, and refractive index of saturated solutions were measured.	Not stated.
	ESTIMATED ERROR: Not stated.
	REFERENCES:

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium chloride; $CaCl_2$; [10043-52-4]	Ivanov, S.A.
(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1969, *66*, 82-95
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility in the system $CaCl_2$-$Ca(ClO_4)_2$-H_2O at 40°C:

Liquid phase composition						Solid[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		phase
(1)	(2)	(1)	(2)	(1)	(2)	
13.99	54.12	5.938	10.67	3.953	7.101	C
12.37	55.78	5.275	11.05	3.499	7.328	C
9.03	59.62	3.929	12.05	2.595	7.958	C
5.82	62.77	2.547	12.76	1.670	8.362	C
2.26	65.48	0.977	13.14	0.631	8.493	C
-	68.40	-	14.03	-	9.057	C

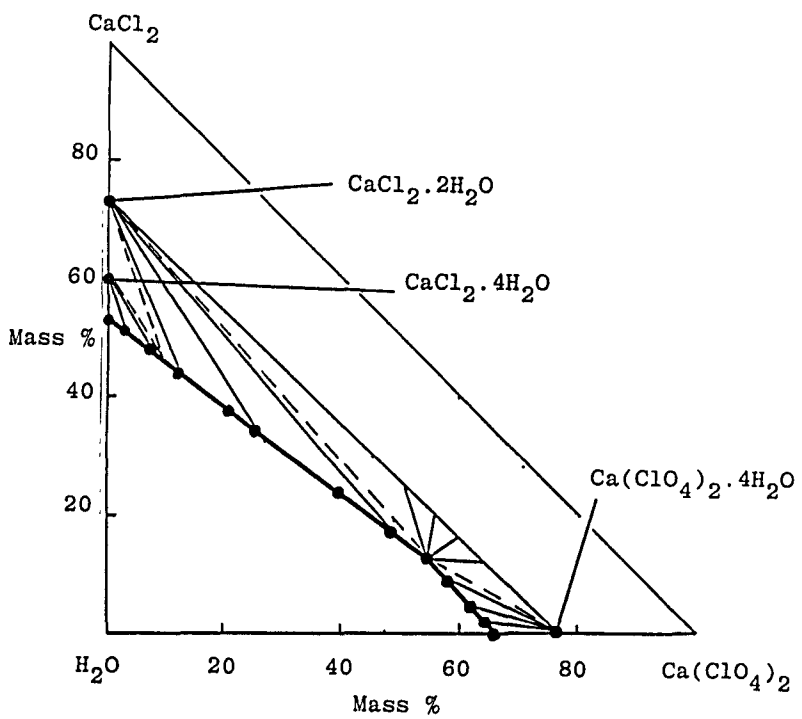
[a] Compiler's calculations.

[b] A = $CaCl_2.4H_2O$; B = $CaCl_2.2H_2O$; C = $Ca(ClO_4)_2.4H_2O$

COMMENTS AND/OR ADDITIONAL DATA :

The isotherm shows the branches of crystallization of $CaCl_2.4H_2O$, $CaCl_2.2H_2O$ and $Ca(ClO_4)_2.4H_2O$.

The eutectic composition (mass %): 54.40 % $Ca(ClO_4)_2$, 14.00 % $CaCl_2$, and 31.60 % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (2) Cerium perchlorate; $Ce(ClO_4)_3$; [14017-47-1] (3) Water; H_2O; [7732-18-5]	Rybina, T.V.; Druzhinina, G.V. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1977, *164*, 74-6.
VARIABLES: One temperature: 298 K. Composition.	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the system $Ca(ClO_4)_2$-$Ce(ClO_4)_3$-H_2O at 25°C :

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
65.57	-	12.55	-	7.969	-	$Ca(ClO_4)_2.4H_2O$
50.19	12.08	9.006	1.181	5.566	0.730	"
40.83	22.34	7.539	2.248	4.639	1.383	"
33.92	31.34	6.627	3.337	4.086	2.057	"
26.21	39.82	5.257	4.353	3.229	2.673	"
24.20	43.07	5.022	4.872	3.094	3.001	$Ca(ClO_4)_2.4H_2O$ + $Ce(ClO_4)_3.9H_2O$
24.20	43.07	5.022	4.872	3.094	3.001	" "
20.08	46.43	4.101	5.168	2.509	3.162	$Ce(ClO_4)_3.9H_2O$
8.31	55.50	1.602	5.832	0.961	3.498	"
-	64.80	-	7.032	-	4.198	"

[a] Compiler's calculations.

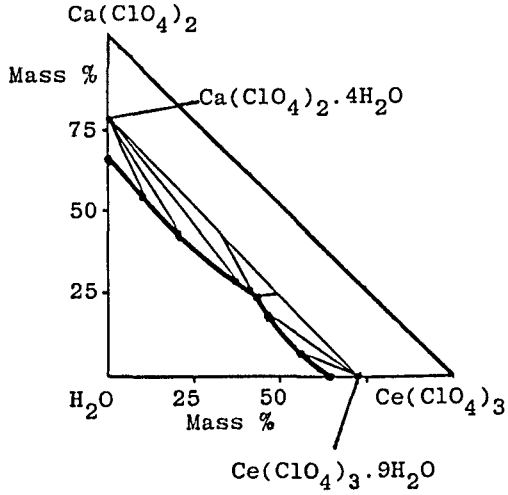
AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Isothermal method. Details of saturation method were not given. ClO_4^- was determined by nitron precipitation; Ce^{3+} by complexometric titration with the indicator xylenol orange; Ca^{2+} was determined by difference.

SOURCE AND PURITY OF MATERIALS:
Not stated.

ESTIMATED ERROR:
Not stated.

REFERENCES:



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (2) Samarium perchlorate; $Sm(ClO_4)_3$; [13569-60-3] (3) Water; H_2O; [7732-18-5]	Guseva, A.D. *Uch. Zap. Yarosl. Gos. Ped. Inst.* <u>1980</u>, *185*, 3-5.
VARIABLES: One temperature: 298 K. Composition.	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the system of $Ca(ClO_4)_2$-$Sm(ClO_4)_3$-H_2O at 25° C :

Liquid phase composition						Solid[b] phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
65.77	-	12.65	-	8.040	-	A
58.42	7.69	11.41	0.800	7.213	0.506	A
43.84	20.62	8.330	2.087	5.162	1.293	A
36.72	29.14	7.270	3.073	4.501	1.902	A
23.94	43.28	4.969	4.784	3.056	2.943	A + B
23.85	43.42	4.957	4.806	3.049	2.957	A + B
19.32	45.24	3.762	4.692	2.281	2.845	B
8.54	56.25	1.69	5.926	1.015	3.560	B
4.03	61.46	0.815	6.619	0.489	3.969	B
-	64.98	-	6.933	-	4.135	B

[a] Compiler's calculations.

[b] A = $Ca(ClO_4)_2.4H_2O$ B = $Sm(ClO_4)_3.9H_2O$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Isothermal recrystallization. Periods of equilibrium varied from 5 to 6 days. Sm^{3+} was determined by titrating with EDTA with xylenol orange as indicator; ClO_4^- by mercurimetric titration with diphenylcarbazone as indicator; Ca^{2+} by difference. The compositions of the solid phases were determined by Schreinemakers' method of residues .	The salts were synthesized from carbonates and 57% $HClO_4$ (chemically pure) (ref 1). Since the salts were hygroscopic, they were kept in a vacuum desiccator over phosphoric anhydride or H_2SO_4.
	ESTIMATED ERROR: Not stated.
	REFERENCES: 1. Guseva, A.D. *Uch. Zap. Yarosl. Gos. Ped. Inst.*, <u>1978</u>, *169*, 5.

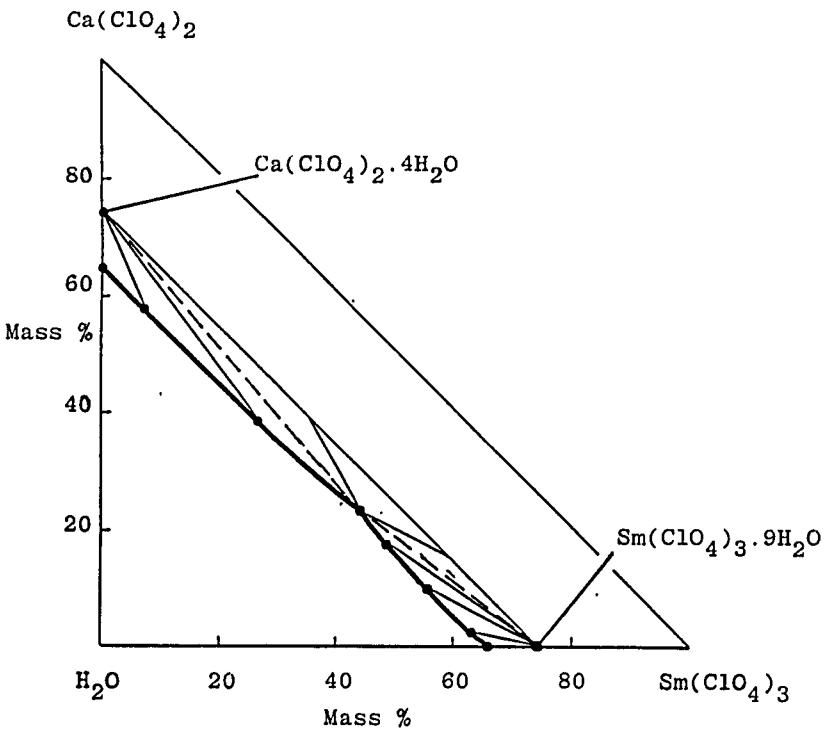
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	Guseva, A.D.
(2) Samarium perchlorate; $Sm(ClO_4)_3$; [13569-60-3]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1980, *185*, 3-5.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS/ADDITIONAL DATA:

The solubility isotherm, as given below, consists of the branches of crystallization of $Ca(ClO_4)_2.4H_2O$ and $Sm(ClO_4)_3.9H_2O$. The solubility of $Ca(ClO_4)_2$ in the eutectic is 23.9 mass %.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (2) Terbium perchlorate; $Tb(ClO_4)_3$; [14014-09-6] (3) Water; H_2O; [7732-18-5]	Komissarova, V.I.; Andronova, N.P. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1978, *169*, 18-20.
VARIABLES: One temperature: 298 K. Composition.	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the system $Ca(ClO_4)_2$-$Tb(ClO_4)_3$-H_2O at 25° C :

Liquid phase composition						Solid[b] phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
65.90	-	12.72	-	8.087	-	A
53.28	12.62	10.40	1.288	6.538	0.809	A
40.90	24.38	7.954	2.478	4.929	1.536	A
36.41	30.07	7.329	3.163	4.545	1.962	A
27.70	37.34	5.421	3.819	3.315	2.336	A
20.42	43.40	3.904	4.336	2.362	2.623	A + B
20.42	43.40	3.904	4.336	2.362	2.623	A + B
18.12	49.72	3.849	5.520	2.358	3.381	B
3.42	63.60	0.721	7.010	0.434	4.217	B
-	64.43	-	6.661	-	3.961	B

[a] Compiler's calculations.

[b] A = $Ca(ClO_4)_2.4H_2O$ B = $Tb(ClO_4)_3.9H_2O$

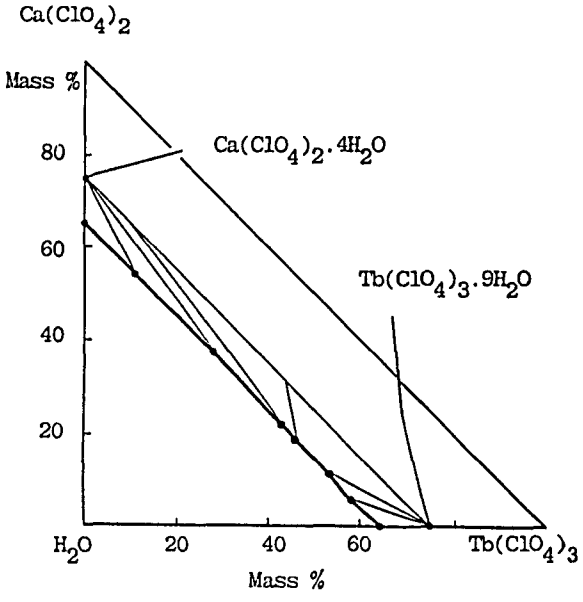
AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Isothermal method (ref. 1).
Details not given.

SOURCE AND PURITY OF MATERIALS:
Terbium perchlorate was prepared by neutralizing 30% perchloric acid with terbium carbonate and then evaporating the solution, filtering and desiccating over P_2O_5.

ESTIMATED ERROR:
Not given

REFERENCES:
1. Andronova, N.P.; *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1975, *144*; 1976, *164*.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (2) Lutetium perchlorate; $Lu(ClO_4)_3$; [14646-29-8] (3) Water; H_2O; [7732-18-5]	Andronova, N.P.; Pavlova, E.V. *Sb. Nauch. Tr. Yarosl. Gos. Ped. Inst.* 1982, *199*, 26.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Ca(ClO_4)_2$-$Lu(ClO_4)_3$-H_2O at 25°C :

Liquid phase composition						Solid phase
mass %		mol % [a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
65.90	-	12.716	-	8.087	-	$Ca(ClO_4)_2 \cdot 4H_2O$
52.61	12.45	10.071	1.203	6.301	0.753	"
42.82	23.45	8.528	2.358	5.312	1.469	"
37.07	28.05	7.213	2.756	4.447	1.699	"
27.40	39.17	5.585	4.031	3.430	2.475	$Ca(ClO_4)_2 \cdot 4H_2O$ + $Lu(ClO_4)_3 \cdot 9H_2O$
28.00	39.67	5.871	4.200	3.624	2.592	" "
24.73	41.69	5.034	4.285	3.082	2.623	$Lu(ClO_4)_3 \cdot 9H_2O$
9.20	56.78	1.881	5.861	1.132	3.526	"
-	64.56	-	6.484	-	3.849	"

[a] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Details of saturation method not given. Liquid phases and solid residues were analysed; perchlorate by gravimetry, using nitron precipitation, and lutetium by titration with Trilon B.	Not stated.
	ESTIMATED ERROR: Not stated.
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (2) Carbamide (*urea*); CH_4N_2O; [57-13-6] (3) Water; H_2O; [7732-18-5]	Zakharova, V.P.; Runov, N.N. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1973, *120*, 89-94.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility system $Ca(ClO_4)_2$ - $CO(NH_2)_2$ - H_2O at 25°C :

Liquid phase composition						Solid phase[b]
mass %		mol % [a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	54.53	-	26.46	-	19.97	A
11.01	51.88	1.551	29.09	1.241	23.28	A
26.56	58.15	5.764	50.22	7.269	63.33	A + B
32.02	46.19	6.342	36.41	6.149	35.30	B
38.04	38.55	7.578	30.56	6.799	27.42	B
50.22	33.71	12.633	33.74	13.077	34.93	B + C
53.39	31.37	14.036	32.82	14.659	34.27	C
55.06	30.03	14.787	32.09	15.452	33.54	C
57.08	28.40	15.737	31.16	16.450	32.57	C + D
58.02	25.15	15.214	26.24	14.425	24.88	D
59.36	23.70	15.688	24.92	14.663	23.30	D
62.23	22.03	17.349	24.44	16.544	23.31	D + E
61.82	15.45	14.552	14.47	11.381	11.32	E
63.35	7.23	13.133	5.96	9.010	4.09	E
65.34	-	12.443	-	7.888	-	E

[a] Compiler's calculations.

[b] A = $CO(NH_2)_2$ B = $Ca(ClO_4)_2.6CO(NH_2)_2$

C = $Ca(ClO_4)_2.4CO(NH_2)_2$ D = $Ca(ClO_4)_2.2CO(NH_2)_2.2H_2O$

E = $Ca(ClO_4)_2.4H_2O$

AUXILIARY INFORMATION

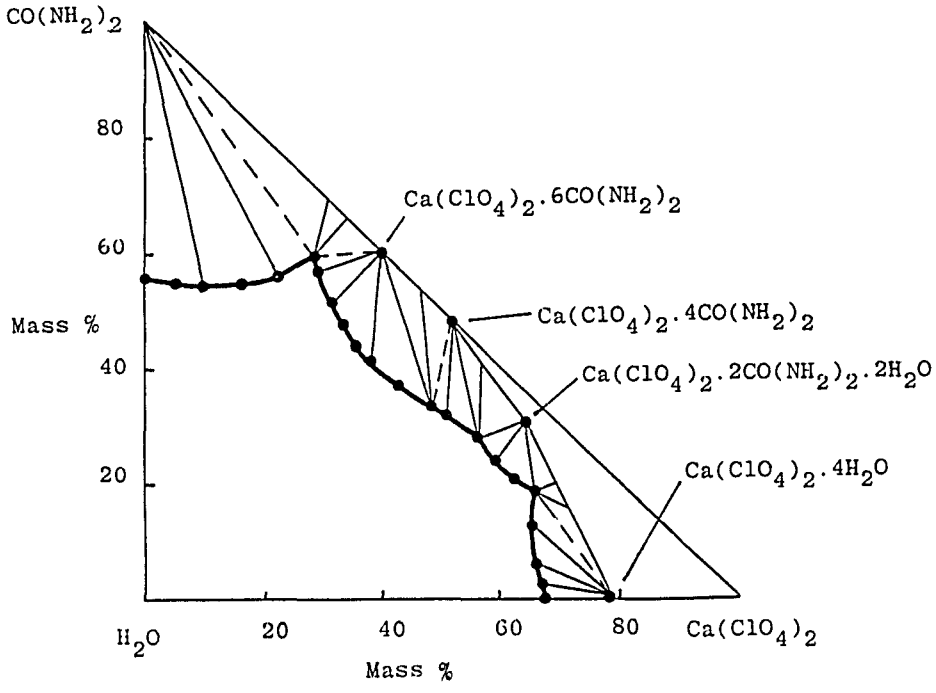
METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Details of saturation method not given. Ca^{2+} was determined by complexometric titration with the indicator chrome blue black; carbamide by Kjeldahl's method. Thermographical and optical crystallography methods were used in the study of the solid phases.	Calcium perchlorate and carbamide were of chemically pure grade.
	ESTIMATED ERROR: Not stated.
	REFERENCES:

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	Zakharova, V.P.; Runov, N.N.
(2) Carbamide (*urea*); CH_4N_2O; [57-13-6]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1973, *120*, 89-94.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA : The solubility isotherm is shown in the diagram given below. When carbamide content in the saturated solutions reached 22.03-28.40 mass % , the incongruently soluble compound $Ca(ClO_4)_2.2CO(NH_2)_2.2H_2O$ crystallized. A further increase in the carbamide content led to the formation of the compound $Ca(ClO_4)_2.4CO(NH_2)_2$. Above 33.71 mass % of carbamide, the congruently soluble compound $Ca(ClO_4)_2.6CO(NH_2)_2$ precipitated. The branches of the isotherm which corresponds to the crystallization of $Ca(ClO_4)_2.4H_2O$ and $CO(NH_2)_2$ are also indicated.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (2) Dimethylcarbamide (*dimethylurea*); $C_3H_8N_2O$; [1320-50-9] (3) Water; H_2O; [7732-18-5]	Karnaukhov, A.S.; Vasil'eva, S.I.; Rylenkova, I.N. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1978, *169*, 22-6. Vasil'eva, S.I; Rylenkova, I.N. *Fiz.-khim. Issled. Neorg. Org. Soed.* 1979, 7-15.
VARIABLES: One temperature: 298 K. Composition.	PREPARED BY: N.A. Kozyreva; C.C. Ho

EXPERIMENTAL VALUES:

Solubility in the system $Ca(ClO_4)_2$-$C_3H_8N_2O$-H_2O at 25° C :

Liquid phase composition						Solid
mass %		mol %[a]		molality[a]/mol kg^{-1}		phase
(1)	(2)	(1)	(2)	(1)	(2)	
-	25.29	-	6.473	-	3.842	$C_3H_8N_2O$
6.26	27.94	0.656	7.936	0.398	4.819	"
11.08	31.22	1.287	9.833	0.804	6.141	"
13.42	32.02	1.629	10.54	1.029	6.661	"
20.37	35.94	2.921	13.98	1.951	9.336	"
25.78	37.98	4.229	16.90	2.977	11.89	"
27.23	39.63	4.741	18.72	3.438	13.57	"
34.48	46.81	8.417	30.99	7.711	28.39	$C_3H_8N_2O$ + $Ca(ClO_4)_2.4C_3H_8N_2O$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Isothermal method. Details of saturation were not given. Ca^{2+} was determined by titrating with Trilon B at pH 10-11 with the indicator chrome blue black; dimethylcarbamide by the Kjeldahl method. The density, viscosity and refractive index of saturated solutions were measured.	Calcium perchlorate was prepared by reacting CaO with perchloric acid. Asymmetric dimethylcarbamide (chemically pure grade) was used.
	ESTIMATED ERROR: Not stated.
	REFERENCES:

(continued next page)

COMPONENTS:

(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]

(2) Dimethylcarbamide (*dimethylurea*); $C_3H_8N_2O$; [1320-50-9]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Karnaukhov, A.S.; Vasil'eva, S.I.; Rylenkova, I.N.

Uch. Zap. Yarosl. Gos. Ped. Inst. 1978, *169*, 22-6.

Vasil'eva, S.I; Rylenkova, I.N.

Fiz.-khim. Issled. Neorg. Org. Soed. 1979, 7-15.

EXPERIMENTAL VALUES: (continued)

Solubility in the system $Ca(ClO_4)_2$-$C_3H_8N_2O$-H_2O at 25° C :

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
35.21	42.83	7.954	26.24	6.709	22.14	$Ca(ClO_4)_2.4C_3H_8N_2O$
35.53	40.21	7.618	23.38	6.128	18.81	"
36.53	40.21	8.044	24.01	6.572	19.62	"
37.82	37.87	8.168	22.18	6.510	17.68	"
38.91	33.11	7.784	17.97	5.819	13.43	"
39.38	32.45	7.859	17.56	5.850	13.07	$Ca(ClO_4)_2.4C_3H_8N_2O$ + $Ca(ClO_4)_2.3C_3H_8N_2O$
39.73	31.59	7.854	16.94	5.797	12.50	$Ca(ClO_4)_2.3C_3H_8N_2O$
41.83	29.56	8.340	15.99	6.118	11.73	"
42.17	27.34	8.097	14.24	5.787	10.18	"
44.72	22.26	8.234	11.12	5.667	7.651	"
46.28	19.40	8.351	9.495	5.643	6.415	"
48.02	14.21	8.172	6.559	5.320	4.270	"
51.50	9.17	8.611	4.16	5.479	2.65	"
62.82	3.24	12.00	1.68	7.745	1.08	"
63.94	2.87	12.49	1.52	8.061	0.981	$Ca(ClO_4)_2.3C_3H_8N_2O$ + $Ca(ClO_4)_2.4H_2O$
64.36	2.31	12.55	1.22	8.080	0.787	"
64.49	2.76	12.73	1.48	8.240	0.96	"
64.95	3.48	13.17	1.91	8.609	1.25	"
65.00	2.37	12.89	1.27	8.336	0.824	"
65.64	-	12.59	-	7.994	-	$Ca(ClO_4)_2.4H_2O$

[a] Compiler's calculations.

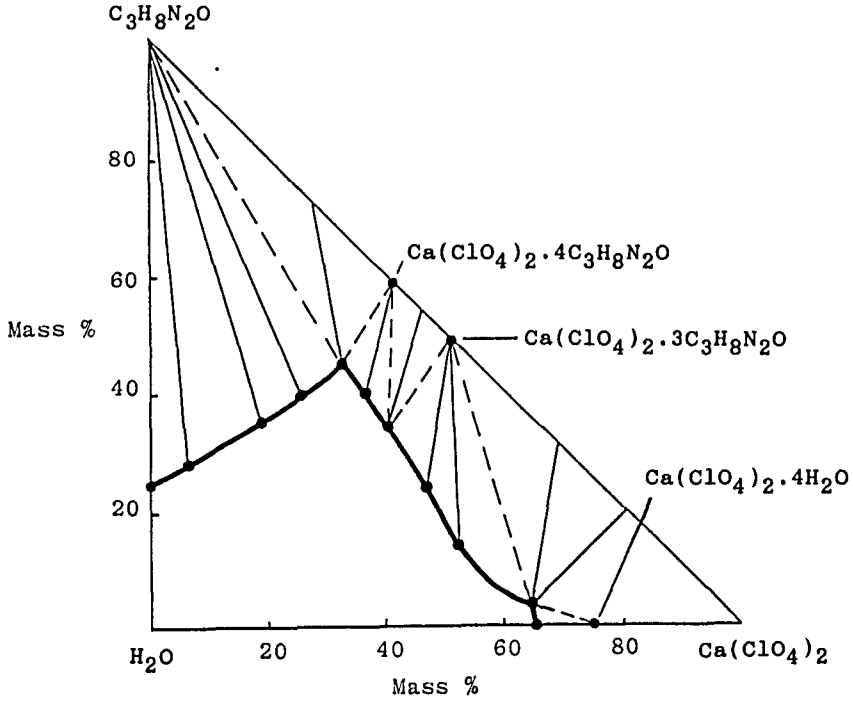
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (2) Dimethylcarbamide (*dimethylurea*); $C_3H_8N_2O$; [1320-50-9] (3) Water; H_2O; [7732-18-5]	Karnaukhov, A.S.; Vasil'eva, S.I.; Rylenkova, I.N. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1978, *169*, 22-6. Vasil'eva, S.I; Rylenkova, I.N. *Fiz.-khim. Issled. Neorg. Org. Soed.* 1979, 7-15.

EXPERIMENTAL VALUES: (continued)

COMMENTS/ADDITIONAL DATA:

The solubility isotherm given below shows the branches of crystallization of $Ca(ClO_4)_2.4H_2O$; $C_3H_8N_2O$; $Ca(ClO_4)_2.4C_3H_8N_2O$ and $Ca(ClO_4)_2.3C_3H_8N_2O$.



COMPONENTS:

(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]

(2) Thiocarbamide (*thiourea*); CH_4N_2S; [62-56-6]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Zakharova, V.P.; Runov, N.N.

Uch. Zap. Yarosl. Gos. Ped. Inst. 1970, *78*, 107-11.

VARIABLES:

One temperature: 298 K.

Composition.

PREPARED BY:

I.S. Bodnya

EXPERIMENTAL VALUES:

Solubility in the system $Ca(ClO_4)_2$-CH_4N_2S-H_2O at 25.0 °C:

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	14.26	-	3.79	-	2.185	CH_4N_2S
7.44	13.38	0.676	3.819	0.393	2.220	"
15.34	12.45	1.515	3.861	0.889	2.265	"
22.36	11.51	2.390	3.862	1.415	2.287	"
32.65	10.08	3.962	3.841	2.386	2.312	"
44.95	9.73	6.643	4.51	4.150	2.820	"
51.40	9.81	8.613	5.16	5.545	3.322	"
57.18	9.96	10.90	5.96	7.281	3.982	"
58.70	10.44	11.72	6.544	7.959	4.444	"
58.71	10.44	11.72	6.546	7.963	4.446	CH_4N_2S + $Ca(ClO_4)_2.4H_2O$
58.74	10.42	11.73	6.535	7.970	4.439	"

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method. Details of saturation method were not given. Ca^{2+} was determined by titrating with Trilon B; thiocarbamide was determined by the Kjeldahl method. The densities, viscosities and electrical conductivities of the saturated solutions were measured.

SOURCE AND PURITY OF MATERIALS:

Calcium perchlorate was prepared by reacting $CaCO_3$ with perchloric acid; the salt was then recrystallized twice. Chemically pure thiocarbamide was further purified by recrystallization.

ESTIMATED ERROR:

Temp. precision: ± 0.1 °C

REFERENCES:

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	Zakharova, V.P.; Runov, N.N.
(2) Thiocarbamide (*thiourea*); CH_4N_2S; [62-56-6]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *78*, 107-11.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

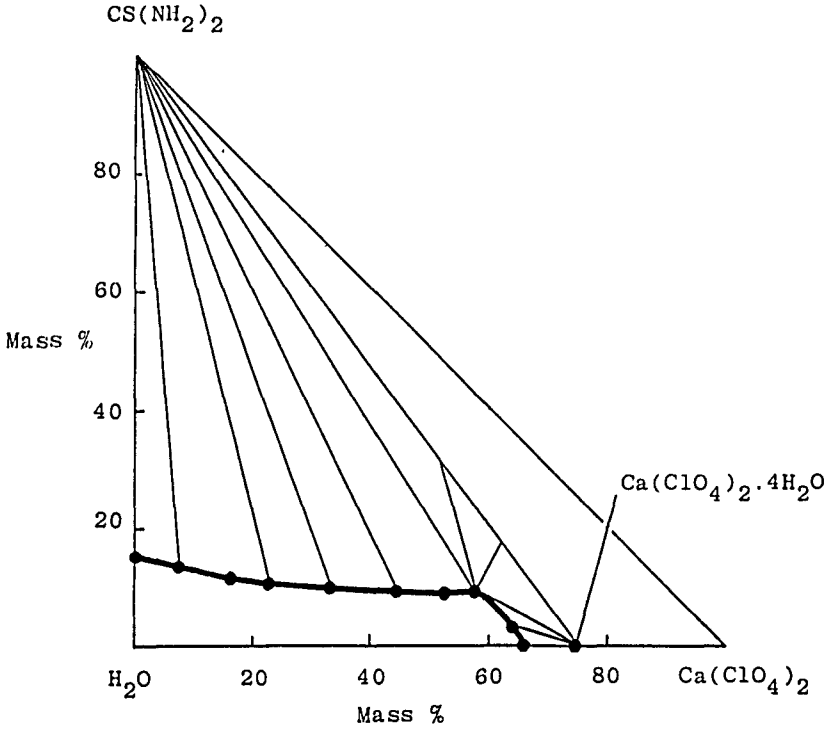
Solubility in the system $Ca(ClO_4)_2$-CH_4N_2S-H_2O at 25.0°C:

Liquid phase composition						Solid
mass %		mol %[a]		molality[a]/mol kg^{-1}		phase
(1)	(2)	(1)	(2)	(1)	(2)	
58.70	10.39	11.71	6.506	7.946	4.416	$Ca(ClO_4)_2.4H_2O$
63.64	4.61	12.75	2.90	8.387	1.907	"
65.38	-	12.46	-	7.902	-	"

[a] Compiler's calculations.

COMMENTS/ADDITIONAL DATA :

The eutectic composition (in mass %) is as follows:
10.44 % CH_4N_2S; 58.71 % $Ca(ClO_4)_2$ and 30.85 % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (2) Hexamethylenetetramine; $C_6H_{12}N_4$; [100-97-0] (3) Water; H_2O; [7732-18-5]	Karnaukhov, A.S.; Kosheleva, N.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1975, *135*, 60-4.
VARIABLES: One temperature: 298 K. Composition.	PREPARED BY: I.S. Bodnya

EXPERIMENTAL VALUES:

Solubility in the system $Ca(ClO_4)_2$-$C_6H_{12}N_4$-H_2O at 25° C :

Liquid phase composition						Solid[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		phase
(1)	(2)	(1)	(2)	(1)	(2)	
-	46.50	-	10.05	-	6.200	A
4.22	44.56	0.556	10.00	0.345	6.206	A
5.41	44.20	0.722	10.06	0.449	6.257	A + B
7.05	44.20	0.967	10.33	0.605	6.467	B
9.80	39.70	1.31	9.055	0.812	5.608	B
10.00	39.15	1.331	8.883	0.823	5.492	B + C
10.70	36.90	1.392	8.183	0.854	5.023	C
15.64	24.35	1.833	4.865	1.091	2.894	C
61.25	5.95	12.09	2.00	7.814	1.294	C
64.30	3.82	13.02	1.32	8.440	0.855	D
65.50	-	12.52	-	7.944	-	D

[a] Compiler's calculations.

[b] A = $C_6H_{12}N_4$; B = $Ca(ClO_4)_2.3C_6H_{12}N_4$; C = $Ca(ClO_4)_2.2C_6H_{12}N_4.6H_2O$; D = $Ca(ClO_4)_2.4H_2O$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Isothermal. Equilibrium was reached in 12 or 14 days. Ca^{2+} was determined by titrating with EDTA; $C_6H_{12}N_4$ by potentiometric titration.	Not stated.
	ESTIMATED ERROR: Not stated.
	REFERENCES: (continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	Karnaukhov, A.S.; Kosheleva, N.I.
(2) Hexamethylenetetramine; $C_6H_{12}N_4$; [100-97-0]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1975, *135*, 60-4.
(3) Water; H_2O; [7732-18-5]	

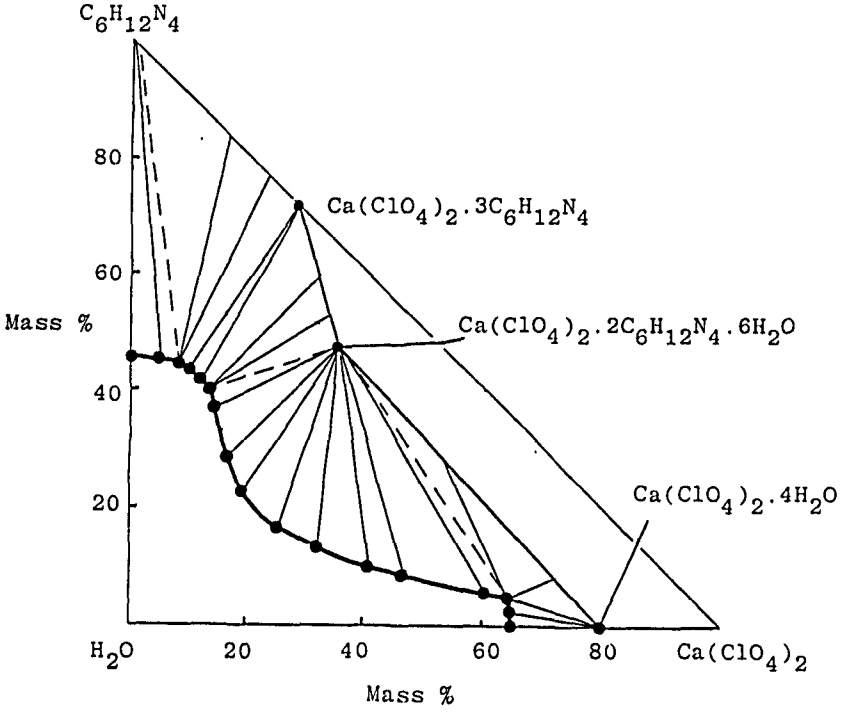
EXPERIMENTAL VALUES: (continued)

COMMENTS/ADDITIONAL DATA:

The solubility isotherm shows four branches of crystallization : $Ca(ClO_4)_2.4H_2O$, $Ca(ClO_4)_2.2C_6H_{12}N_4.6H_2O$, $Ca(ClO_4)_2.3C_6H_{12}N_4$ and $C_6H_{12}N_4$. The two transition points were (i) 4.88 mass % $Ca(ClO_4)_2$, 44.35 mass % $C_6H_{12}N_4$ and 50.77 mass % H_2O; (ii) 10.44 mass % $Ca(ClO_4)_2$, 36.90 mass % $C_6H_{12}N_4$ and 52.40 mass % H_2O respectively.

The eutectic point (mass %) : 64.30 $Ca(ClO_4)_2$,
3.81 $C_6H_{12}N_4$
31.89 H_2O.

The compound $Ca(ClO_4)_2.3C_6H_{12}N_4$ which contains 33.80 mass % $Ca(ClO_4)_2$ and 66.20 mass % $C_6H_{12}N_4$ is incongruent. The compound $Ca(ClO_4)_2.2C_6H_{12}N_4.6H_2O$ whose composition is 38.10 mass % $Ca(ClO_4)_2$, 17.25 mass % $C_6H_{12}N_4$ is congruently soluble.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Lithium perchlorate; $LiClO_4$; [7791-03-9] (2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (3) Hexamethylenetetramine; $C_6H_{12}N_4$; [100-97-0] (4) Water; H_2O; [7732-18-5]	Kosheleva, N.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1978, *169*, 124-7.
VARIABLES: One temperature: 298 K. Composition.	PREPARED BY: I.S. Bodnya

EXPERIMENTAL VALUES:

Solubility in the system $LiClO_4$-$Ca(ClO_4)_2$-$C_6H_{12}N_4$-H_2O at 25° C :

Liquid phase composition									Solid[b] phase
mass %			mol %[a]			molality[a]/mol kg^{-1}			
(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	
-	5.41	44.20	-	0.722	10.06	-	0.449	6.257	A+B
-	10.44	39.16	-	1.400	8.951	-	0.867	5.542	B+C
-	64.30	3.82	-	13.02	1.32	-	8.440	0.855	C+D
1.11	63.35	-	0.46	11.79	-	0.29	7.459	-	E+F
33.26	-	10.32	8.886	-	2.093	5.541	-	1.305	F+G
18.10	-	35.50	5.673	-	8.444	3.667	-	5.458	G+H
6.24	-	48.10	2.00	-	11.69	1.285	-	7.514	H+A
5.10	3.70	41.80	1.54	0.50	9.607	0.970	0.31	6.036	A+B+H
19.18	20.29	26.85	7.750	3.650	8.233	5.353	2.521	5.687	B+H+G
21.31	4.89	21.56	6.117	0.625	4.697	3.834	0.392	2.944	B+C+G
9.50	54.45	8.01	4.62	11.80	2.96	3.18	8.126	2.04	C+G+F
3.85	64.45	-	1.75	13.06	-	1.14	8.507	-	E+F+C

[a] Compiler's calculations.

[b] A = $C_6H_{12}N_4$; B = $Ca(ClO_4)_2.4C_6H_{12}N_4.6H_2O$; C = $Ca(ClO_4)_2.2C_6H_{12}N_4.6H_2O$; D = $Ca(ClO_4)_2.6H_2O$; E = $Ca(ClO_4)_2.4H_2O$; F = $LiClO_4.3H_2O$; G = $LiClO_4.C_6H_{12}N_4.3H_2O$; H = $LiClO_4.2C_6H_{12}N_4.4H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Isothermal method. Details of saturation method were not given. Roozeboom-Gibbs triangle was employed for graphical representation.	Not stated.
	ESTIMATED ERROR: Not stated.
	References:

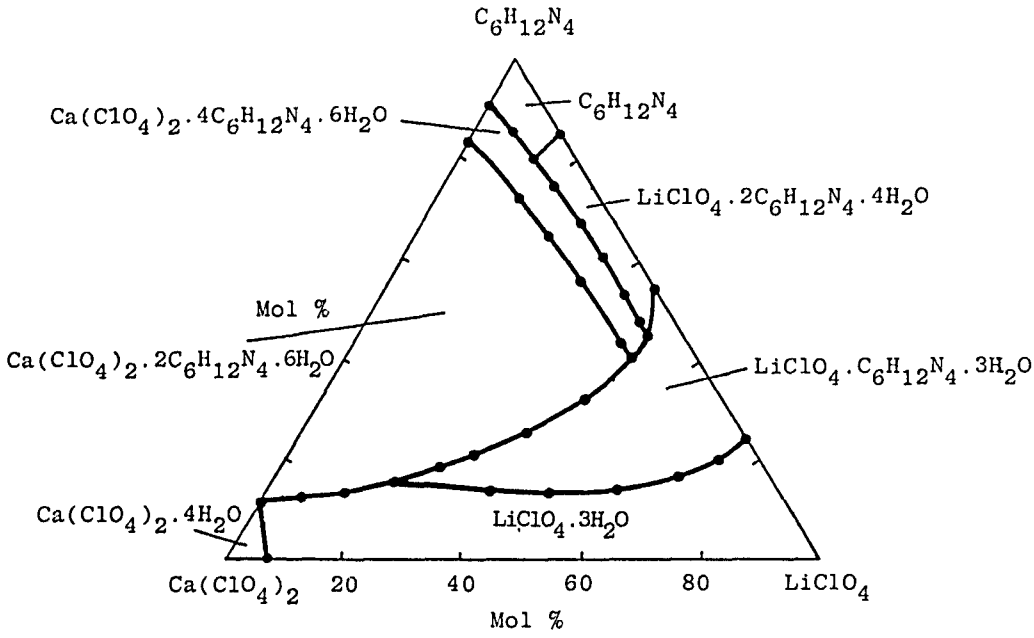
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Lithium perchlorate; $LiClO_4$; [7791-03-9] (2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6] (3) Hexamethylenetetramine; $C_6H_{12}N_4$; [100-97-0] (4) Water; H_2O; [7732-18-5]	Kosheleva, N.I. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1978, *169*, 124-7.

EXPERIMENTAL VALUES: (continued)

COMMENTS/ADDITIONAL DATA:

Complex compounds of calcium and lithium perchlorates which contain many $C_6H_{12}N_4$ molecules per molecule of an inorganic salt are more readily soluble. The phase diagram given below shows the crystallization fields of the various compound phases.



COMPONENTS:

(1) Calcium chromate; $CaCrO_4$; [13765-19-0]

(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]

(3) Ammonium chromate; $(NH_4)_2CrO_4$; [7788-98-9]

(4) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]

(5) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Karnaukhov, A.S.; Orekhov, O.L.

Uch. Zap. Yarosl. Gos. Ped. Inst. 1970, *78*, 3-19.

VARIABLES:

One temperature: 298.2 K

Composition.

PREPARED BY:

N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the system $2NH_4^+$, Ca^{2+} // $2ClO_4^-$, CrO_4^{2-} - H_2O at 25.0°C:

Liquid phase composition								Solid[b]
mass %				mol %[a]				phase
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
0.10	64.15	-	-	0.03	11.91	-	-	A + B
-	45.37	0.39	0.85	-	6.002	0.08	0.23	A + B + C
-	54.89	-	0.67	-	8.500	-	0.21	A + C
-	37.22	0.59	2.14	-	4.436	0.11	0.52	B + C
-	31.70	0.65	3.08	-	3.540	0.11	0.70	B + C
-	21.54	1.75	4.98	-	2.185	0.28	1.03	B + C
-	17.14	2.35	7.26	-	1.702	0.37	1.47	B + C
-	15.34	3.17	7.43	-	1.507	0.49	1.48	B + C
-	10.07	6.96	8.04	-	0.976	1.06	1.59	B + C
5.80	-	3.23	15.52	0.85	-	0.49	3.017	B + C
7.36	-	8.73	10.65	1.11	-	1.35	2.127	B + C + D
-	-	3.78	17.45	-	-	0.55	3.267	C + E
3.68	-	3.15	16.47	0.53	-	0.47	3.156	D + C
6.21	-	5.32	11.41	0.89	-	0.79	2.183	D + C
7.21	-	5.62	11.17	1.05	-	0.84	2.162	D + C
7.25	-	7.59	11.64	1.09	-	1.17	2.317	D + C
-	-	25.55	0.91	-	-	3.946	0.182	E + C
4.98	-	23.35	1.36	0.78	-	3.745	0.282	E + D
3.93	-	23.59	1.88	0.61	-	3.770	0.389	F + C + E
6.99	-	19.32	2.66	1.08	-	3.071	0.547	F + C + E + B

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method. Details of saturation method were not given. Ca^{2+} was determined by titrating with Trilon B at pH 10-11 with the indicator chrome blue black; NH_4^+ by distilling off NH_3 into H_3BO_3 solution and then titrating with 0.1M H_2SO_4; CrO_4^{2-} iodiometrically; ClO_4^- was determined by difference.

SOURCE AND PURITY OF MATERIALS:

Not stated.

ESTIMATED ERROR:

±0.1°C in temperature.

REFERENCES:

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium chromate; $CaCrO_4$; [13765-19-0]	Karnaukhov, A.S.; Orekhov, O.L.
(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *78*, 3-19.
(3) Ammonium chromate; $(NH_4)_2CrO_4$; [7788-98-9]	
(4) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	
(5) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility in the system $2NH_4^+$, Ca^{2+} // $2ClO_4^-$, CrO_4^{2-} - H_2O at 25.0 °C:

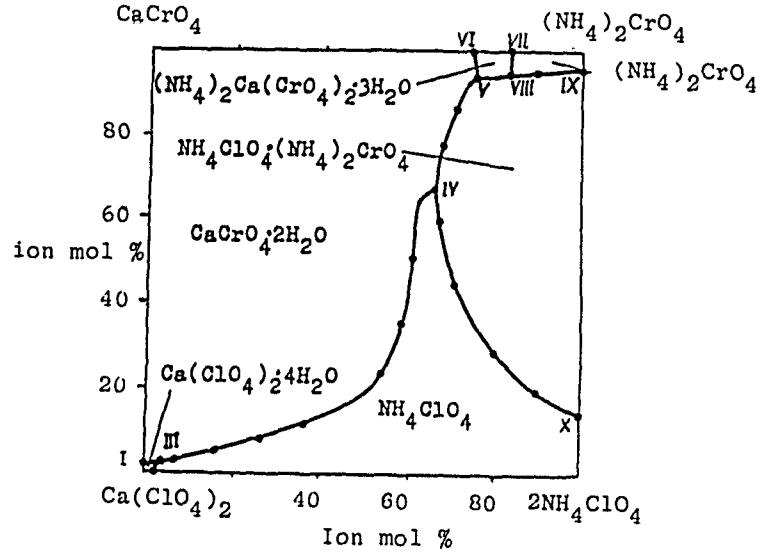
Liquid phase composition								Solid[b]
mass %				mol %[a]				phase
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
7.57	-	10.37	5.74	1.10	-	1.549	1.11	C + E + B
7.27	-	9.62	7.20	1.06	-	1.443	1.40	C + E + B
7.31	-	7.77	8.20	1.06	-	1.154	1.58	C + E + B
5.72	-	24.98	-	0.91	-	4.058	-	E + B
8.55	-	20.94	-	1.33	-	3.353	-	B + E

[a] Compiler's calculation.

[b] A = $Ca(ClO_4)_2.4H_2O$; B = $CaCrO_4.2H_2O$; C = NH_4ClO_4;
D = $NH_4ClO_4.(NH_4)_2CrO_4$; E = $(NH_4)_2CrO_4$; F = $(NH_4)_2Ca(CrO_4)_2.3H_2O$.

COMMENTS/ADDITIONAL DATA:

The solubility isotherm is given below. The diagram shows six crystallisation fields: $Ca(ClO_4)_2.4H_2O$; $CaCrO_4.2H_2O$; $(NH_4)_2Ca(CrO_4)_2.3H_2O$; $(NH_4)_2CrO_4$; $NH_4ClO_4.(NH_4)_2CrO_4$; and NH_4ClO_4. Four triple points are found (points III, IV, V and VIII in the diagram).



COMPONENTS:

(1) Calcium nitrate; $Ca(NO_3)_2$; [10124-37-5]

(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]

(3) Ammonium nitrate; NH_4NO_3; [6484-52-2]

(4) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]

(5) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Vasil'eva, S.I.

Uch. Zap. Yarosl. Gos. Ped. Inst. 1977, *164*, 76-79.

VARIABLES:

One temperature: 298 K.

Composition.

PREPARED BY:

I.S. Bodnya

EXPERIMENTAL VALUES:

Solubility in the system $2NH_4^+$, Ca^{2+} // $2ClO_4^-$, $2NO_3^-$ - H_2O at 25°C :

Liquid phase composition, mass %				Liquid phase composition, mol %[a]				Solid[b] phase
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
-	-	74.83	4.23	-	-	43.82	1.69	A + B
10.18	-	68.23	3.68	3.20	-	43.94	1.61	A + B
25.37	-	56.49	3.01	8.96	-	40.89	1.48	A + B
31.75	-	51.96	3.28	12.15	-	40.76	1.75	A + B
41.18	-	46.21	3.13	18.17	-	41.80	1.93	A + B + C
42.35	-	47.58	-	18.29	-	42.11	-	B + C
60.98	-	26.29	3.28	29.67	-	26.22	2.23	A + D + C
60.94	-	27.86	-	27.69	-	25.95	-	D + C
71.29	-	8.19	3.92	29.13	-	6.86	2.24	A + D
47.67	-	38.51	3.16	20.90	-	34.61	1.93	A + C
54.12	-	31.18	3.15	23.77	-	28.08	1.93	A + C

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method. Details of saturation method were not given. Ca^{2+} was determined by titrating with Trilon B at pH 10-11 with the indicator chrome blue black; NH_4^+ by distilling off NH_3 into H_3BO_3 solution and then titrating with 0.1M H_2SO_4; NO_3^- by Devarda's method; ClO_4^- was determined by difference. A Janecke diagram was used for the graphical representation.

SOURCE AND PURITY OF MATERIALS:

Calcium perchlorate was prepared by reacting $CaCO_3$ with perchloric acid. Anhydrous calcium nitrate was obtained from tetrahydrate by heating at 100°C under vacuum. Ammonium salts were purified by recrystallization.

ESTIMATED ERROR:

Not stated.

(continued next page)

COMPONENTS:

(1) Calcium nitrate; $Ca(NO_3)_2$; [10124-37-5]

(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]

(3) Ammonium nitrate; NH_4NO_3; [6484-52-2]

(4) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]

(5) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Vasil'eva, S.I.

Uch. Zap. Yarosl. Gos. Ped. Inst. 1977, *164*, 76-79.

EXPERIMENTAL VALUES: (continued)

Solubility of the system $2NH_4^+$, Ca^{2+} // $2ClO_4^-$, $2NO_3^-$ - H_2O at 25°C :

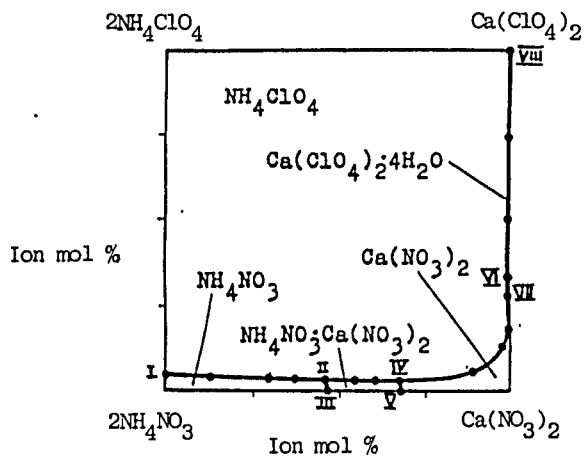
Liquid phase composition								Solid[b]
mass %				mol %[a]				phase
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
66.37	9.37	-	1.49	23.51	2.28	-	0.74	A + D
58.41	17.39	-	1.01	20.64	4.22	-	0.50	A + D
49.25	27.39	-	0.98	18.02	6.88	-	0.50	A + D
47.32	32.86	-	0.85	19.40	9.25	-	0.49	A + D + E
47.60	33.48	-	-	19.60	9.46	-	-	D + E
31.18	44.08	-	0.86	11.13	10.80	-	0.43	F
14.87	55.78	-	0.80	4.73	12.18	-	0.36	F
-	68.73	-	0.82	-	14.49	-	0.35	F

[a] Compiler's calculation.

[b] A = NH_4ClO_4; B = NH_4NO_3; C = $NH_4NO_3.Ca(NO_3)_2$; D = $Ca(NO_3)_2$; E = $Ca(ClO_4)_2.4H_2O$; F = $NH_4ClO_4.Ca(ClO_4)_2.4H_2O$.

COMMENTS/ADDITIONAL DATA:

The diagram below shows five crystallization fields: NH_4ClO_4; NH_4NO_3; $Ca(NO_3)_2$; $Ca(ClO_4)_2.4H_2O$ and $NH_4NO_3.Ca(NO_3)_2$. Three triple points are found (points II, IV and VI in the diagram). The equilibrium of the reaction $Ca(ClO_4)_2 + 2NH_4NO_3 \rightleftharpoons 2NH_4ClO_4 + Ca(NO_3)_2$ is shifted to the right. The salting-out action of salts on ammonium perchlorate increases with temperature.



COMPONENTS:

(1) Calcium chloride; $CaCl_2$; [10043-52-4]

(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]

(3) Ammonium chloride; NH_4Cl; [12125-02-9]

(4) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]

(5) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Ivanov, S.A.

Uch. Zap. Yarosl. Gos. Ped. Inst. 1970, *79*, 57-60.

VARIABLES:

One temperature: 298 K.

Composition.

PREPARED BY:

N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the system $2NH_4^+$, Ca^{2+} // $2ClO_4^-$, $2Cl^-$ - H_2O at 25°C :

Liquid phase composition								Solid[b]
mass %				mol %[a]				phase
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
-	54.89	-	0.67	-	8.50	-	0.21	A + B
1.28	53.93	-	0.66	0.43	8.382	-	0.21	A + B
4.42	51.03	-	0.85	1.48	7.949	-	0.27	A + B
7.35	47.74	-	0.60	2.43	7.316	-	0.19	A + B
11.23	49.08	-	0.69	4.08	8.290	-	0.24	A + B
14.75	49.25	-	-	5.69	8.817	-	-	A + C
15.08	47.68	-	0.63	5.73	8.408	-	0.23	A + C + B
19.39	41.53	-	0.91	7.06	7.021	-	0.31	A + B
30.67	25.44	-	1.55	10.06	3.876	-	0.48	A + B
37.82	14.01	-	1.69	11.38	1.96	-	0.480	A + B
38.43	13.86	-	-	11.34	1.90	-	-	A + B
44.20	1.14	-	2.89	12.06	0.14	-	0.745	A + B
45.81	-	5.23	-	12.79	-	3.03	-	D + E
41.62	-	5.52	0.26	11.03	-	3.03	0.065	A + E + B
35.05	-	5.72	-	8.51	-	2.88	-	E + F
36.57	-	5.59	0.39	9.09	-	2.88	0.092	F + B
30.27	-	6.76	1.24	7.11	-	3.294	0.275	F + B
25.14	-	8.91	1.43	5.68	-	4.178	0.305	F + B
20.06	-	12.32	2.61	4.47	-	5.698	0.550	F + B
12.64	-	16.61	3.43	2.72	-	7.410	0.697	F + B
6.60	-	20.93	5.21	1.41	-	9.253	1.05	F + B
-	-	26.48	5.50	-	-	11.466	1.08	F + B

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method. Details of saturation method and chemical procedures were not given.

SOURCE AND PURITY OF MATERIALS:

Not stated.

ESTIMATED ERROR:

Not stated.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Calcium chloride; $CaCl_2$; [10043-52-4]	Ivanov, S.A.
(2) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *79*, 57-60.
(3) Ammonium chloride; NH_4Cl; [12125-02-9]	
(4) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	
(5) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

[a] Compiler's calculation.

[b] A = $Ca(ClO_4)_2.4H_2O$; B = NH_4ClO_4; C = $CaCl_2.4H_2O$;
D = $CaCl_2.6H_2O$; E = $m(CaCl_2).n(NH_4Cl)$; F = NH_4Cl

COMMENTS/ADDITIONAL DATA:

The diagram below shows six crystallisation fields:
(1) $Ca(ClO_4)_2.4H_2O$; (2) $CaCl_2.6H_2O$; (3) NH_4Cl; (4) NH_4ClO_4;
(5) solid solutions $m(CaCl_2).n(NH_4Cl)$; and (6) $CaCl_2.4H_2O$.

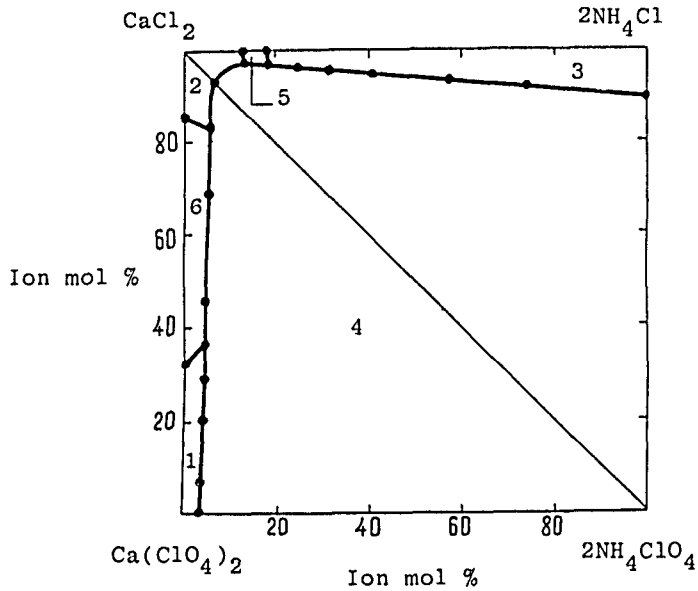
Partial dehydration of $CaCl_2.6H_2O$, viz.

$$CaCl_2.6H_2O = CaCl_2.4H_2O + 2H_2O$$

occurs under the action of calcium perchlorate when its concentration in the liquid phase exceeds 14 mass %. The equilibrium of the reaction

$$Ca(ClO_4)_2 + 2NH_4Cl \rightleftharpoons 2NH_4ClO_4 + CaCl_2$$

is shifted in the direction of formation of NH_4ClO_4.



COMPONENTS:	EVALUATOR:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	C.Y. Chan Department of Chemistry University of Malaya Kuala Lumpur, Malaysia
(2) Water; H_2O; [7732-18-5]	March, 1987

CRITICAL EVALUATION:

SOLUBILITY OF STRONTIUM PERCHLORATE IN WATER

Several reports of the solubility of $Sr(ClO_4)_2$ in water at 298 K were found and Table 1 summarizes these. Only two of these (1,2) gave an indication of the precision of their solubility analyses. It should be noted that, as seen in Table 1, certain values have been obtained from more than one compilation reference source and in these cases, the evaluator is of the opinion that the solubility determination had been carried out only once, i.e. by the co-author whose name was cited in all the sources referred to.

Table 1. Solubility of $Sr(ClO_4)_2$ in water.

T/K	mass % $Sr(ClO_4)_2$	Source
298.15 ± 0.01	75.59 ± 0.04 [a]	Willard and Smith (1)
298	75.52 [b]	Bogachev et al (3-5)
"	75.53 [c]	Karnaukhov and Zakharova (6)
"	75.53 [b]	Runov and Zakharova (7)
"	75.52 [b]	Runov and Novikov (8)
"	75.50 [c]	Ivanov (9)
"	75.12 [b,e]	Lilich and Dzhurinsky (10)
"	75.01 [b]	Guseva and Druzhinina (11); Druzhinina (12); Guseva and Golubkova (13)
298.15 ± 0.02	74.85 ± 0.04 [d]	Lilich et al (2)
298.2 ± 0.1	74.32 [b]	Karnaukhov and Sudakova (14); Lepeshkov, Bogachev and Sudakova (15)

[a] Solid phase was reported to be a mixt. of the anhyd. salt and the hydrate crystallized from the satd sln; the authors suggested that the stable phase at 298 K was the dihydrate.

[b] Reported solid phase was $Sr(ClO_4)_2.4H_2O$

[c] Reported solid phase was $Sr(ClO_4)_2.2H_2O$

[d] Reported solid phase was $Sr(ClO_4)_2.3H_2O$

[e] Evaluator's calculation.

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	C.Y. Chan Department of Chemistry University of Malaya Kuala Lumpur, Malaysia
(2) Water; H_2O; [7732-18-5]	March, 1987

CRITICAL EVALUATION: (continued)

The first six values in Table 1 give a mean value of 75.532 % with a standard deviation of 0.034 %, and these include Willard and Smith's data which appear to be the most precise of those reported here. The remaining four values are lower by 0.55 - 1.6 % of the mean value.

There is only one reported investigation (10) of the variation of solubility of strontium perchlorate in water over a range of temperatures though values at 273.15 K and 298.15 K were reported in (2). Lilich and Dzhurinsky (10) studied this system over the range 273 - 313K at 5K intervals. From their analyses of the solid phases in equilibrium with the saturated solutions at the various temperatures, they concluded that at 298K and below, the solid phase was $Sr(ClO_4)_2.4H_2O$ while at the higher temperatures studied up to 313K, the solid phase was $Sr(ClO_4)_2.3H_2O$. Based on the treatment described in (16) and in the INTRODUCTION to this volume, with the assumption that the terms involving variation of activity coefficients with solubility and temperature have the same form, equation (1) is used to fit Lilich and Dzhurinsky's data together with all the data given in Table 1 initially, and then selectively rejecting data until all the solubility values (mol fraction) are fitted to within $\pm 2s$ of the calculated value at each selected temperature, where s is the standard error defined by $s^2 = (x_{obs.}-x_{calc.})^2/(N-3)$, N being the total number of data points.

$$F(x) = a(T/K)^{-1} + b \ln(T/K) + c \qquad (1)$$

where $F(x) = \ln[x^v(1-x)^n/(1 + (v-1)x)^{n+v}]$.

For $Sr(ClO_4)_2$, v=3, with n=4 for the tetrahydrate and n=3 for the trihydrate respectively. The best-fit equations are as follows:

for the tetrahydrate, (plot A, Figure 1) ,

$$\ln [x^3(1-x)^4/(1+2x)^7] = 11.297 - 1331(T/K)^{-1} - 2.626 \ln (T/K) \qquad (2)$$

for the trihydrate, (plot B, Figure 1) ,

$$\ln [x^3(1-x)^3/(1+2x)^6] = -14.099 - 240.1(T/K)^{-1} + 1.271 \ln (T/K) \qquad (3)$$

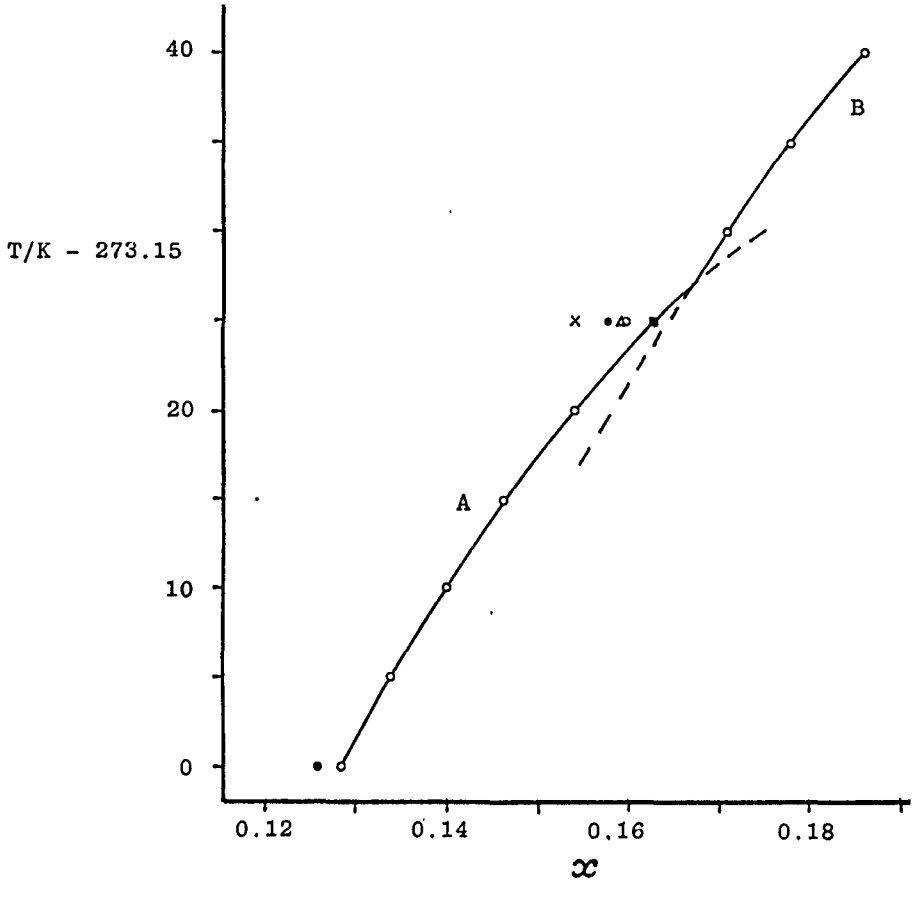
(continued next page)

COMPONENTS:	EVALUATOR:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	C.Y. Chan Department of Chemistry University of Malaya Kuala Lumpur, Malaysia
(2) Water; H_2O; [7732-18-5]	March, 1987

CRITICAL EVALUATION: (continued)

Figure 1. Solubility polytherms for the $Sr(ClO_4)_2$ - water system. Solid (stable system) and dashed (metastable or unstable) lines represent smoothed points, with calculations based on equations (2) and (3).
A: solid phase $Sr(ClO_4)_2.4H_2O$; B: solid phase $Sr(ClO_4)_2.3H_2O$

ref.(2); ref.(10); ref.(1,3-9); ref.(11-13) ref.(14-15).



The value of s for plot A in Figure 1 is 0.07 mol %. Since only 3 data points are available for plot B, it is not meaningful to have a value for s. From equations (2) and (3), the temperature at which the solid phase

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	C.Y. Chan Department of Chemistry University of Malaya Kuala Lumpur, Malaysia
(2) Water; H_2O; [7732-18-5]	March, 1987

CRITICAL EVALUATION: (continued)

transition between the tetrahydrate and the trihydrate occurs is calculated to be 299.94 K and the sat. solution at this point contains 16.65 mol % of $Sr(ClO_4)_2$.

Based on the above data analysis, the solubility data at 298K from (2,10,11,14) and the value at 273K from (2) are rejected. Table 2 gives the recommended and tentative smoothed values of the solubility of strontium perchlorate in water, calculated from equations (2) and (3) at selected temperatures.

Table 2. Recommended and tentative smoothed solubility data for $Sr(ClO_4)_2$ in water at selected temperatures.

T/K	solubility		status	solid phase
	mol %	molality/mol kg^{-1}		
273.15	12.82	8.17	recommended	$Sr(ClO_4)_2.4H_2O$
278.15	13.37	8.57	"	"
283.15	13.97	9.01	"	"
288.15	14.63	9.51	"	"
293.15	15.37	10.08	"	"
298.15	16.26	10.78	"	"
299.85	16.65	11.09	tentative	$Sr(ClO_4)_2.4H_2O$ + $Sr(ClO_4)_2.3H_2O$
303.15	17.08	11.43	tentative	$Sr(ClO_4)_2.3H_2O$
308.15	17.80	12.02	"	"
313.15	18.62	12.70	"	"

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	C.Y. Chan Department of Chemistry University of Malaya Kuala Lumpur, Malaysia
(2) Water; H_2O; [7732-18-5]	March, 1987

CRITICAL EVALUATION: (continued)

MULTICOMPONENT SYSTEMS

Aqueous Systems

Only two separate reports were found for each of the ternary systems at 298.2K, $Sr(ClO_4)_2$-NH_4ClO_4-water and $Sr(ClO_4)_2$-$SrCl_2$-water, which give data for the mutual solubilities of $Sr(ClO_4)_2$ and the other solute. These and their mean values are summarised in Table 3, and they should be considered at this stage as tentative values only.

It is not possible to carry out critical evaluations of the data compiled for the other multicomponent aqueous solubility systems of strontium perchlorate because only one publication exists for each one of them. In addition, insufficient experimental and analytical details were given in every one of these reports.

Table 3. Mutual solubilities at 298.2K in the systems: (A) $Sr(ClO_4)_2$-NH_4ClO_4-water and (B) $Sr(ClO_4)_2$-$SrCl_2$-water.

(A) : solid phase = $Sr(ClO_4)_2.4H_2O + NH_4ClO_4$

Solubility						Reference
$Sr(ClO_4)_2$			NH_4ClO_4			
mass %	mol %	mol kg^{-1}	mass %	mol %	mol kg^{-1}	
74.32	15.92	10.59	1.19	0.622	0.414	(17)
73.31	15.42	10.19	1.162	0.592	0.391	(15)
73.62	15.21	10.02	1.159	0.588	0.387	(15)
mean: 73.7 ± 0.5	15.5 ± 0.4	10.3 ± 0.3	1.17 ± 0.02	0.60 ± 0.02	0.40 ± 0.01	

(B) : solid phase = $Sr(ClO_4)_2.4H_2O + SrCl_2.6H_2O$

Solubility						Reference
$Sr(ClO_4)_2$			$SrCl_2$			
mass %	mol %	mol kg^{-1}	mass %	mol %	mol kg^{-1}	
72.21	14.60	9.48	1.40	0.513	0.335	(14)
72.05	14.51	9.55	1.41	0.512	0.335	(14)
72.02	14.50	9.46	1.42	0.516	0.337	(15)
mean: 72.1 ± 0.1	14.54 ± 0.05	9.50 ± 0.05	1.41 ± 0.01	0.514 ± 0.002	0.336 ± 0.001	

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	C.Y. Chan Department of Chemistry University of Malaya Kuala Lumpur, Malaysia
(2) Water; H_2O; [7732-18-5]	March, 1987

CRITICAL EVALUATION: (continued)

Non-aqueous Systems

Data compiled for the solubilities of strontium perchlorate in various organic solvents (binary systems only) cannot be critically evaluated since only one reference source was found for each of these systems. However, the evaluator is of the opinion that the data reported by Willard and Smith (1) for the solubilities of $Sr(ClO_4)_2$ in aliphatic alcohols, ethyl acetate and acetone (see the relevant Compilations) can be tentatively accepted because, based on the information given by them regarding experimental procedures and analytical precision, it is apparent that their data had been obtained with great care.

References

1. Willard, H.H.; Smith, G.H. *J. Am. Chem. Soc.* 1923, *45*, 286.
2. Lilich, L.S.; Kurbanova, Z.I.; Kocheregin, S.B.; Chernykh, L.V. *Zh. Neorg. Khim.* 1971, *16*, 2268; *Russ. J. Inorg. Chem. (Engl. Transl.)* 1971,*16*, 1210.
3. Bogachev, A.V.; Ivanov, S.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1972, *103*, 23.
4. Bogachev, A.V. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1973, *120*, 31.
5. Bogachev, A.V.; Karnaukhov, A.S. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1978, *169*, 31.
6. Karnaukhov, A.S.; Zakharova, V.P. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *79*, 107.
7. Runov, N.N.; Zakharova, V.P. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1972, *103*, 67.
8. Runov, N.N.; Novikov, V.V. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1975, *144*, 37.
9. Ivanov, S.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1973, *120*, 20.
10. Lilich, L.S.; Dzhurinsky, B.F. *Zh. Obshch. Khim.* 1956, *26*, 1549.
11. Guseva, A.D.; Druzhinina, G.V. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1975, *144*, 81.
12. Druzhinina, G.V. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1972, *103*, 39.
13. Guseva, A.D.; Golubkova, O.N. *Sb. Tr. Yarosl. Ped. Inst.* 1979, *178*, 3.

(continued next page)

COMPONENTS:	EVALUATOR:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	C.Y. Chan Department of Chemistry University of Malaya Kuala Lumpur, Malaysia
(2) Water; H_2O; [7732-18-5]	March, 1987

CRITICAL EVALUATION: (continued)

References (continued)

14. Karnaukhov, A.S.; Sudakova, A.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1973, *120*, 3.
15. Lepeshkov, I.N.; Bogachev, A.V.; Sudakova, A.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1972, *103*, 28.
16. Cohen-Adad, R.; Saugier, M.T.; Said, J. *Rev. Chim. Miner.* 1973, *10*, 631.
17. Lepeshkov, I.N.; Sudakova, A.A. *Zh. Neorg. Khim.* 1975, *20*, 559; *Russ. J. Inorg. Chem. (Engl. Transl.)* 1975, *20*, 312.
18. Druzhinina, G.V. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1979, *178*, 10.
19. Bogachev, A.V.; Lepeshkov, I.N. *Zh. Neorg. Khim.* 1982, *27*, 1605; *Russ. J. Inorg. Chem. (Engl. Transl.)* 1982, *27*, 907.
20. Dawson, L.R.; Berger, J.E.; Vaughn, J.W.; Eckstrom, H.C. *J. Phys. Chem.* 1963, *67*, 281.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0] (2) Water; H_2O; [7732-18-5]	Lilich, L.S.; Dzhurinsky, B.F. *Zh. Obshchei Khim.* 1956, *26*, 1549-53; **J. General Chem. U.S.S.R.* (Engl. Transl.) 1956, *26*, 1733-7.
VARIABLES: Temperature/K: 273-313	PREPARED BY: K.H. Khoo

EXPERIMENTAL VALUES:

Solubility of $Sr(ClO_4)_2$ (s) in water at various temperatures (T)

T/ °C	0	5	10	15	20	25	30	35	40
s/mol kg^{-1}	8.16	8.57	9.03	9.49	10.10	10.54	11.43	12.02	12.70

Note: The solid phase is $Sr(ClO_4)_2.4H_2O$ at temperatures below 25.7°C; above this temperature, the solid phase is $Sr(ClO_4)_2.3H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The salt was stirred with water in a thermostat. Equilibrium was reached after continuous stirring for 1-4 h. Owing to the great tendency of the salt to form super-saturated solutions, equilibrium was approached from below. Strontium was determined by precipitation as sulfate [1]. The composition of the solid phase was determined at the same time as the solubility by pressing a sample with filter paper between metal plates kept at about the temperature of the solution. In most cases, the excess of adsorbed water was 0-6 mol % of the total amount of water of crystallization.

SOURCE AND PURITY OF MATEIALS:
$Sr(ClO_4)_2$ was prepared by saturating perchloric acid with SrO (analytically pure grade) and recrystallized twice or thrice from solution. The purity of the salt was not stated.

ESTIMATED ERROR:
Not stated.

REFERENCES:
1. Kolthoff, I.M.; Lundell, G.E. *Quantitative Analysis.* 1948, 772.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0] (2) Water; H_2O; [7732-18-5]	Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1923, *45*, 286-96.
VARIABLES: One temperature: 298.15 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of strontium perchlorate in water at 25.00°C :

mass %	g/100 cm^3 sln	mol %	mol dm^{-3}	mol kg^{-1}	sat. sln. density/g cm^{-3}
75.59	157.51	16.297[b]	5.497[b]	10.808[b]	2.0837

[a] The solid phase was a mixture of the anhydrous salt and its hydrate which was not analysed. The authors reported that when strontium perchlorate was crystallized at about 25°C the dihydrate was obtained. This observation is in error and the solid phase was probably $Sr(ClO_4)_2.4H_2O$.

[b] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A sat. sln. of the salt was prepared at a temperature slightly above 25°C and sealed together with about 1 g of the anhydrous salt in a solubility tube, capacity 18-20 cm^3. This tube was then rotated end-over-end in the thermostat bath at 25.00°C for 24-48h and stood vertically to allow the solids to settle. Samples of the clear sat. sln. were then analysed for solute content by an evaporation-to-dryness method using Pt crucibles. The salt was dried to constant wt. at 250°C in a current of air dried with P_2O_5. Duplicate soly determinations were made, those analyses in which chloride (from thermal decomposition) was found present being rejected.

SOURCE AND PURITY OF MATERIALS:

Hydrated (1) was prepared from twice-recrystallized strontium nitrate and purified $HClO_4$ (ref.1). Anhyd. (1) obtained by heating the hydrate to const. wt. at 250°C.

ESTIMATED ERROR:

Precision in temp. was ±0.01°C; precision in soly. about ±0.05% .

REFERENCES:

1. Willard, H.H. *J. Am. Chem. Soc.* 1912, *34*, 1480.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0] (2) Hydogen peroxide; H_2O_2; [7722-84-1]	Titova, K.V.; Kolmakova, E.I.; Rosolovskii, V.Ya. *Zh. Neorg. Khim.* 1986, *31*, 3213-5; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1986, *31*, 1846-7.
VARIABLES: One temperature: 273 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

The solubility[a] of strontium perchlorate in hydrogen peroxide at 0°C :

g(1)/ 100 g(2)	mass %	mol %	molality/ mol kg^{-1}
113.3	53.12	11.86	3.954

[a] Mass %, mol % and molality values calculated by compiler.

The solid phase was reported as $Sr(ClO_4)_2.H_2O_2$. Analysis gave the following mass % values : Sr 27.1% , ClO_4 62.8% and H_2O_2 10.6%. The corresponding theoretical values are Sr 27.32%, ClO_4 62.07% and H_2O_2 10.61% for the solid $Sr(ClO_4)_2.2H_2O_2$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
No details of saturation method was given. Solubility equilibrium was established in 1-1.5 h. The concentration of the solutions did not change noticeably during the next 3h but after that slow decomposition of peroxide began. The concentrations of perchlorate in the sat. solutions were determined by gravimetric analysis using nitron as the agent for precipitation. H_2O_2 was analysed by permanganate titration.	The anhydrous perchlorate was prepared by heating the hydrate in vacuum (source not given). Samples that showed no water I.R. absorption bands in the range 1620-1635 cm^{-1} were used. The H_2O_2 was 99.8% ± 0.2% pure.
	ESTIMATED ERROR: Not stated.
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium Perchlorate; $Sr(ClO_4)_2$; [13450-97-0] (2) *Alcohols*: (A) Methanol (*methyl alcohol*); CH_4O; [67-56-1] (B) Ethanol (*ethyl alcohol*); C_2H_6O; [64-17-5] (C) 1-Propanol (*n-propyl alcohol*); C_3H_8O; [71-23-8] (D) 1-Butanol (*n-butyl alcohol*); $C_4H_{10}O$; [71-36-3] (E) 2-Methyl-1-propanol (*iso-butyl alcohol*); $C_4H_{10}O$; [78-83-1]	Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1923, *45*, 286-96.
VARIABLES: One temperature: 298.15 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of strontium perchlorate in various alcohols at 25.00°C, the solid phase being the anhydrous salt :

soly in :	methanol	ethanol	1-propanol	1-butanol	2-methyl-1-propanol
mass %	67.95	64.37	58.40	53.16	43.78
g/100 cm^3 sln.	113.95	100.01	83.31	71.205	52.63
mol %[a]	19.116	22.51	22.75	22.70	16.77
mol dm^{-3} [a]	3.977	3.4905	2.908	2.4852	1.8369
mol kg^{-1} [a]	7.400	6.305	4.900	3.961	2.718

[a] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
A sat. sln. of the salt was prepared at a temperature slightly above 25°C and sealed together with about 1 g of the anhydrous salt in a solubility tube, capacity 18-20 cm^3. This tube was then rotated end-over-end in the thermostat bath at 25.00°C for 24-48h	Hydrated (1) was prepared from twice-recrystallized strontium nitrate and purified $HClO_4$ (ref.1) Anhyd. (1) obtained by heating hydrate to const. wt. at 250°C. Alcohols purified by fract. distillation after refluxing with Ca.

(continued next page)

COMPONENTS:

(1) Calcium perchlorate; $Ca(ClO_4)_2$; [13477-36-6]

(2) Alcohols:

(A) Methanol (*methyl alcohol*); CH_4O; [67-56-1]

(B) Ethanol (*ethyl alcohol*); C_2H_6O; [64-17-5]

(C) 1-Propanol (*n-propyl alcohol*); C_3H_8O; [71-23-8]

(D) 1-Butanol (*n-butyl alcohol*); $C_4H_{10}O$; [71-36-3]

(E) 2-Methyl-1-propanol (*iso-butyl alcohol*); $C_4H_{10}O$; [78-83-1]

ORIGINAL MEASUREMENTS:

Willard, H.H.; Smith, G.F.

J. Am. Chem. Soc. 1923, *45*, 286-96.

EXPERIMENTAL VALUES:(continued)

soly in:	methanol	ethanol	1-propanol	1-butanol	2-methyl-1-propanol
sat. sln. density/g cm^{-3}	1.6771	1.5539	1.4266	1.3394	1.2022
pure solvent density/g cm^{-3}	0.78705	0.78515	0.7989	0.8059	0.7981

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:(continued)

and stood vertically to allow the solids to settle. Samples of the clear sat. sln. were then analysed for solute content by an evaporation-to-dryness method using Pt crucibles. The salt was dried to constant wt. at 250°C in a current of air dried with P_2O_5. Duplicate soly determinations were made, those analyses in which chloride (from thermal decomposition) was found present being rejected.

ESTIMATED ERROR:

Precision in temp. was ±0.01°C. soly precision probably about ± 0.1% (compiler).

REFERENCES:

1. Willard, H.H. *J. Am. Chem. Soc.* 1912, *34*, 1480.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	Willard, H.H.; Smith, G.F.
(2) Acetone; C_3H_6O; [67-64-1]	*J. Am. Chem. Soc.* 1923, *45*, 286-96.
VARIABLES:	PREPARED BY:
One temperature: 298.15 K	C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of strontium perchlorate in acetone at 25.00°C :

mass %	g/100 cm^3 sln.	mol %	mol dm^{-3}	mol kg^{-1}	sat. sln. density/g cm^{-3}
60.01	89.92	23.32[b]	3.138[b]	5.237[b]	1.4984

[a] The solid phase was the anhydrous salt.

[b] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A sat. sln. of the salt was prepared at a temperature slightly above 25°C and sealed together with about 1 g of the anhydrous salt in a solubility tube, capacity 18-20 cm^3. This tube was then rotated end-over-end in the thermostat bath at 25.00°C for 24-48h and stood vertically to allow the solids to settle. Samples of the clear sat. sln. were then analysed for solute content by an evaporation-to-dryness method using Pt crucibles. The salt was dried to constant wt. at 250°C in a current of air dried with P_2O_5. Duplicate soly determinations were made, those analyses in which chloride (from thermal decomposition) was found present being rejected.

SOURCE AND PURITY OF MATERIALS:

Hydrated (1) was prepared from twice-recrystallized strontium nitrate and purified $HClO_4$ (ref.1). Anhyd. (1) obtained by heating the hydrate to const. wt. at 250°C. (2) was purified by refluxing with KOH and fractional distillation. Density of (2) at 25°C was 0.7852 g cm^{-3}; b.p. was 56.16-56.51 °C .

ESTIMATED ERROR:

Precision in temp. was ± 0.01°C . Soly precision probably about ± 0.1% (compiler).

REFERENCES:

1. Willard, H.H. *J. Am. Chem. Soc.* 1912, *34*, 1480.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	Dawson, L.R.; Berger, J.E.; Vaughn, J.W.; Eckstrom, H.C.
(2) N-methyl-acetamide; C_3H_7NO; [79-16-3]	*J. Phys. Chem.* 1963, *67*, 281-3.
VARIABLES: Temperature: 313 K	PREPARED BY: W.L. Ng

EXPERIMENTAL VALUES:

Solubility of $Sr(ClO_4)_2$ in N-methyl-acetamide at 40°C: 0.87 mol L^{-1}
(0.92 mol kg^{-1} , compiler's calculation)

Density of (2) at 40°C: 942.0 kg m^{-3} (ref. 2)

AUXILIARY INFORMATION

METHOD
Saturated solution was prepared in a large test tube fitted with a stopper and covered with aluminium foil. The solution was equilibrated in a water bath at 40°C. The concn was determined from conductance measurements.

SOURCE AND PURITY OF MATERIALS:
(1): reagent grade; purity not stated.
(2): prepared and purified (ref. 1-3). Specific conductance: $(0.6\text{-}2.0)\times10^{-7}$ ohm^{-1} cm^{-1}.

ESTIMATED ERROR:
Solubility ±5% ; error in temperature not stated.

REFERENCES:
(1) Dawson, L.R.; Sears, P.G.; Graves, R.H. *J. Am. Chem. Soc.*, 1955, *77*, 1986.
(2) Dawson, L.R.; Wilhoit, E.D.; Sears, P.G. *J. Am. Chem. Soc.*, 1956, *78*, 1569.
(3) Dawson, L.R.; Wilhoit, E.D.; Hoomes, R.R.; Sears, P.G. *J. Am. Chem. Soc.*, 1957, *79*, 3004.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	Willard, H.H.; Smith, G.F.
(2) Ethyl acetate; $C_4H_8O_2$; [141-78-6]	*J. Am. Chem. Soc.* 1923, *45*, 286-96.
VARIABLES:	PREPARED BY:
One temperature: 298.15 K	C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of strontium perchlorate in ethyl acetate at 25.00°C :

mass %	g/100 cm^3 sln.	mol %	mol dm^{-3}	mol kg^{-1}	sat. sln. density/g cm^{-3}
52.10	76.67	25.06[b]	2.676[b]	3.796[b]	1.4717

[a] The solid phase was the anhydrous salt.

[b] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A sat. sln. of the salt was prepared at a temperature slightly above 25°C and sealed together with about 1 g of the anhydrous salt in a solubility tube, capacity 18-20 cm^3. This tube was then rotated end-over-end in the thermostat bath at 25.00°C for 24-48h and stood vertically to allow the solids to settle. Samples of the clear sat. sln. were then analysed for solute content by an evaporation-to-dryness method using Pt crucibles. The salt was dried to constant wt. at 250°C in a current of air dried with P_2O_5. Duplicate soly determinations were made, those analyses in which chloride (from thermal decomposition) was found present being rejected.

SOURCE AND PURITY OF MATERIALS:

Hydrated (1) was prepared from twice-recrystallized strontium nitrate and purified $HClO_4$ (ref.1). Anhyd. (1) obtained by heating the hydrate to const. wt. at 250°C. (2) was purified by refluxing with P_2O_5 and fractional distillation. Density of (2) at 25°C was 0.8945 g cm^{-3}; b.p. was 77.14-77.16 °C .

ESTIMATED ERROR:

Precision in temp. was ± 0.01°C .

REFERENCES:

1. Willard, H.H. *J. Am. Chem. Soc.* 1912, *34*, 1480.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0] (2) Hydrazine; N_2H_4; [302-01-2]	Sakk, Zh.G.; Rosolovskii, V.Ya. *Zh. Neorg. Khim.* 1972, *17*, 1783-4; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1972, *17*, 927-8.
VARIABLES: One temperature: 298.15 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

The solubility of strontium perchlorate in hydrazine at 25.0°C was reported as 88.0 g(1)/100 g(2). The corresponding mol % and molality values calculated by the compiler are 8.96% and 3.07 mol kg^{-1} , respectively.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
4-6 g of the salt and 8-11 cm^3 of hydrazine were thermostated at 25°C for 7-8 h with continuous stirring in a vessel isolated from atmospheric moisture. Samples for analysis were removed by drawing solution and part of the solid phase into a vessel fitted with a porosity no.4 filter at reduced pressure. After separating the phases, the solution was analysed for hydrazine. Methods of analysis not given. Replicate soly determinations were made.	The methods of purification of the perchlorate and of preparation of hydrazine were as described in ref.1 . Salt purity was about 99.5 - 99.9% . ESTIMATED ERROR: Precision in temp. was ±0.01°C; Absolute error in soly value was 0.4% . REFERENCES: 1. Rosolovskii, V.Ya.; Sakk, Zh.G. *Zh. Neorg. Khim.* 1970, *15*, 2262 .

COMPONENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]
(2) Perchloric acid; $HClO_4$; [7601-90-3]
(3) Water, H_2O; [7732-18-5])

ORIGINAL MEASUREMENTS:
Lilich, L.S.; Kurbanova, Z.I.; Kocheregin, S.B.; Chernykh, L.V.

Zh. Neorg. Khim., 1971, *16*, 2268-72; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1971 *16*, 1210-2.

VARIABLES:
Temperature/K: 273.2, 298.15 and 323.15
Composition

PREPARED BY:
C.C. Ho

EXPERIMENTAL VALUES:

Solubility in the system $Sr(ClO_4)_2$-$HClO_4$-H_2O at 0°C :

Liquid phase composition						Solid[b] phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
69.58	-	12.57	-	7.983	-	A
63.21	5.20	10.89	2.555	6.984	1.639	A
52.58	15.97	8.788	7.613	5.835	5.055	A
45.82	22.16	7.411	10.22	4.994	6.889	A
34.28	33.77	5.367	15.08	3.745	10.52	A

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Equilibrium of salt solution was attained after 6-10h depending on temperature. Specimens of liquid and solid phases were withdrawn and analysed for Sr^{2+} by titrating with Trilon B using fluorescein as indicator (ref. 1). $HClO_4$ was determined by titrating the H^+ with borax solution.
The composition of the solid phases was found by Schreinemakers' method.

SOURCE AND PURITY OF MATERIALS:
Chemically pure grade perchloric acid and pure grade strontium carbonate were used to prepare the perchlorate which was recrystallized three times before use.

ESTIMATED ERROR :
Temperature: precision ±0.2° at 0°C, ±0.02° at 25°C and ±0.05° at 50°C.
Relative error in analytical determination: ±0.05%.
In the range of higher $HClO_4$ concentration : ±0.1%.

REFERENCES:
Pribil, R.; "*Komplexony v Chemicke Analyse*" (Translated into Russian), Inostr. Lit., Moscow, 1960, 154.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	Lilich, L.S.; Kurbanova, Z.I.; Kocheregin, S.B.; Chernykh, L.V.
(2) Perchloric acid; $HClO_4$; [7601-90-3]	*Zh. Neorg. Khim.*, 1971, *16*, 2268-72; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1971 *16*, 1210-2.
(3) Water, H_2O; [7732-18-5])	

EXPERIMENTAL VALUES: (continued)

Solubility in the system $Sr(ClO_4)_2$-$HClO_4$-H_2O at 0°C :

Liquid phase composition						Solid[b] phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
29.35	38.64	4.525	16.99	3.200	12.02	A + C
23.50	44.25	3.547	19.05	2.543	13.66	C
20.58	47.25	3.086	20.21	2.233	14.62	C
16.52	50.92	2.431	21.37	1.771	15.57	C
15.00	52.30	2.192	21.80	1.601	15.92	C
13.47	55.74	2.034	24.01	1.527	18.02	C
7.46	64.88	1.180	29.26	0.941	23.35	C
5.00	69.00	0.813	31.98	0.671	26.42	C + E
2.95	72.09	0.487	33.96	0.412	28.75	E
2.03	74.70	0.347	36.41	0.304	31.96	E

Solubility in the system $Sr(ClO_4)_2$-$HClO_4$-H_2O at 25°C :

Liquid phase composition						Solid[b] phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
74.85	-	15.76	-	10.39	-	B
67.52	6.03	13.36	3.40	8.909	2.269	B
50.50	21.60	9.085	11.08	6.317	7.707	B
43.18	28.73	7.551	14.33	5.365	10.18	B
34.65	36.44	5.791	17.37	4.183	12.55	B
30.40	41.00	5.048	19.42	3.710	14.27	B + C
27.25	43.41	4.412	20.04	3.242	14.73	B + C
24.36	46.35	3.914	21.24	2.903	15.75	C
23.84	47.67	3.890	22.18	2.920	16.66	C + D
22.77	48.40	3.677	22.29	2.757	16.71	D
18.75	52.78	3.014	24.20	2.299	18.45	D
12.42	59.85	1.990	27.35	1.563	21.49	D
11.88	61.15	1.931	28.35	1.537	22.57	D
11.30	62.40	1.860	29.29	1.500	23.62	D + E
9.60	64.40	1.582	30.27	1.289	24.66	E
7.80	66.40	1.284	31.17	1.055	25.62	E
4.75	70.50	0.792	33.54	0.670	28.36	E
1.85	74.97	0.317	36.59	0.279	32.20	E
1.57	76.87	0.279	38.89	0.254	35.49	E

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	Lilich, L.S.; Kurbanova, Z.I.; Kocheregin, S.B.; Chernykh, L.V.
(2) Perchloric acid; $HClO_4$; [7601-90-3]	*Zh. Neorg. Khim.*, 1971, *16*, 2268-72; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1971 *16*, 1210-2.
(3) Water, H_2O; [7732-18-5])	

EXPERIMENTAL VALUES: (continued)

Solubility in the system $Sr(ClO_4)_2$-$HClO_4$-H_2O at 50°C :

Liquid phase composition						Solid[b] phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
76.41	2.94	18.49	2.03	12.91	1.417	C
76.87	2.56	18.69	1.78	13.04	1.239	C
73.74	4.62	17.11	3.06	11.89	2.125	C
70.90	6.98	16.02	4.50	11.19	3.141	C
65.75	11.33	14.21	6.986	10.01	4.921	C
61.46	14.96	12.83	8.905	9.097	6.315	C
55.28	20.24	11.00	11.49	7.881	8.230	C
54.03	22.10	10.88	12.69	7.900	9.216	C + D
52.48	23.37	10.43	13.25	7.584	9.633	C + D
49.13	25.94	9.455	14.24	6.878	10.36	D
40.74	33.68	7.494	17.67	5.559	13.11	D
31.20	41.90	5.393	20.66	4.048	15.51	D
24.20	48.31	4.039	23.00	3.072	17.49	D
16.30	58.16	2.770	28.19	2.227	22.67	D
7.40	67.94	1.247	32.66	1.047	27.43	D
4.79	71.94	0.826	35.37	0.718	30.77	E
1.16	78.90	0.214	41.42	0.203	39.39	E
0.90	85.60	0.20	53.10	0.233	63.12	E

[a] Compiler's calculation.

[b] A = $Sr(ClO_4)_2.4H_2O$
B = $Sr(ClO_4)_2.3H_2O$
C = $Sr(ClO_4)_2.2H_2O$
D = $Sr(ClO_4)_2.H_2O$
E = $Sr(ClO_4)_2$

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sodium perchlorate; $NaClO_4$; [7601-89-0]	Druzhinina, G.V.
(2) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1972, *103*, 39-41.
(3) Water; H_2O; [7732-18-5]	
VARIABLES: One temperature, 298 K. Composition.	PREPARED BY: I.S. Bodnya

EXPERIMENTAL VALUES:

Solubility System $NaClO_4$-$Sr(ClO_4)_2$-H_2O at 25°C.

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
68.84	-	24.53	-	18.04	-	$NaClO_4$
55.51	12.80	20.09	1.979	14.31	1.410	"
40.04	28.45	15.03	4.564	10.38	3.151	"
23.80	47.06	9.836	8.311	6.671	5.636	"
12.30	58.39	5.202	10.55	3.427	6.953	"
5.81	69.39	2.848	14.54	1.913	9.765	$NaClO_4$ + $Sr(ClO_4)_2.4H_2O$
-	75.01	-	15.88	-	10.48	$Sr(ClO_4)_2.4H_2O$

[a] Compiler's calculations.

COMMENTS / ADDITIONAL DATA

The solubility isotherm consists of two branches, corresponding to solid phases $Sr(ClO_4)_2.4H_2O$ and $NaClO_4.H_2O$. Average composition (mass %) of the eutectic solution : 5.81% $NaClO_4$; 69.39% $Sr(ClO_4)_2$ and 24.8% H_2O .

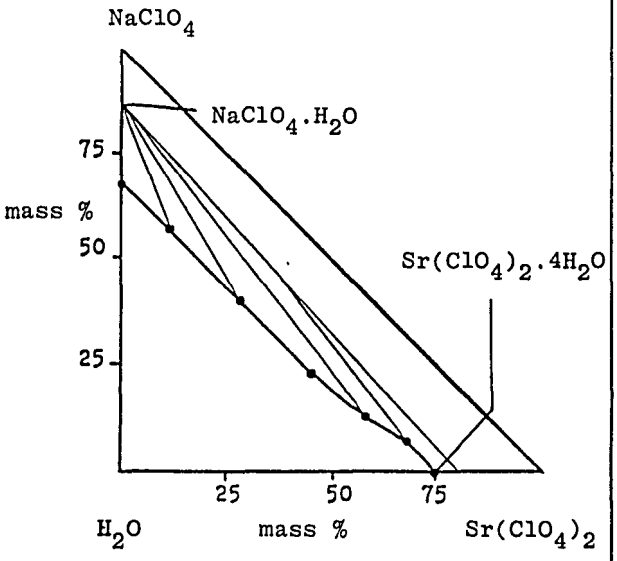
AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
No details.

SOURCE AND PURITY OF MATERIALS:
Not stated.

ESTIMATED ERROR:
Not stated.

REFERENCES:
None.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0] (2) Thallium perchlorate; $TlClO_4$; [13453-40-2] (3) Water; H_2O; [7732-18-5]	Ivanov, S.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1973, *120*, 20-3.
VARIABLES: One temperature, 298 K. Composition.	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility System $Sr(ClO_4)_2$-$TlClO_4$-H_2O at 25°C:

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	14.09	-	0.963	-	0.540	$TlClO_4$
10.43	7.67	0.790	0.548	0.444	0.308	"
22.88	3.00	1.899	0.235	1.077	0.133	"
29.70	2.91	2.690	0.249	1.538	0.142	"
34.88	2.21	3.362	0.201	1.935	0.116	"
41.90	2.20	4.491	0.222	2.616	0.130	"
56.03	1.11	7.585	0.142	4.563	0.085	"
67.12	1.30	11.763	0.215	7.418	0.135	"
72.45	1.38	14.787	0.266	9.662	0.174	$TlClO_4$ + $Sr(ClO_4)_2.2H_2O$
75.50	-	16.231	-	10.755	-	$Sr(ClO_4)_2.2H_2O$

[a] Compiler's calculations.

COMMENTS / ADDITIONAL DATA

The average composition (mass %) of the eutectic solution was :
1.38 % $TlClO_4$; 72.45 % $Sr(ClO_4)_2$; 26.17 % H_2O .

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Conditions of saturation not given. Sr^{2+} was analysed by titrating with Trilon B in the presence of the Mg complex; Tl^+ by the bromate method; perchlorate by precipitation with nitron. Details of solid phase analyses not given.	Not stated.
	ESTIMATED ERROR:
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0] (2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9] (3) Water; H_2O; [7732-18-5]	Karnaukhov, A.S.; Sudakova, A.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1972, *103*, 28-32.
VARIABLES: One temperature, 298 K. Composition.	PREPARED BY: I.S. Bodnya

EXPERIMENTAL VALUES:

Solubility System NH_4ClO_4-$Sr(ClO_4)_2$-H_2O at 25°C.

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a] / mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	20.02	-	3.696	-	2.131	A
8.81	13.73	0.691	2.628	0.397	1.509	A
16.12	10.24	1.330	2.060	0.764	1.184	A
26.40	6.443	2.378	1.415	1.372	0.817	A
35.52	3.905	3.522	0.944	2.047	0.549	A
51.31	1.698	6.391	0.516	3.811	0.308	A
64.87	1.357	10.717	0.547	6.704	0.342	A
73.31	1.162	15.205	0.588	10.023	0.387	A + B
73.62	1.159	15.416	0.592	10.188	0.391	A + B
73.80	1.198	15.558	0.616	10.302	0.408	B
74.32	-	15.395	-	10.101	-	B

[a] Compiler's calculations.

[b] A = NH_4ClO_4 B = $Sr(ClO_4)_2.4H_2O$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Solubility equilibrium obtained in 4-5 h. Sr^{2+} was determined complexometrically with the use of eriochrome black (ref.1); NH_4^+ by distillation into 4% boric acid with subsequent titration with 0.05 mol L^{-1} H_2SO_4. Solid phase composition was determined using Schreinemakers' method.	Strontium perchlorate obtained by reacting reagent grade strontium carbonate with perchloric acid and recrystallization.
	ESTIMATED ERROR: Not stated.

REFERENCES:

1. *Kompleksonometriya (teoreticheskiye osnovy i prakticheskoye primeneniye). Collection of transactions GN-T, Izd. Khim. Lit., Moscow* 1962.

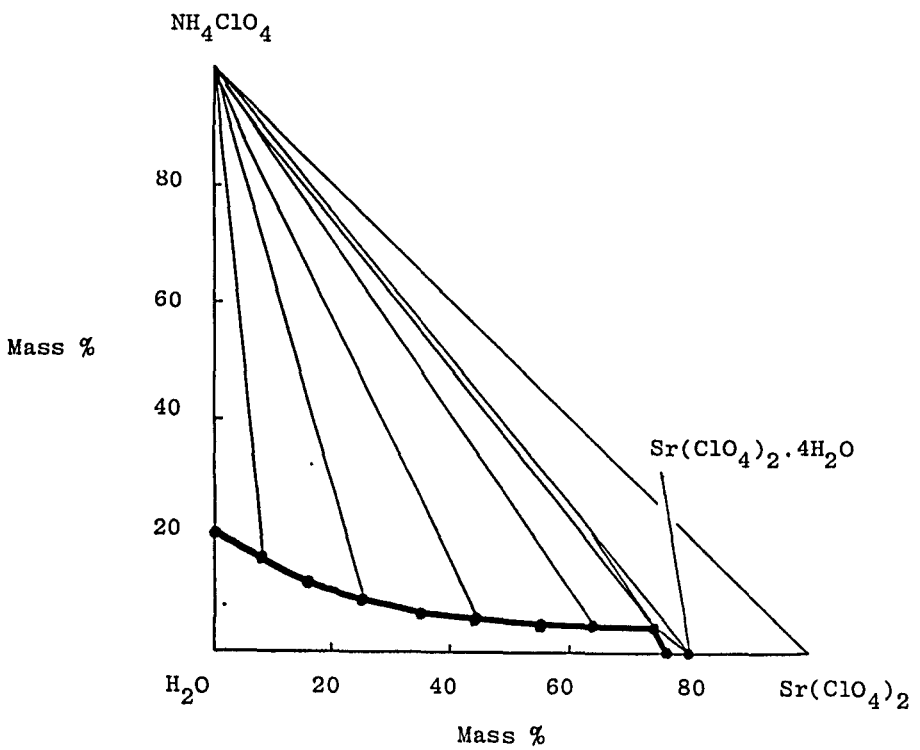
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	Karnaukhov, A.S.; Sudakova, A.A.
(2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	*Uch. Zap. Yarosl. Gos. Ped. Inst.*, 1972, *103*, 28-32.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES:(continued)

COMMENTS / ADDITIONAL DATA

The solubility isotherm, shown below, consists of two branches, corresponding to the solid phases $Sr(ClO_4)_2.4H_2O$ and NH_4ClO_4 respectively. The average composition (mass %) of the eutectic solution is : 74.42% $Sr(ClO_4)_2$; 1.19% NH_4ClO_4 and 24.39% H_2O . Strontium perchlorate has a strong salting-out effect on ammonium perchlorate.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0] (2) Strontium nitrate; $Sr(NO_3)_2$; [10042-76-9] (3) Water; H_2O; [7732-18-5]	Bogachev, A.V.; Ivanov, S.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* <u>1972</u>, *103*, 23-7.
VARIABLES: One temperature: 298 K. Composition.	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

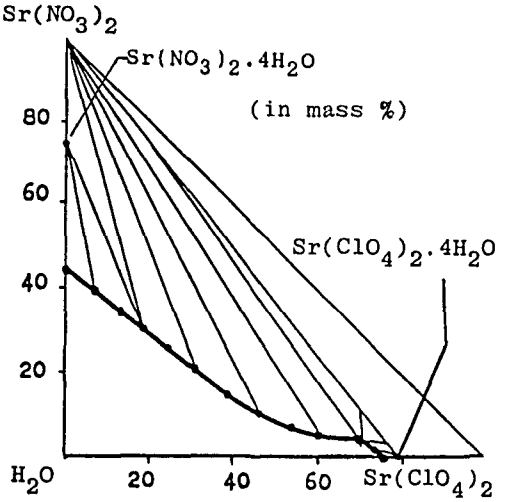
Solubility system $Sr(ClO_4)_2$-$Sr(NO_3)_2$-H_2O at 25°C .

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	44.58	-	6.409	-	3.801	$Sr(NO_3)_2.4H_2O$
18.43	29.74	2.087	4.560	1.241	2.711	"
20.12	28.10	2.282	4.315	1.356	2.564	$Sr(NO_3)_2$
40.02	12.68	4.944	2.121	2.953	1.267	"
54.22	6.47	7.879	1.273	4.814	0.778	"
71.44	3.26	14.938	0.923	9.855	0.609	" + $Sr(ClO_4)_2.4H_2O$
75.52	-	16.246	-	10.767	-	$Sr(ClO_4)_2.4H_2O$

[a] Compiler's calculations.

<u>COMMENTS / ADDITIONAL DATA</u>

The solubility isotherm consists of three branches, corresponding to the solid phases strontium nitrate tetrahydrate, anhydrous strontium nitrate, and strontium perchlorate tetrahydrate. The average composition (mass %) of the eutectic solution was 3.26% $Sr(NO_3)_2$, 71.44% $Sr(ClO_4)_2$ and 25.30% H_2O.



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Soly equilibria attained in 4-5 days. Sr^{2+} was determined by titrating with Trilon B in the presence of the indicator chrome blue black at pH 10-11 ; NO_3^- was reduced by Devarda's alloy to NH_3 with subsequent distillation into a saturated solution of boric acid and titration with 0.05 mol L^{-1} H_2SO_4; ClO_4^- was determined by difference. The composition of the solid phase was determined using Schreinemakers' method.

SOURCE AND PURITY OF MATERIALS:

Not stated.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0] (2) Strontium chloride; $SrCl_2$; [10476-85-4] (3) Water; H_2O; [7732-18-5]	Karnaukhov, A.S.; Sudakova,A.A. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1973, *120*, 3-8.
VARIABLES: One temperature: 298 K. Composition.	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Sr(ClO_4)_2$-$SrCl_2$-H_2O at 25°C

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	35.92	-	5.99	-	3.536	$SrCl_2.6H_2O$
25.13	19.96	2.689	3.860	1.597	2.293	"
33.58	15.15	3.832	3.124	2.286	1.864	"
52.27	6.45	7.255	1.618	4.419	0.986	"
63.95	2.79	10.695	0.843	6.711	0.529	"
72.21	1.40	14.604	0.512	9.550	0.335	" + $Sr(ClO_4)_2.4H_2O$
72.05	1.41	14.506	0.513	9.475	0.335	" + "
74.32	-	15.395	-	10.101	-	$Sr(ClO_4)_2.4H_2O$

[a] Compiler's calculations.

COMMENTS / ADDITIONAL DATA

The solubility isotherm consists of two branches corresponding to the crystallization of strontium chloride hexahydrate and strontium perchlorate tetrahydrate. The eutectic solution has the following mean composition (mass%): 72.02% $Sr(ClO_4)_2$; 1.42% $SrCl_2$; and 26.56% H_2O.

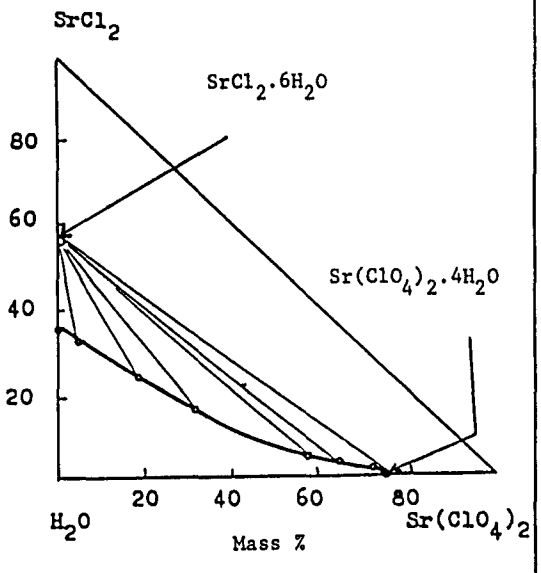
AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Isothermal method. Equilibrium in the system was reached in 4-5 h. Sr^{2+} was determined by complexometric titration with eriochrome black. Other information not given.

SOURCE AND PURITY OF MATERIALS:
Chemically pure salts used were further purified by recrystallization.

ESTIMATED ERROR:
Precision in temperature was ±0.1°C.

REFERENCES:



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0] (2) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (3) Water; H_2O; [7732-18-5]	Bogachev, A.V. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1973, *120*, 31-35.
VARIABLES: One temperature: 298K. Composition.	PREPARED BY: Gryzlova, E.S.

EXPERIMENTAL VALUES:

Solubility system $Sr(ClO_4)_2$-$Ba(ClO_4)_2$-H_2O at 25.0 °C :

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	66.75	-	9.711	-	5.970	$Ba(ClO_4)_2.3H_2O$
6.07	59.32	1.000	8.327	0.612	5.097	"
17.48	46.24	2.758	6.216	1.682	3.791	"
28.83	33.10	4.352	4.257	2.643	2.586	"
42.04	21.06	6.499	2.774	3.976	1.697	"
50.87	14.83	8.353	2.075	5.176	1.286	"
58.90	8.46	10.065	1.232	6.298	0.771	"
64.32	4.75	11.480	0.722	7.258	0.457	$Ba(ClO_4)_2.3H_2O$ + $Sr(ClO_4)_2.4H_2O$
69.14	3.08	13.462	0.511	8.686	0.330	$Sr(ClO_4)_2.4H_2O$
75.52	-	16.246	-	10.767	-	"

[a] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Solubility equilibrium was attained with continuous stirring after 1-2 days. Ba^{2+} was determined gravimetrically as barium chromate, precipitated from potassium chromate sln containing an acetate buffer mixture, and perchlorate by precipitation with nitron. Sr^{2+} content was calculated by difference. Solid phase composition determined by Schreinemakers' method. The water thermostat was maintained at 25.0° ± 0.1°C .	Not stated. ESTIMATED ERROR: Insufficient information for estimation. Temp. precision ± 0.1°C. REFERENCES:

(continued next page)

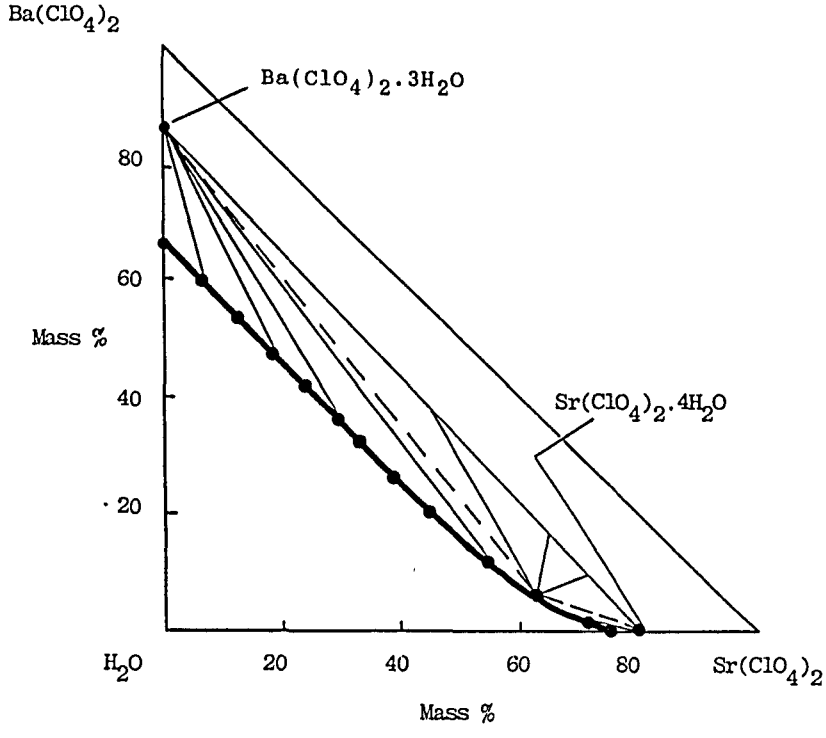
COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	Bogachev, A.V.
(2) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	*Sb. Tr. Yarosl. Gos. Ped. Inst.* 1973, *120*, 31-35.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA :

The eutectic solution has the following mass % composition : $Sr(ClO_4)_2$ 64.32% ; $Ba(ClO_4)_2$ 4.75% ; H_2O 30.93% .

Strontium perchlorate has a strong salting-out effect on barium perchlorate.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0] (2) Cerium perchlorate; $Ce(ClO_4)_3$; [14017-47-1] (3) Water; H_2O; [7732-18-5]	Guseva, A.D.; Druzhinina, G.V. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1975, *144*, 81-5.
VARIABLES: One temperature, 298 K. Composition.	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility System $Sr(ClO_4)_2$-$Ce(ClO_4)_3$-H_2O at 25°C :

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
75.01	-	15.877	-	10.476	-	$Sr(ClO_4)_2 \cdot 4H_2O$
67.86	6.12	13.972	0.823	9.102	0.536	"
58.73	14.79	11.997	1.974	7.741	1.274	"
50.75	22.34	10.287	2.959	6.582	1.893	"
41.07	31.86	8.340	4.228	5.295	2.684	$Sr(ClO_4)_2 \cdot 4H_2O$ + $Ce(ClO_4)_3 \cdot 9H_2O$
41.24	31.53	8.333	4.163	5.286	2.641	" "
36.47	35.16	7.142	4.499	4.487	2.826	$Ce(ClO_4)_3 \cdot 9H_2O$
30.43	40.10	5.793	4.988	3.604	3.103	"
14.57	53.30	2.600	6.215	1.583	3.783	"
8.21	58.07	1.410	6.515	0.850	3.928	"
-	64.62	-	6.980	-	4.166	"

[a] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
No details. Cerium ion was determined by complexometric titration with Trilon B in the presence of urotropin and the indicator xylenol orange. Perchlorate was determined gravimetrically as nitron perchlorate.	Not stated.
	ESTIMATED ERROR: Not stated.
	REFERENCES:

(continued next page)

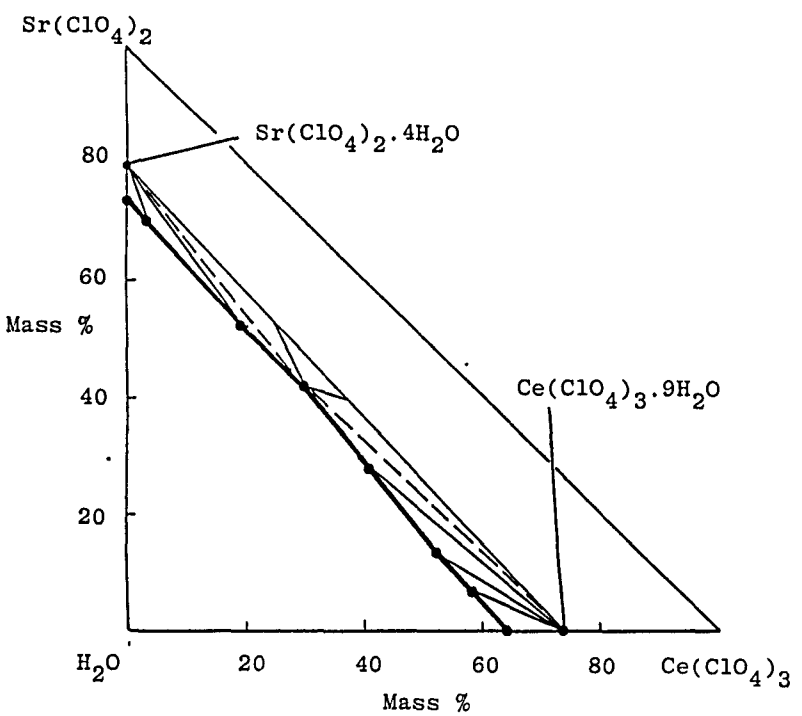
COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	Guseva, A.D.; Druzhinina, G.V.
(2) Cerium perchlorate; $Ce(ClO_4)_3$; [14017-47-1]	*Sb. Tr. Yarosl. Gos. Ped. Inst.* 1975, *144*, 81-5.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS / ADDITIONAL DATA

The solubility isotherm at 298 K, given below, does not indicate the formation of new solid phases in the system in addition to the solids $Ce(ClO_4)_3.9H_2O$ and $Sr(ClO_4)_2.4H_2O$. The eutectic composition (mass %) was : 31.68% $Ce(ClO_4)_3$; 41.15% $Sr(ClO_4)_2$; 27.17% H_2O.

The almost linear configuration of the isotherm is attributed to the high comparable solubilities of both salts in the system, and they have equal salting-out effects.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0] (2) Praseodymium perchlorate; $Pr(ClO_4)_3$; [13498-07-2] (3) Water; H_2O; [7732-18-5]	Runov, N.N.; Novikov, V.V. *Uch. Zap. Yarosl. Gos. Ped. Inst.* <u>1975</u>, *144*, 37-9.
VARIABLES: One temperature: 298 K. Composition.	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility system $Sr(ClO_4)_2$-$Pr(ClO_4)_3$-H_2O at 25°C :

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	64.89	-	7.046	-	4.208	$Pr(ClO_4)_3.9H_2O$
14.22	50.12	2.316	5.324	1.392	3.200	"
33.92	32.09	5.697	3.515	3.483	2.149	"
35.15	31.74	6.035	3.555	3.705	2.182	"
39.14	27.64	6.685	3.079	4.112	1.894	$Pr(ClO_4)_3.9H_2O$ + $Sr(ClO_4)_2.4H_2O$
52.02	15.94	9.095	1.818	5.667	1.133	$Sr(ClO_4)_2.4H_2O$
75.52	-	16.246	-	10.767	-	"

[a] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Solubility equilibrium was attained in 2 - 3 days. Details of method not given. Pr^{3+} was determined by complexometric titration with Trilon B ; perchlorate gravimetrically as nitron perchlorate. Solid phase compositions were determined using Schreinemakers' method.	$Pr(ClO_4)_3$ was prepared from very pure grade Pr_6O_{11} and 57% chemically pure perchloric acid. The dissolution was slow (6-8 h) with slight heating. Recrystallized salt washed with ether to remove excess perchloric acid. All the salts used were chemically pure.
	ESTIMATED ERROR: Not stated.
	REFERENCES: None.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	Guseva, A.D.; Golubkova, O.N.
(2) Samarium perchlorate; $Sm(ClO_4)_3$; [13569-60-3]	*Sb. Tr. Yarosl. Gos. Ped. Inst.* 1979, *178*, 3-6.
(3) Water; H_2O; [7732-18-5]	
VARIABLES:	**PREPARED BY:**
One temperature: 298 K.	E.S. Gryzlova
Composition.	

EXPERIMENTAL VALUES:

Solubility system $Sr(ClO_4)_2$-$Sm(ClO_4)_3$-H_2O at 25°C .

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
75.01	-	15.88	-	10.48	-	A
65.55	8.65	13.62	1.147	8.867	0.747	A
56.49	18.06	11.95	2.439	7.747	1.582	A
46.67	26.24	9.442	3.390	6.013	2.159	A
41.35	31.94	8.499	4.192	5.403	2.665	A + B
41.28	31.68	8.398	4.115	5.328	2.611	A + B
24.43	45.81	4.636	5.551	2.865	3.431	B
13.07	54.94	2.347	6.299	1.426	3.828	B
5.82	62.65	1.063	7.310	0.644	4.428	B
-	64.98	-	6.933	-	4.135	B

[a] Compiler's calculations. [b] A = $Sr(ClO_4)_2.4H_2O$ B = $Sm(ClO_4)_3.9H_2O$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Periods of equilibration varied from 5 to 6 days. Sm^{3+} and ClO_4^- were determined by the methods described in ref.(1); strontium by difference.

SOURCE AND PURITY OF MATERIALS:

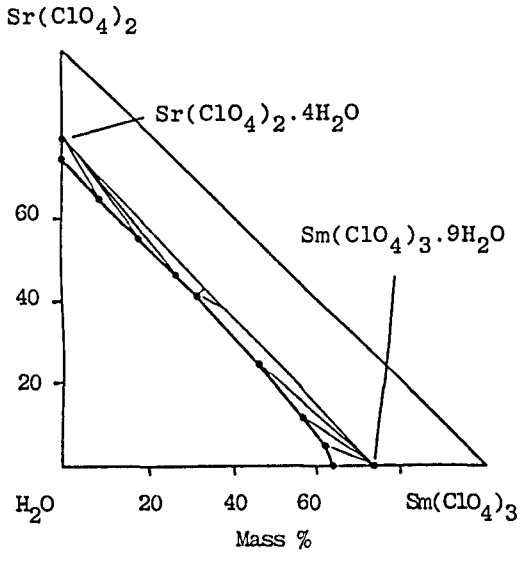
No details given.

ESTIMATED ERROR:

Not stated.

REFERENCES:

1. Guseva, A.D. in *Sb. Fizikokhimicheskie Issledovaniya Ravnovesii v Rastvorakh* 1979, *164*, 23.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0] (2) Gadolinium perchlorate; $Gd(ClO_4)_3$; [14017-52-8] (3) Water; H_2O; [7732-18-5]	Druzhinina, G.V. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1978, *169*, 31.
VARIABLES: One temperature: 298 K. Composition.	PREPARED BY: I.S. Bodnya

EXPERIMENTAL VALUES:

Solubility system $Sr(ClO_4)_2$-$Gd(ClO_4)_3$-H_2O at 25°C :

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
75.01	-	15.88	-	10.48	-	$Sr(ClO_4)_2.4H_2O$
65.93	8.01	13.58	1.078	8.830	0.701	"
51.14	22.21	10.45	2.965	6.697	1.901	"
45.38	28.09	9.344	3.779	5.970	2.415	"
41.52	33.67	9.063	4.803	5.841	3.095	$Sr(ClO_4)_2.4H_2O$ + $Gd(ClO_4)_3.9H_2O$
36.52	37.06	7.594	5.035	4.824	3.199	$Gd(ClO_4)_3.9H_2O$
26.31	43.98	4.987	5.447	3.091	3.376	"
14.05	52.51	2.422	5.914	1.466	3.581	"
4.48	61.12	0.757	6.752	0.455	4.052	"
-	64.62	-	6.980	-	4.166	"

[a] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Gadolinium ion was determined by potentiometric titration with EDTA, using xylenol orange as indicator in the presence of urotropin buffer, pH = 5-6 , (Ref. 1); perchlorate ion determined gravimetrically as nitron perchlorate, (Ref. 2). Solid phase compositions were determined using Schreinemakers' method.	The starting salts were prepared by reacting the appropriate carbonates with 57% $HClO_4$ and recrystallizing. Excess acid was washed away with ether. Both hydrates were stored in a desiccator containing phosphorus anhydride.
	ESTIMATED ERROR: Not stated.

REFERENCES:

1. Nikolaev, N.; ed. *Radiochemistry*, Moscow, Vyssh. Shkola, 1969, 296.
2. Loebich, O.Z. *Z. Analyt. Chem.* 1926, *68*, 34.

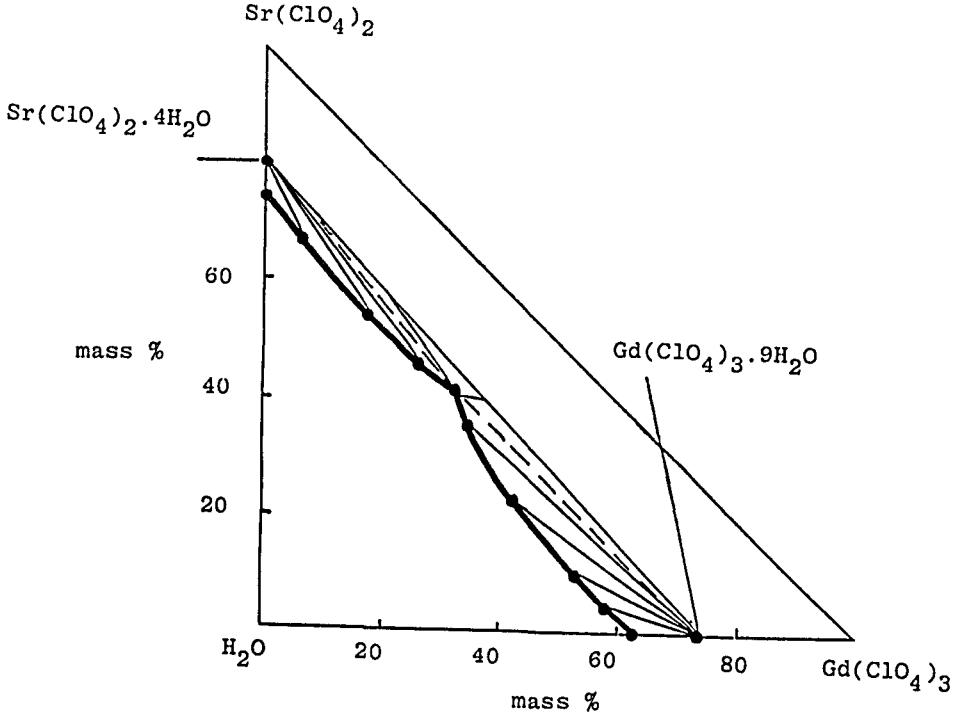
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	Druzhinina, G.V.
(2) Gadolinium perchlorate; $Gd(ClO_4)_3$; [14017-52-8]	*Sb. Tr. Yarosl. Gos. Ped. Inst.* 1978, *169*, 31.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS /ADDITIONAL DATA

The solubility isotherm for the system $Sr(ClO_4)_2$ - $Gd(ClO_4)_3$ - H_2O at 25°C , as shown below, consists of two branches, one corresponding to the crystallization of $Sr(ClO_4)_2.4H_2O$ and the other to that of $Gd(ClO_4)_3.9H_2O$.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0] (2) Carbamide (*urea*); CH_4N_2O; [57-13-6] (3) Water; H_2O; [7732-18-5]	Runov, N.N.; Zakharova, V.P. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1972, *103*, 67-72.
VARIABLES: One temperature, 298 K. Composition.	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility System $Sr(ClO_4)_2$-CH_4N_2O-H_2O at 25°C :

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		Solute mol %[a]		
(1)	(2)	(1)	(2)	(1)	(2)	
-	54.53	-	26.46	-	100.00	A
17.94	52.06	2.413	33.41	6.74	93.26	A
34.67	55.53	7.612	58.17	11.57	88.43	A
39.06	59.85	11.423	83.51	12.03	87.97	A + B
45.61	49.97	12.873	67.29	16.06	83.94	B
50.71	44.10	14.756	61.22	19.42	80.58	B
54.77	33.40	13.615	39.61	25.58	74.42	C
61.21	21.94	14.108	24.13	36.90	63.10	C
68.90	12.08	16.059	13.43	54.45	45.55	C + D
69.82	9.45	15.704	10.14	60.76	39.24	D
71.13	7.36	15.865	7.83	66.95	33.05	D
74.72	4.15	17.353	4.60	79.05	20.95	D + E
74.20	2.80	16.367	2.95	84.74	15.26	E
75.53	-	16.253	-	100.00	-	E

[a] Compiler's calculations.

[b] A = CH_4N_2O B = $Sr(ClO_4)_2.5CH_4N_2O$
C = $Sr(ClO_4)_2.2CH_4N_2O$ D = $Sr(ClO_4)_2.CH_4N_2O.H_2O$
E = $Sr(ClO_4)_2.4H_2O$

AUXILIARY INFORMATION

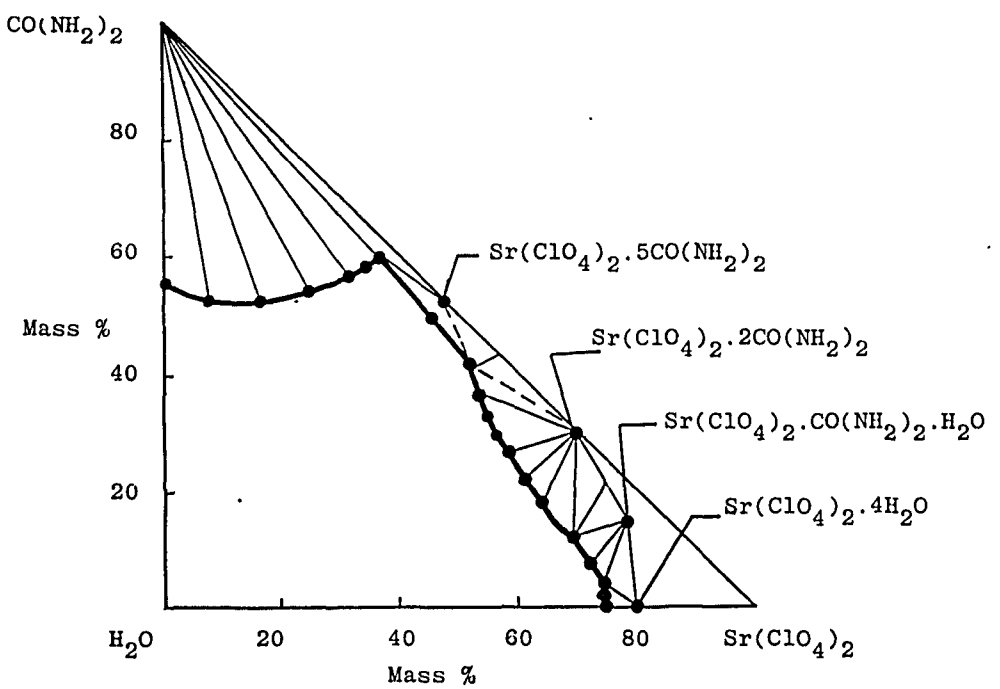
METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Conditions of saturation not given. Sr^{2+} was determined by complexometric titration at pH 11 in the presence of $Mg(NO_3)_2$; carbamide by the Kjeldahl method. Thermographic studies of the solid phases were carried out.	Strontium perchlorate was obtained by neutralization of strontium carbonate with perchloric acid and purified by recrystallization.
	ESTIMATED ERROR: Not stated.
	REFERENCES: (continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	Runov, N.N.; Zakharova, V.P.
(2) Carbamide (*urea*); CH_4N_2O; [57-13-6]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1972, *103*, 67-72.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES:(continued)

COMMENTS / ADDITIONAL DATA

The isotherm consists of five branches corresponding to the following solid phases : $Sr(ClO_4)_2.4H_2O$; CH_4N_2O;
$Sr(ClO_4)_2.CH_4N_2O.H_2O$ (incongruently soluble);
$Sr(ClO_4)_2.2CH_4N_2O$ (congruently soluble) ; and
$Sr(ClO_4)_2.5CH_4N_2O$.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0] (2) Thiocarbamide (*thiourea*); CH_4N_2S; [62-56-6] (3) Water; H_2O; [7732-18-5]	Karnaukhov, A.S.; Zakharova, V.P. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *79*, 107-14.
VARIABLES: One temperature: 298 K. Composition.	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility system $Sr(ClO_4)_2$-$CS(NH_2)_2$-H_2O at 25°C :

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	14.26	-	3.787	-	2.185	A
10.01	13.09	0.781	3.842	0.454	2.236	A
21.26	11.44	1.874	3.795	1.103	2.233	A
30.80	10.46	3.067	3.920	1.830	2.339	A
44.43	8.72	5.403	3.991	3.310	2.445	A
53.73	8.20	7.786	4.473	4.926	2.830	A
58.07	7.81	9.216	4.665	5.940	3.007	A
65.77	7.02	12.529	5.034	8.436	3.389	A
68.74	6.71	14.189	5.214	9.772	3.591	A
71.62	6.67	16.203	5.680	11.514	4.036	A
71.65	6.65	16.218	5.666	11.524	4.026	A + B
71.64	6.63	16.201	5.644	11.506	4.008	B
73.52	3.61	16.307	3.014	11.220	2.074	B
75.53	-	16.253	-	10.773	-	B

[a] Compiler's calculations.

[b] A = $CS(NH_2)_2$; B = $Sr(ClO_4)_2.2H_2O$ (This could be erroneous as the solid phase should more likely be the tetrahydrate (Evaluator)).

AUXILIARY INFORMATION

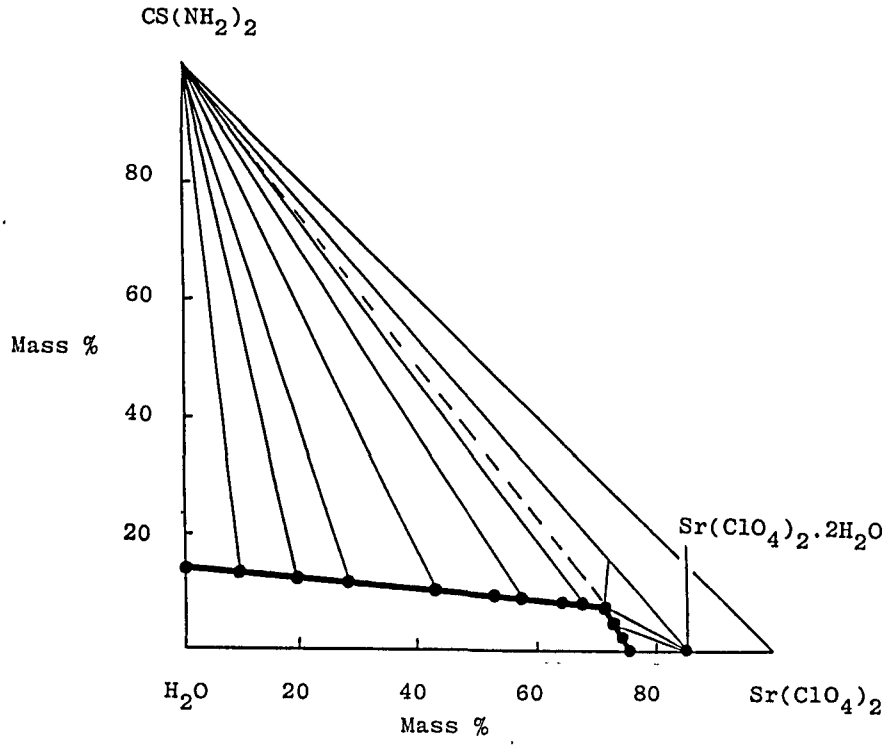
METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Solubility equilibrium at each data point was attained after periods of between 24-168h. Sr^{2+} was determined by titration with Trilon B in the presence of a magnesium salt at pH 11-12 and CH_4N_2S was determined by the Kjeldahl method. Solid phase compositions were determined using Schreinemakers' method.	$Sr(ClO_4)_2$ prepared from chemically pure $SrCO_3$ and reagent-grade $HClO_4$ and recrystallized. Chemically pure CH_4N_2S further purified by recrystallization.
	ESTIMATED ERROR: Not stated.
	REFERENCES: (continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]	Karnaukhov, A.S.; Zakharova, V.P.
(2) Thiocarbamide (*thiourea*); CH_4N_2S; [62-56-6]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *79*, 107-14.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES:(continued)

COMMENTS / ADDITIONAL DATA

The solubility isotherm given below has two branches, one corresponding to the crystallization of $Sr(ClO_4)_2.2H_2O$ and the other to that of $CS(NH_2)_2$. The average mass % composition of the eutectic solution consists of 6.65% $CS(NH_2)_2$; 71.65% $Sr(ClO_4)_2$; and 21.70% H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [1350-97-0] (2) Hexamethylenetetramine; $C_6H_{12}N_4$; [100-97-0] (3) Water; H_2O; [7732-18-5]	Bogachev, A.V.; Karnaukhov, A.S. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1978, *169*, 31-33.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: I.S. Bodnya

EXPERIMENTAL VALUES:

Solubility in the system $Sr(ClO_4)_2$ - $C_6H_{12}N_4$-water at 25°C .

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	46.52	-	10.05	-	6.205	A
8.18	44.13	0.955	10.54	0.599	6.601	A
17.87	43.46	2.476	12.31	1.613	8.017	A + B
20.22	34.34	2.487	8.632	1.553	5.391	B
31.07	22.24	3.793	5.549	2.323	3.398	B
41.76	15.32	5.526	4.143	3.396	2.546	B
43.10	15.04	5.828	4.156	3.594	2.563	B + C
50.33	10.77	7.283	3.185	4.516	1.975	C
54.54	9.48	8.441	2.999	5.291	1.879	C + D
68.06	2.60	12.60	0.984	8.096	0.632	D
74.47	1.78	16.34	0.798	10.94	0.535	D + E
75.52	-	16.25	-	10.77	-	E

[a] Compiler's calculations.

[b] A = $C_6H_{12}N_4$ B = $Sr(ClO_4)_2 \cdot 2C_6H_{12}N_4 \cdot 8H_2O$

C = $2Sr(ClO_4)_2 \cdot 3C_6H_{12}N_4 \cdot 12H_2O$ D = $Sr(ClO_4)_2 \cdot C_6H_{12}N_4 \cdot 4H_2O$

E = $Sr(ClO_4)_2 \cdot 4H_2O$

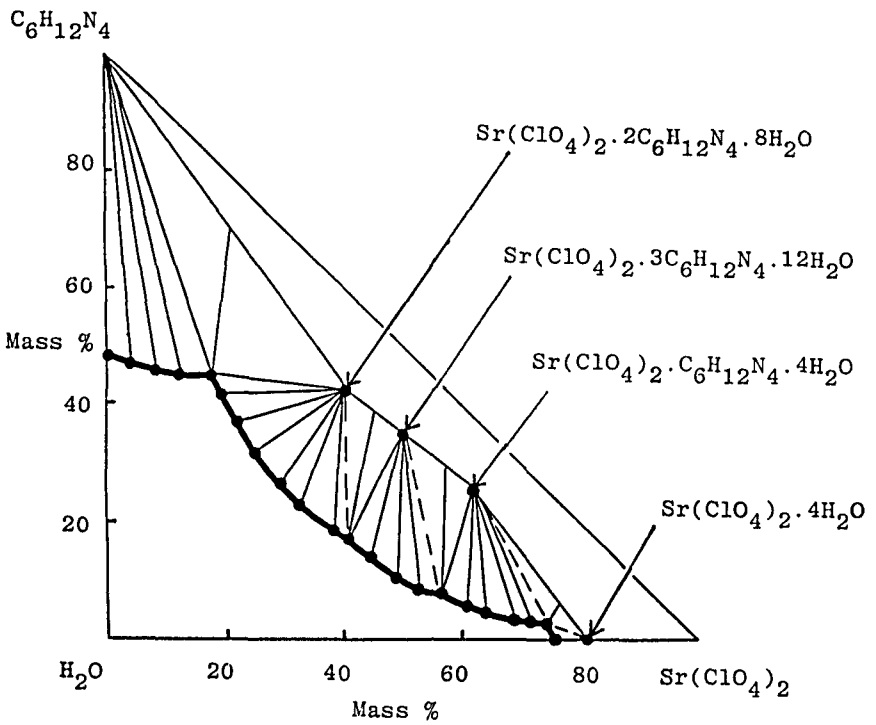
AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Solubility equilibrium in the system required 2-3 weeks. $C_6H_{12}N_4$ content was determined via acid hydrolysis, distillation of liberated ammonia into boric acid and analysis of the ammonia. Sr^{2+} was determined by titration using Trilon B. Solid phase composition was determined using Schreinemakers' method.	Not stated. ESTIMATED ERROR: Not stated. REFERENCES: (continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [1350-97-0]	Bogachev, A.V.; Karnaukhov, A.S.
(2) Hexamethylenetetramine; $C_6H_{12}N_4$; [100-97-0]	*Sb. Tr. Yarosl. Gos. Ped. Inst.* 1978, *169*, 31-33.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS/ADDITIONAL DATA : The solubility isotherm in the diagram shown below shows several branches corresponding to the formation of the following solid phases : $C_6H_{12}N_4$, $Sr(ClO_4)_2.2C_6H_{12}N_4.8H_2O$, $2Sr(ClO_4)_2.3C_6H_{12}N_4.12H_2O$, $Sr(ClO_4)_2.C_6H_{12}N_4.4H_2O$, and $Sr(ClO_4)_2.4H_2O$.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [1350-97-0] (2) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (3) Hexamethylenetetramine; $C_6H_{12}N_4$; [100-97-0] (4) Water; H_2O; [7732-18-5]	Bogachev, A.V.; Lepeshkov, I.N. *Zh. Neorg. Khim.* 1982, *27*, 1605-6; **Russ. J. Inorg. Chem. Engl. Transl.)* 1982, *27*, 907-8.
VARIABLES: One temperature: 298 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

Solubility in the system $Sr(ClO_4)_2$-$Ba(ClO_4)_2$-$C_6H_{12}N_4$-water at 25°C :

Liquid phase composition [a]									Solid phase [c]
mass %			mol % [b]			molality[b] / mol kg^{-1}			
(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	
64.32	4.75	-	11.480	0.722	-	7.258	0.457	-	A+B
58.54	9.18	2.81	10.825	1.446	1.062	6.933	0.926	0.680	A+B+C
51.90	14.46	3.58	9.443	2.242	1.331	6.026	1.431	0.850	B+C

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
The method involved adding the third component to the sat. eutonic sln. under isothermal conditions and in the presence of excess solid phase until a new solid phase appeared. Compositions of liquid and solid phases were determined from analyses of the ions as follows: perchlorate gravimetrically with nitron; barium with potassium dichromate; strontium by difference from total perchlorate concentration. $C_6H_{12}N_4$ determined via initial hydrolysis, distillation of the hydrolysis product into alkali and analysis of ammonia in the distillate. Saturation equilibria were attained after continuous stirring for 12-15 days in a thermostat.

SOURCE AND PURITY OF MATERIALS:
No information.

ESTIMATED ERROR:
Not stated.

REFERENCES:

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [1350-97-0]	Bogachev, A.V.; Lepeshkov, I.N.
(2) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	*Zh. Neorg. Khim.* 1982, *27*, 1605-6; **Russ. J. Inorg. Chem. Engl. Transl.)* 1982, *27*, 907-8.
(3) Hexamethylenetetramine; $C_6H_{12}N_4$; [100-97-0]	
(4) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility in the system $Sr(ClO_4)_2$-$Ba(ClO_4)_2$-$C_6H_{12}N_4$-water at 25°C :

Liquid phase composition[a]									Solid phase[c]
mass %			mol %[b]			molality[b] / mol kg^{-1}			
(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	
33.85	25.40	5.53	5.399	3.452	1.803	3.354	2.145	1.120	B+C+D
32.61	32.24	6.49	6.163	5.192	2.507	3.971	3.346	1.615	B+D+E
23.10	40.73	7.41	4.356	6.544	2.856	2.803	4.212	1.838	B+E+F
-	65.15	6.34	-	10.637	2.483	-	6.796	1.586	B+F
74.47	-	1.78	16.337	-	0.80	10.944	-	0.535	A+C
54.54	-	9.48	8.441	-	2.999	5.291	-	1.879	C+D
43.10	-	15.04	5.828	-	4.156	3.594	-	2.563	D+E
16.72	37.49	12.42	2.765	5.282	4.197	1.749	3.341	2.655	E+F+G
6.21	21.04	36.29	0.916	2.644	10.94	0.594	1.716	7.10	E+G+H
17.87	-	43.46	2.476	-	12.31	1.613	-	8.02	E+H
-	26.45	39.06	-	3.463	12.27	-	2.281	8.08	G+H

[a] Data for the ternary systems tabulated by the authors were obtained from their previous publications (see the relevant Compilations for these systems).

[b] Compiler's calculations.

[c] A = $Sr(ClO_4)_2.4H_2O$ B = $Ba(ClO_4)_2.3H_2O$;

C = $Sr(ClO_4)_2.C_6H_{12}N_4.4H_2O$; D = $2Sr(ClO_4)_2.3C_6H_{12}N_4.12H_2O$;

E = $Sr(ClO_4)_2.2C_6H_{12}N_4.8H_2O$; F = $Ba(ClO_4)_2.C_6H_{12}N_4.4H_2O$;

G = $Ba(ClO_4)_2.2C_6H_{12}N_4.6H_2O$; H = $C_6H_{12}N_4$

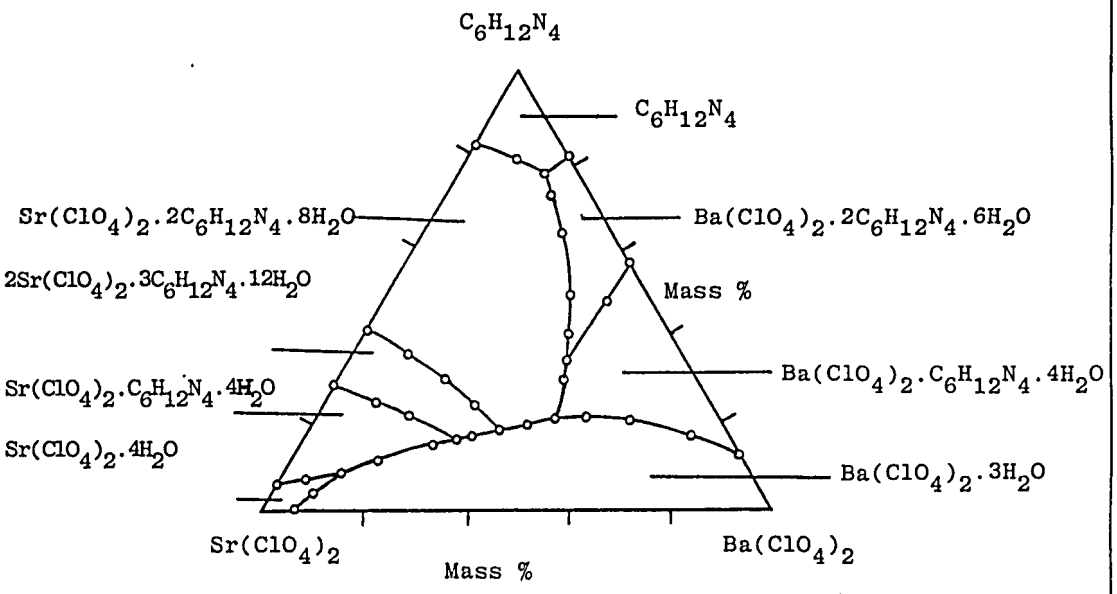
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [1350-97-0] (2) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (3) Hexamethylenetetramine; $C_6H_{12}N_4$; [100-97-0] (4) Water; H_2O; [7732-18-5]	Bogachev, A.V.; Lepeshkov, I.N. *Zh. Neorg. Khim.* 1982, *27*, 1605-6; **Russ. J. Inorg. Chem. Engl. Transl.)* 1982, *27*, 907-8.

EXPERIMENTAL VALUES: (continued)

COMMENTS / ADDITIONAL DATA

The solubility phase diagram for the system $Sr(ClO_4)_2$-$Ba(ClO_4)_2$-$C_6H_{12}N_4$-water at 25°C is shown below. The crystallization fields of eight apparent solid phases are indicated. The largest crystallization field (32.84%) is occupied by the congruently soluble compound $Sr(ClO_4)_2.2C_6H_{12}N_4.8H_2O$.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0] (2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9] (3) Strontium nitrate; $Sr(NO_3)_2$; [10042-76-9] (4) Ammonium nitrate; NH_4NO_3; [6484-52-2] (5) Water; H_2O; [7732-18-5]	Bogachev, A.V.; Karnaukhov, A.S.; Lepeshkov, I.N. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1975, *144*, 33-6.
VARIABLES: One temperature, 298 K. Composition.	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility system Sr^{2+}, $2NH_4^+$ // $2ClO_4^-$, $2NO_3^-$ - water at 25.0°C:

Liquid phase composition								Solid Phase[a]
mass %				molality[b]/mol kg^{-1}				
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
73.76	1.18	-	-	10.273	0.401	-	-	A + B
71.35	0.67	3.20	-	10.049	0.230	0.610	-	A + B + C
30.68	3.34	18.05	-	2.234	0.593	1.779	-	B + C
11.37	5.84	32.68	-	0.792	0.992	3.082	-	B + C + D
-	7.53	40.84	3.16	-	1.322	3.981	0.814	B + D
-	5.18	37.64	10.68	-	0.948	3.825	2.869	B + C + D
-	5.05	28.90	32.06	-	1.265	4.018	11.78	B + C
-	4.57	19.16	48.40	-	1.396	3.248	21.70	B + C + E
-	4.36	14.48	52.92	-	1.314	2.423	23.41	B + E
-	6.18	-	63.55	-	1.738	-	26.23	B + E
71.44	-	3.26	-	9.855	-	0.609	-	A + C
19.24	-	30.53	-	1.337	-	2.872	-	A + C
-	-	41.70	11.43	-	-	4.204	3.047	C + E
-	-	22.47	50.28	-	-	3.896	23.05	C + E

[a] A=$Sr(ClO_4)_2.4H_2O$; B=NH_4ClO_4; C=$Sr(NO_3)_2$; D=$Sr(NO_3)_2.4H_2O$; E=NH_4NO_3

[b] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Soly equilibrium attained in 4-5h but details not given. Sr^{2+} determined by titration with Trilon B in the presence of chrome blue black at pH 10-11; NO_3^- was first reduced to ammonia with Devarda's alloy and then distilled into a sat. sln. of H_2SO_4. NH_4^+ was determined by distillation into 4% boric acid and titration with 0.05 mol L^{-1} H_2SO_4 solution. Solid phase composition was determined using Schreinemakers' method.

SOURCE AND PURITY OF MATERIALS:	ESTIMATED ERROR:
The reagent grade salts were purified by recrystallization.	Precision in temp. ±0.1°C.

(continued next page)

COMPONENTS:

(1) Strontium perchlorate; $Sr(ClO_4)_2$; [13450-97-0]

(2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]

(3) Strontium nitrate; $Sr(NO_3)_2$; [10042-76-9]

(4) Ammonium nitrate; NH_4NO_3; [6484-52-2]

(5) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Bogachev, A.V.; Karnaukhov, A.S.; Lepeshkov, I.N.

Uch. Zap. Yarosl. Gos. Ped. Inst. 1975, *144*, 33-6.

EXPERIMENTAL VALUES: (continued)

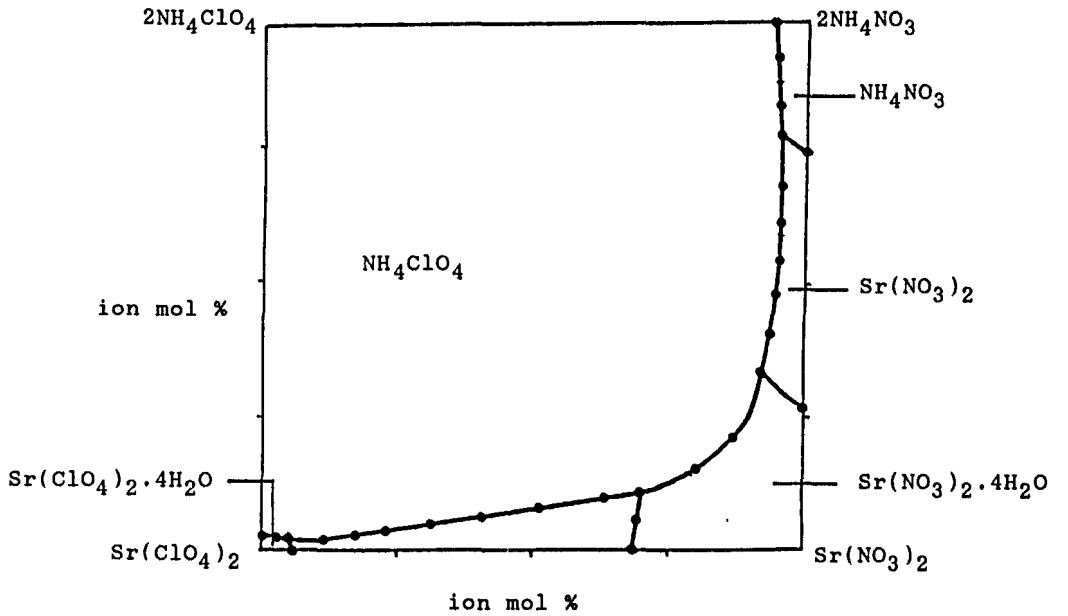
Solubility system Sr^{2+}, $2NH_4^+$ // $2ClO_4^-$, $2NO_3^-$ - water at 25.0°C:

Liquid phase composition, mol %[b]				Liquid phase composition, ion mol %				Solid phase[a]
(1)	(2)	(3)	(4)	Sr^{2+}	$2NH_4^+$	$2NO_3^-$	$2ClO_4^-$	
15.522	0.606	-	-	98.09	1.91	-	100.00	A + B
15.135	0.347	0.919	-	98.93	1.07	5.66	94.34	A + B + C
3.716	0.987	2.960	-	93.12	6.88	41.29	58.71	B + C
1.312	1.643	5.104	-	88.65	11.35	70.53	29.47	B + C + D
-	2.146	6.461	1.322	78.84	21.16	86.91	13.09	B + D
-	1.501	6.057	4.544	66.71	33.29	91.73	8.27	B + C + D
-	1.742	5.536	16.24	38.11	61.89	94.00	6.00	B + C
-	1.705	3.969	26.51	21.96	78.04	95.28	4.72	B + C + E
-	1.590	2.931	28.32	16.39	83.61	95.56	4.44	B + E
-	2.082	-	31.42	-	100.00	93.79	6.21	B + E
14.938	-	0.923	-	100.00	-	5.82	94.18	A + C
2.239	-	4.809	-	100.00	-	68.24	31.76	A + C
-	-	6.699	4.855	73.40	26.60	100.00	-	C + E
-	-	4.725	27.96	25.26	74.74	100.00	-	C + E

[a] A=$Sr(ClO_4)_2.4H_2O$; B=NH_4ClO_4; C=$Sr(NO_3)_2$; D=$Sr(NO_3)_2.4H_2O$; E=NH_4NO_3

[b] Compiler's calculations

COMMENTS AND/OR ADDITIONAL DATA: The solubility phase diagram reproduced below includes data points not tabulated in the original reference.



COMPONENTS:

(1) Strontium perchlorate; $Sr(ClO_4)_2$ [13450-97-01]

(2) Strontium chloride; $SrCl_2$; [10476-85-4]

(3) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]

(4) Ammonium chloride; NH_4Cl; [12125-02-9]

(5) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Lepeshkov, I.N., Sudakova, A.A.,

Zh. Neorg. Khim. 1975, *20*, 559-62; *Russ. J. Inorg. Chem.* Engl. Transl.) 1975, *20*, 312-4.

VARIABLES:

One temperature: 298 K

Composition.

PREPARED BY:

W.L. Ng

EXPERIMENTAL VALUES:

Saturated solution compositions of the aqueous reciprocal salt system $Sr^{2+},NH_4^+//ClO_4^-,Cl^--H_2O$ at 25°C :

	mass %					ion mol[a] %		ion mol %		solid
	(1)	(2)	(3)	(4)	(5)	Sr^{2+}	$2NH_4^+$	$2ClO_4^-$	$2Cl^-$	phase[c]
1	-	-	4.21	26.18	69.61	-	100.00	6.79	93.21	A+B
2	-	5.20	3.77	23.08	67.95	13.00 (12.39)[b]	87.00 (87.61)[b]	6.06	93.94	"
3	-	12.52	3.55	18.30	65.63	29.78	70.22	5.69	94.31	"
4	-	20.12	3.32	14.09	62.47	46.48 (46.53)[b]	53.52 (53.47)[b]	5.67 (5.18)[b]	94.33 (94.82)[b]	"
5	-	30.04	-	9.93	60.03	67.06 (67.12)[b]	32.94 (32.88)[b]	-	100.00	B+C
6	-	29.55	0.98	9.89	59.58	66.08 (65.67)[b]	33.92 (34.33)[b]	1.48	98.52	"

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details of saturation method were not given. Sr^{2+} was determined complexometrically, NH_4^+ by distilling off NH_3 into 4% HNO_3 with subsequent titration with H_2SO_4; Cl^- by argentimetry (no mention was made as to whether it was gravimetric or volumetric), ClO_4^- by difference.

SOURCE AND PURITY OF MATERIALS:

Not stated.

ESTIMATED ERROR:

Not stated, insufficient data for compiler to estimate error.

REFERENCES:

(continued next page)

COMPONENTS:

(1) Strontium perchlorate; $Sr(ClO_4)_2$ [13450-97-01]

(2) Strontium chloride; $SrCl_2$; [10476-85-4]

(3) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]

(4) Ammonium chloride; NH_4Cl; [12125-02-9]

(5) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Lepeshkov, I.N., Sudakova, A.A.,

Zh. Neorg. Khim. 1975, *20*, 559-62; *Russ. J. Inorg. Chem.* Engl. Transl.) 1975, *20*, 312-4.

EXPERIMENTAL VALUES: (continued)

	mass %					ion mole[a] %		ion mol %		solid
	(1)	(2)	(3)	(4)	(5)	Sr^{2+}	$2NH_4^+$	$2ClO_4^-$	$2Cl^-$	phase[c]
7	-	30.52	2.54	9.17	57.77	66.41 (66.60)[b]	33.59 (33.40)[b]	3.73	96.27	A+B+C
8	-	31.72	2.81	8.96	56.51	78.10 (67.64)[b]	21.90 (32.36)[b]	4.67 (4.04)[b]	95.33 (95.96)[b]	A+C
9	-	32.89	6.28	-	60.83	89.01 (88.59)[b]	10.99 (11.41)[b]	10.99 (11.41)[b]	89.01 (88.59)[b]	"
10	12.65	27.61	3.42	-	56.32	93.75	6.25	21.55 (25.27)[b]	78.45 (74.79)[b]	"
11	16.29	25.34	-	1.54	56.83	93.94 (93.77)[b]	6.06 (6.23)[b]	24.21 (24.60)[b]	75.79 (75.40)[b]	"
12	24.03	22.01	-	1.33	52.53	94.62 (94.71)[b]	5.38 (5.29)[b]	35.47 (35.67)[b]	64.53 (64.33)[b]	"
13	26.21	19.28	2.83	-	51.68	94.65	5.35	45.02 (45.98)[b]	54.98 (54.02)[b]	"
14	35.72	12.64	2.42	-	49.22	95.52 (95.20)[b]	4.48 (4.80)[b]	59.61 (62.86)[b]	40.39 (37.14)[b]	"
15	52.30	6.81	-	0.91	39.98	96.33	3.67	77.99	22.01	"
16	55.43	5.74	-	0.88	37.95	96.86 (96.54)[b]	3.38 (3.46)[b]	81.77 (81.33)[b]	18.23 (18.67)[b]	"
17	62.83	4.54	-	0.92	31.71	96.54 (96.65)[b]	3.46 (3.35)[b]	84.93 (85.48)[b]	15.07 (14.52)[b]	"
18	64.84	3.14	-	0.91	31.11	96.67	3.33	88.85	11.15	"
19	66.99	1.83	-	0.72	30.46	97.24 (97.33)[b]	2.76 (2.67)[b]	92.53 (92.75)[b]	7.45 (7.25)[b]	"
20	72.02	1.42	-	-	26.56	100.00	-	96.43 (96.56)[b]	3.57 (3.44)[b]	C+D
21	68.75	1.91	1.21	-	28.13	97.69 (98.00)[b]	2.31 (2.00)[b]	95.32	4.68	A+C+D
22	70.43	0.78	1.17	-	27.62	97.78 (98.05)[b]	2.22 (1.95)[b]	97.56 (98.08)[b]	2.44 (1.92)[b]	A+D
23	74.32	-	1.19	-	24.49	98.16 (98.09)[b]	1.84 (1.91)[b]	100.00	-	"

[a] $$x(2NH_4^+) = \frac{0.5\ n(NH_4^+)}{0.5\ n(NH_4^+) + n(Sr^{2+})} = 1 - x(Sr^{2+})$$

$$x(2ClO_4^-) = \frac{0.5\ n(ClO_4^-)}{0.5\ n(NH_4^+) + n(Sr^{2+})} = 1 - x(2Cl^-)$$

[b] Data in parentheses calculated by compiler. The given data appear to be in error.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$ [13450-97-01]	Lepeshkov, I.N., Sudakova, A.A.,
(2) Strontium chloride; $SrCl_2$; [10476-85-4]	*Zh. Neorg. Khim.* 1975, *20*, 559-62; **Russ. J. Inorg. Chem.* Engl. Transl.) 1975, *20*, 312-4.
(3) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	
(4) Ammonium chloride; NH_4Cl; [12125-02-9]	
(5) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

	mole[d]%					molality[d]/mol kg^{-1}				Solid
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	phase[c]
1	-	-	0.817	11.15	88.03	-	-	0.515	7.031	A+B
2	-	0.768	0.752	10.11	88.37	-	0.472	0.472	6.350	"
3	-	1.930	0.738	8.358	88.98	-	1.203	0.461	5.213	"
4	-	3.267	0.727	6.780	89.23	-	2.031	0.452	4.217	"
5	-	5.113	-	5.01	89.88	-	3.157	-	3.09	B+C
6	-	5.054	0.23	5.06	89.66	-	3.129	0.14	3.13	"
7	-	5.361	0.602	4.77	89.27	-	3.332	0.374	2.97	A+B+C
8	-	5.673	0.678	4.75	88.90	-	3.541	0.423	2.96	A+C
9	-	5.704	1.47	-	92.83	-	3.411	0.879	-	"
10	1.309	5.163	0.863	-	92.67	0.7839	3.092	0.517	-	"
11	1.673	4.703	-	0.847	92.78	1.000	2.813	-	0.507	"
12	2.652	4.390	-	0.786	92.17	1.597	2.643	-	0.473	"
13	2.946	3.917	0.776	-	92.35	1.770	2.353	0.466	-	"
14	4.214	2.700	0.697	-	92.40	2.533	1.620	0.418	-	"
15	7.417	1.75	-	0.69	90.14	4.566	1.075	-	0.43	"
16	8.225	1.54	-	0.70	89.53	5.098	0.954	-	0.43	"
17	10.84	1.42	-	0.85	86.89	6.915	0.903	-	0.54	"
18	11.38	1.00	-	0.86	86.76	7.274	0.636	-	0.55	"
19	12.00	0.592	-	0.69	86.72	7.676	0.379	-	0.44	"
20	14.50	0.516	-	-	85.00	9.464	0.337	-	-	C+D
21	13.16	0.661	0.565	-	85.61	8.530	0.428	0.366	-	A+C+D
22	13.71	0.27	0.555	-	85.46	8.899	0.18	0.361	-	A+D
23	15.92	-	0.622	-	83.46	10.59	-	0.414	-	"

[c] A: NH_4ClO_4, C: $SrCl_2.H_2O$
B: NH_4Cl D: $Sr(ClO_4)_2.4H_2O$

[d] Calculated by compiler.

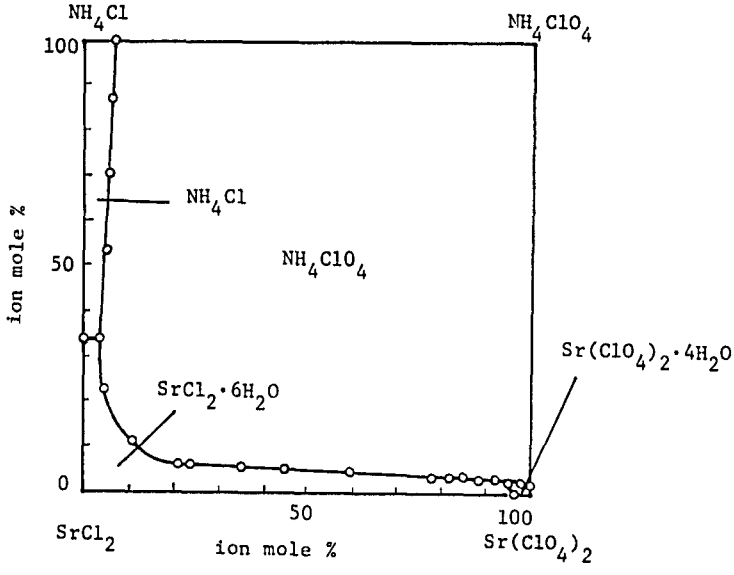
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Strontium perchlorate; $Sr(ClO_4)_2$ [13450-97-01]	Lepeshkov, I.N., Sudakova, A.A.,
(2) Strontium chloride; $SrCl_2$; [10476-85-4]	*Zh. Neorg. Khim.* 1975, *20*, 559-62; **Russ. J. Inorg. Chem.* Engl. Transl.) 1975, *20*, 312-4.
(3) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	
(4) Ammonium chloride; NH_4Cl; [12125-02-9]	
(5) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA

In the Janecke diagram there are four crystallization fields of which NH_4ClO_4 has the largest area (89.51%). This indicates that NH_4ClO_4 has the lowest solubility of the salts of the system. To the left and below the NH_4ClO_4 field are the crystallization fields of NH_4Cl (3.68%) and $SrCl_2.6H_2O$ (6.71%) respectively. The crystallization field of $Sr(ClO_4)_2.4H_2O$ (0.02%) is extremely small due to its high solubility and strong salting-out action on the other components.



COMPONENTS:	EVALUATOR:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	K.H. Khoo
(2) Water; H_2O; [7732-18-5]	Department of Chemistry
(3) Other solvents	University of Malaya
	59100 Kuala Lumpur, Malaysia.
	December 1987

CRITICAL EVALUATION:

Almost all the publications in the literature on the solubility of $Ba(ClO_4)_2$ in water appear in Russian journals and most of these deal with the solubility at 298 K. There are only three papers which report the solubility in water at various temperatures. One of these is the paper by Carlson (1) who determined the solubility of $Ba(ClO_4)_2$ in water at 273-413 K. However, he did not describe his method of determination and his data are 50-74% higher than the data of Lilich and Dzhurinsky (2) who reported the solubility of $Ba(ClO_4)_2$ in water at 273, 293 and 313 K. Lilich, Kurbanova and Chernykh (3) determined the solubility at 273, 298 and 323 K. There is no consistency between the results of these workers. However. at lower temperatures,there is better agreement between the results of Lilich and Dzurinsky and those of Lilich, Kurbanova and Chernykh. In view of this, the data of Carlson are to be rejected. so that the evaluation of the solubility at various temperatures is based on only two sets of data. Of these two sets,the data of Lilich, Kurbanova and Chernykh are more recent and more reliable since the time of equilibration was extended over a longer period. Abdukarimova, et al (4) measured the solubility of $Ba(ClO_4)_2$ in water at 303 K while Zaitseva and Lepeshkov (15) measured the solubility at 323 K. These two values are less reliable than the results of Lilich, Kurbanova and Chernykh as no experimental information is given in the relevant publications. Hence, only the data of Lilich, Kurbanova and Chernykh are adopted as tentative values for the solubility of $Ba(ClO_4)_2$ at the temperatures shown in Table I.

Table I. Tentative values for the solubility of $Ba(ClO_4)_2$ in water at 273 and 323 K

T/K	Solubility/mol kg^{-1}	Solid phase
273	4.68	$Ba(ClO_4)_2.4H_2O$
323	8.44	$Ba(ClO_4)_2.2H_2O$

Solubility in water at 298 K

All the measurements of the solubility of $Ba(ClO_4)_2$ in water at 298 K were obtained using the isothermal saturation method. The solid phase is $Ba(ClO_4)_2.3H_2O$. The earliest measurement was reported by Willard and Smith (5) in 1923 who claimed a precision in the solubility of the order of ± 0.05 % and constancy in temperature to within ± 0.01 K. Analysis of the saturated solutions was made using the evaporation-to-dryness

COMPONENTS:	EVALUATOR:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	K.H. Khoo Department of Chemistry University of Malaya 59100 Kuala Lumpur, Malaysia.
(2) Water; H_2O; [7732-18-5]	
(3) Other solvents	December 1987

CRITICAL EVALUATION: (continued)

method and the solubility was found to be 5.898 mol kg^{-1}. Almost fifty years later, the same value was obtained by Karnaukhov and Zakharova (6). In this and subsequent work, barium was determined either volumetrically or gravimetrically. The results of the various workers are collected in Table II. Data are given weightage according to the availability of experimental details and the reliability of the results. Points (5), (7), (8) and (16) are given one-quarter weightage since they all refer to the same measurement. The same argument applies to points (11) and (14) while point (10) is given 1/2 weightage as there is practically no experimental information in the report. This forms the basis for recommending the value for the solubility of $Ba(ClO_4)_2$ in water at 298 K as shown here.

Table II. Solubility of $Ba(ClO_4)_2$ in water at 298 K (Solid Phase:$Ba(ClO_4)_2.3H_2O$)

No.	Solubility/mol kg^{-1}	Weightage	Reference
1	5.898	2	5
2	5.898	2	6
3	5.898	1	7
4	5.898	1	3
5	5.9705	1/4	8
6	5.9866	1	9
7	5.9705	1/4	10
8	5.9705	1/4	11
9	5.8879	1	12
10	5.997	1/2	13
11	5.8694	1/2	14
12	6.008	1	15
13	5.883	1	16
14	5.8694	1/2	17
15	4.984	0	18
16	5.9705	1/4	20

Recommended value : (5.92 ± 0.04) mol kg^{-1}

Solubility in aqueous solutions of nonelectrolytes

1. Carbamide (urea). There are only two publications on solubility in the ternary system $Ba(ClO_4)_2$-CH_4N_2O-H_2O, one by Zakharova (7) at 298K and the other by Abdukarimova, et al (4) at 303 K. The data of Zakharova are considered to be tentative while the data of Abdukarimova, et al must be regarded as doubtful as no experimental information is given. The solubility isotherms are included in the compilations.

COMPONENTS:	EVALUATOR:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	K.H. Khoo
(2) Water; H_2O; [7732-18-5]	Department of Chemistry
(3) Other solvents	University of Malaya
	59100 Kuala Lumpur, Malaysia.
	December 1987

CRITICAL EVALUATION: (continued)

2. Thiocarbamide (thiourea). As with the previous system, there are only two papers on the $Ba(ClO_4)_2$-CH_4N_2S-H_2O system. The paper by Abdukarimova, et al (4) deals with the system at 303 K. Owing to a complete absence of experimental information, the results must be considered as doubtful. The other paper on the system is reported by Karnaukhov and Zakharova (6) at 298 K. There is no reason to reject their results as some precaution had been exercised to ensure the purity of the materials and the attainment of equilibrium by having an equilibration period of up to 168 hours. Hence the results of Karnaukhov and Zakharova are considered as tentative. The solubility isotherm at 298 K (see compilation) is of the eutonic type with two crystallization branches corresponding to the separation of the solid pure components. Unlike urea, there is no strong interaction between thiourea and barium perchlorate so that no double compound or solid solution is formed and the solubility of one component mutually decreases in the presence of the other.

3. Dimethylcarbamide (dimethylurea). The paper by Vasil'eva, et al (19) gives solubility data for the system $Ba(ClO_4)_2$-$C_3H_8N_2O$-H_2O at 298 K. No experimental details are given whereas the other paper by Karnaukhov, et al (16), also at 298 K, gives some experimental information. Generally, these two sets of data are in good agreement, although the disparity in the solubility of dimethylurea in pure water is about 5 %, the solubility being 3.84 mol kg^{-1} according to Vasil'eva, et al and 4.05 mol kg^{-1} according to Karnaukhov, et al. The solubility isotherm is shown in Figure 1. It has five branches of crystallization. The first branch AB corresponds to the crystallization of dimethylurea. This branch can be fitted empirically to the equation

$$m_1 = 3.8766 + 1.42745\ m_2 + 0.47350\ m_2^2 - 0.0313836\ m_2^3$$

where m_1 and m_2 are the molalities of $Ba(ClO_4)_2$ and dimethylurea, respectively. The coefficient of correlation is 0.99989 and the standard error of estimate is 0.14. Table III gives the solubility of dimethylurea at round molalities of $Ba(ClO_4)_2$ in the region where the solid phase is dimethylurea. The solubility of dimethylurea increases markedly with increasing concentration of $Ba(ClO_4)_2$ and this indicates complex formation in the system. The other three branches of the solubility isotherm, BC, CD and DE correspond to the crystallization of $3C_3H_8N_2O.Ba(ClO_4)_2$, $2C_3H_8N_2O.Ba(ClO_4)_2.H_2O$ and $C_3H_8N_2O.Ba(ClO_4)_2.2H_2O$, respectively, while the last branch EF shows that $Ba(ClO_4)_2.3H_2O$ crystallizes within a narrow

COMPONENTS:	EVALUATOR:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	K.H. Khoo Department of Chemistry University of Malaya 59100 Kuala Lumpur, Malaysia.
(2) Water; H_2O; [7732-18-5]	
(3) Other solvents	December 1987

CRITICAL EVALUATION: (continued)
range of dimethylurea concentration only.

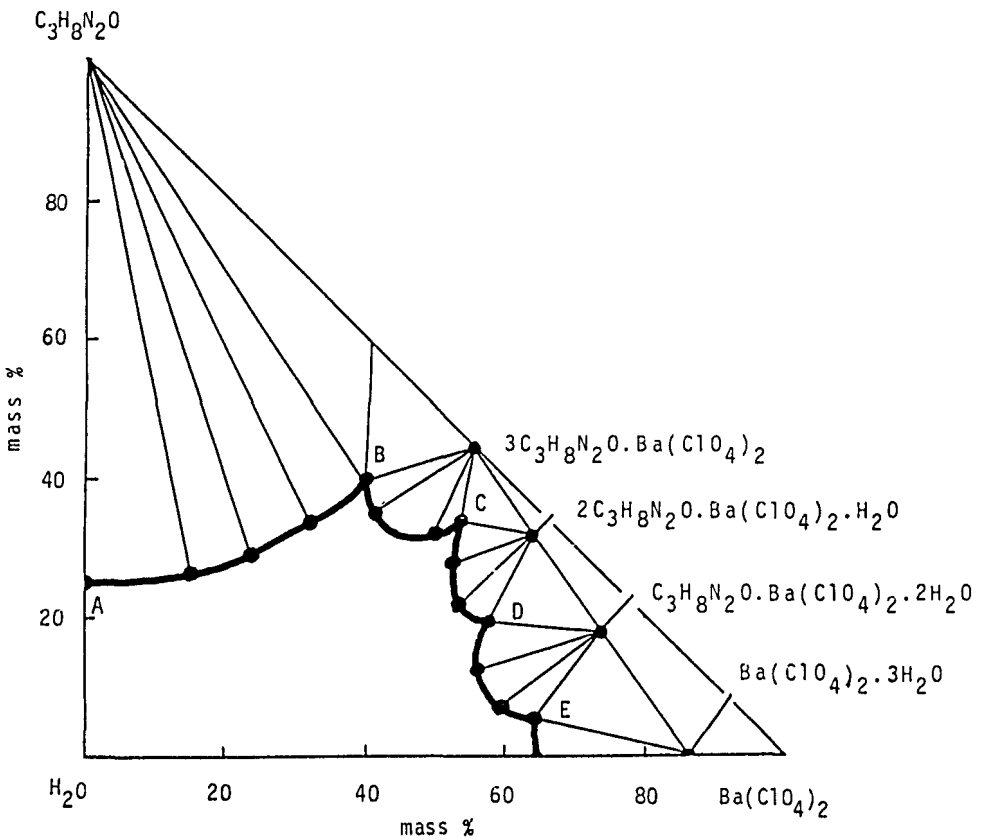


Figure 1. Solubility isotherm for the system $Ba(ClO_4)_2$-$C_3H_8N_2O$-H_2O at 298 K

4. Other nonelectrolytes. There is one publication on the solubility of $Ba(ClO_4)_2$ in aqueous acetamide (12) and one in aqueous hexamethylenetetramine (11) systems at 298 K. Both were studied using the isothermal method. As there is no reason to reject the results, they are classified as tentative. The respective solubility isotherms are attached to the compilations for these systems.

COMPONENTS:	EVALUATOR:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	K.H. Khoo Department of Chemistry University of Malaya 59100 Kuala Lumpur, Malaysia.
(2) Water; H_2O; [7732-18-5]	
(3) Other solvents	December 1987

CRITICAL EVALUATION: (continued)

Table III. The solubility of dimethylurea (m_1) in aqueous solutions of $Ba(ClO_4)_2$ (m_2) at 298 K.(solid phase = dimethylurea)

m_1/mol kg^{-1}	m_2/mol kg^{-1}	m_1/mol kg^{-1}	m_2/mol kg^{-1}
0	3.88	5	18.93
0.5	4.70	6	22.71
1	5.75	7	26.31
2	8.37	8	29.53
3	11.57	9	32.20
4	15.15	10	34.12

Solubility in aqueous electrolyte solutions

1. Perchloric acid. The paper by Lilich, et al (3) is the only paper reporting the solubility of $Ba(ClO_4)_2$ in aqueous perchloric acid at 273 , 298 and 323 K. Unlike most of the Russian publications reviewed, this paper reports the estimated errors in temperature and solubility and also gives a detailed account of the experimental procedure. The solubility isotherms given in Figure 2 show a shallow minimum at 273 K

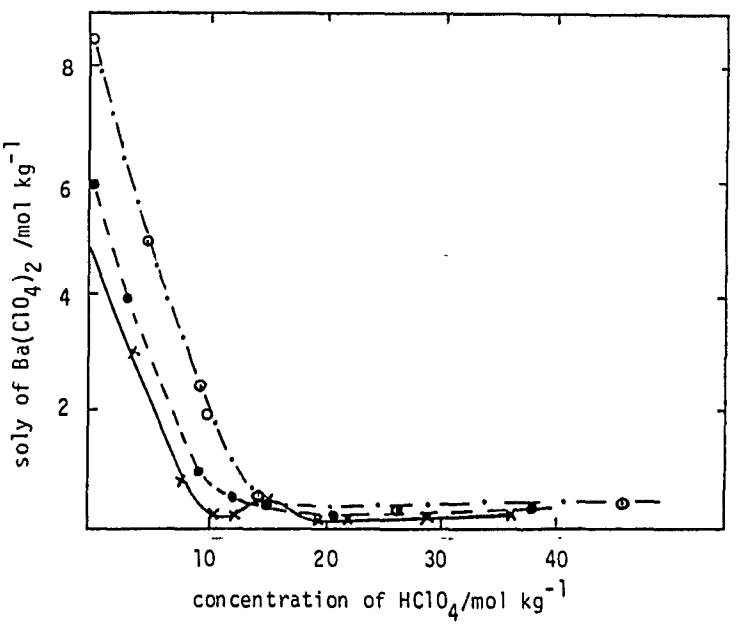


Figure 2. Solubility of $Ba(ClO_4)_2$ in aqueous $HClO_4$ solutions at various temperatures : (—) 273 K ; (--) 298 K ; (-·-) 323 K

COMPONENTS:	EVALUATOR:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	K.H. Khoo
(2) Water; H_2O; [7732-18-5]	Department of Chemistry
(3) Other solvents	University of Malaya
	59100 Kuala Lumpur, Malaysia.
	December 1987

CRITICAL EVALUATION: (continued)

which gradually disappears as the temperature is raised. This minimum is not significant and it can be ascribed to changes in the coordination number in the crystal which occur at an acid concentration of 10-12 mol kg^{-1}. Apart from this, there is a monotonic salting-out of $Ba(ClO_4)_2$ since the Ba^{2+} ion is weakly hydrated. In highly-concentrated acid solutions (>16 mol kg^{-1}) where the solid phase is the unhydrated salt, $Ba(ClO_4)_2$, the solubility of the salt appears to be little affected by changes in temperature or further increases in the concentration of the acid.

The highest crystal hydrate of the salt exists as the solid phase up to an acid concentration of about 12 mol kg^{-1}. This is $Ba(ClO_4)_2.4H_2O$ at 273K, $Ba(ClO_4)_2.3H_2O$ at 298 K and $Ba(ClO_4)_2.2H_2O$ at 323 K. Here, the solubility data can be represented by the equation

$$m_1 = a_o + a_1 m_2 + a_2 m_2^2 + a_3 m_2^3 \qquad (1)$$

where m_1 and m_2 are the molal solubility of $Ba(ClO_4)_2$ and molal concentration of perchloric acid, respectively. Table IV gives the values of the fitting parameters and Table V gives the calculated solubility at round molalities of the acid. These values are regarded as tentative.

Table IV. Parameters of Equation (1)

T/K	a_o	$-a_1$	$10^2 a_2$	$10^3 a_3$	max m_2	R[a]	σ[b]
273	4.6925	0.5140	-2.53	3.24	10.4	0.9997	0.05
298	5.9135	0.6183	-0.871	1.91	12.8	0.9998	0.05
323	8.4404	0.8811	4.31	-2.22	9.4	0.9997	0.09

[a] R = coefficient of regression

[b] σ = standard error of estimate

2. Barium nitrate. The solubility of $Ba(ClO_4)_2$ in aqueous barium nitrate solutions has been reported in only one publication by Karnaukhov and Bogachev (20) at 298 K. No information is provided on the purity of the materials used and no estimated error is given. There is also no mention of the saturation conditions. Nitrate and total barium were determined volumetrically but perchlorate was determined by difference and not analytically. Furthermore, there are only 7 data points in the compilation for this system. This renders the available data for the system unsuitable for evaluation. Nevertheless, the paper is included in the compilation together with the solubility isotherm so as to give a

COMPONENTS:	EVALUATOR:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	K.H. Khoo
(2) Water; H_2O; [7732-18-5]	Department of Chemistry
(3) Other solvents	University of Malaya
	59100 Kuala Lumpur, Malaysia.
	December 1987

CRITICAL EVALUATION: (continued)

tentative picture of the solubility behaviour of the $Ba(ClO_4)_2$-$Ba(NO_3)_2$-H_2O system at 298 K.

Table V. Solubility of $Ba(ClO_4)_2$ (m_1) in aqueous $HClO_4$(m_2)

m_2/mol kg^{-1}	m_1/mol kg^{-1}		
	273 K	298 K	323 K
1	4.16	5.29	7.60
2	3.59	4.66	6.83
3	3.01	4.03	6.12
4	2.44	3.42	5.46
5	1.89	2.84	4.84
6	1.40	2.30	4.23
7	0.96	1.82	3.62
8	0.62	1.39	3.01
9	0.37	1.04	2.38
10	0.25	0.77	-
11	-	0.61	-

3. Ammonium perchlorate. There is only one publication on solubility in the $Ba(ClO_4)_2$-NH_4ClO_4-H_2O system (8) and this is at 298 K. This system was studied by the same authors as those who reported the results for the previous system and ,consequently, an evaluation of the system is also not worthwhile.

4. Other salt systems. The solubility of $Ba(ClO_4)_2$ in the following systems has been reported:

System	Temp/K	Ref
(A) $Ba(ClO_4)_2$ + $LiClO_4$ + H_2O	298	18
(B) $Ba(ClO_4)_2$ + $NaClO_4$ + H_2O	298;323	15
(C) $Ba(ClO_4)_2$ + $Sr(ClO_4)_2$ + H_2O	298	10
(D) $Ba(ClO_4)_2$ + $Pr(ClO_4)_3$ + H_2O	298	9
(E) $Ba(ClO_4)_2$ + $Sm(ClO_4)_3$ + H_2O	298	13
(F) $Ba(ClO_4)_2$ + $Lu(ClO_4)_3$ + H_2O	298	14
(G) $Ba(ClO_4)_2$ + $Tb(ClO_4)_3$ + H_2O	298	17
(H) $Ba(ClO_4)_2$ + $Ba(NO_3)_2$ + NH_4ClO_4 + NH_4NO_3 + H_2O	298	21

There is only one publication for each system. In some of the papers, there is practically no experimental information given (13,15,17,18) while in others the experimental data are scarce and in only paper (10)

COMPONENTS:	EVALUATOR:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	K.H. Khoo
(2) Water; H_2O; [7732-18-5]	Department of Chemistry
(3) Other solvents	University of Malaya
	59100 Kuala Lumpur, Malaysia.
	December 1987

CRITICAL EVALUATION: (continued)

is mention made of the precision in temperature. As such, no evaluation is made of the data for these systems. In the absence of other studies of these systems, the data sheets are given in the compilations together with the relevant solubility isotherms as a guide to the solubility behaviour of these systems.

Solubility in nonaqueous solvents

Only three groups of workers studied the solubility of $Ba(ClO_4)_2$ in organic solvents. Van-Valkenburg and McDaniels (22) reported the solubility in solvents containing 95-99.8% ethanol (presumably by weight) at 293 K. A rough extrapolation gives the solubility of $Ba(ClO_4)_2$ in pure ethanol as 96 g/100 cm^3 (ethanol) at 293 K compared with the value of 97.85 g/100 cm^3 (ethanol) at 298 K calculated from the data of Willard and Smith (5). This shows some consistency between the two sets of data. However, since no experimental information is given in the short report of Van-Valkenburg and McDaniels, their results cannot be accepted. On the other hand, Willard and Smith gave a detailed account of their experimental procedure. Solubility measurements were made in duplicate by an evaporation-to-dryness method to within a precision of $\pm$ 0.05% and the temperature was controlled to within $\pm$ 0.01 K. Adequate time was allowed for saturation and care was taken to ensure that no solute remained in the saturated solutions during analysis. The solvents were purified by refluxing and fractional distillation and their purity was checked by density and boiling-point determinations. However, the moisture content of the solvents was not specified and the solid phase in equilibrium with the saturated solution in each solvent was not mentioned. Since no other work similar to the work of Willard and Smith is available, the values of Willard and Smith are accepted as tentative values. Similarly, the value obtained by Sakk and Rosolovskii (23) for the solubility of $Ba(ClO_4)_2$ in hydrazine at 298 K is accepted as a tentative value. Table VI summarizes the solubility of $Ba(ClO_4)_2$ in the various organic solvents at 298 K.

COMPONENTS:	EVALUATOR:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	K.H. Khoo
(2) Water; H_2O; [7732-18-5]	Department of Chemistry
(3) Other solvents	University of Malaya
	59100 Kuala Lumpur, Malaysia.
	December 1987

CRITICAL EVALUATION: (continued)

Table VI. Tentative values for the solubility of $Ba(ClO_4)_2$ in nonaqueous solvents at 298 K. (Solid phase unidentified).

Solvent	Solubility				
	mass %	g/100 cm^3	mol %	mol dm^{-3}	mol kg^{-1}
methanol	68.46	119.85	17.13	3.564	6.455
ethanol	55.48	78.54	14.58	2.336	3.706
acetone	55.49	81.05	17.72	2.411	3.708
1-propanol	43.07	52.31	11.91	1.556	2.250
ethyl acetate	53.04	80.81	22.84	2.403	3.359
n-butyl alcohol	36.78	41.72	11.37	1.241	1.730
iso-butyl alcohol	35.99	36.67	11.03	1.091	1.672
hydrazine	52.22	-	9.43	-	3.251

REFERENCES

1. Carlson, B. *Festschrift*, (Klason, P.,Editor) Norstedt, Stockholm, 1910, 247-66.
2. Lilich, L.S.; Dzhurinsky, B.F. *Zh. Obshchei Khim.* 1956, *26*, 1549-53; **J. General Chem. U.S.S.R.* (Engl. Transl.) 1956, *26*, 1733-7.
3. Lilich, L.S.; Kurbanova, Z.I.; Chernykh, L.V. *Zh. Neorg. Khim.* 1972, *17*, 812-6; **Russ. J. Inorg. Chem.* (Engl. Transl.) 1972, *17*, 424-6.
4. Abdukarimova, F.M.; Nogoev, K.; Sulaimankulov, K. *Zh. Neorg. Khim.* 1973, *18*, 2275-8; **Russ. J. Inorg. Chem.* (Engl. Transl.) 1973, *18*, 1203-5.
5. Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1923, *45*, 286-96.
6. Karnaukhov, A.S.; Zhakharova, V.P. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *79*, 107-14.
7. Zakharova, V.P. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1971, *95*, 95-7.
8. Karnaukhov, A.S.; Bogachev, A.V. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1971, *95*, 32-5.
9. Runov, N.N.; Novikov, V.V. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1975, *144*, 37-9.
10. Bogachev, A.V. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1973, *120*, 31-5.
11. Bogachev, A.V. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1976, *154*, 55-8.
12. Tarakanov, V.F. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1977, *164*, 35-6.
13. Guseva, A.D.; Golubkova, O.N. *Tr. Yarosl. Gos. Ped. Inst.* 1979, *178*, 3-6.
14. Andronova, N.P.; Druzhinina, G.V. *Tr. Yarosl. Gos. Ped. Inst.* 1980, *185*, 9-12.
15. Zaitseva, S.N.; Lepeshkov, I.N. *Uch. Zap. Yarosl. Gos. Ped. Inst.*

COMPONENTS:	EVALUATOR:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	K H. Khoo
(2) Water; H_2O; [7732-18-5]	Department of Chemistry
(3) Other solvents	University of Malaya
	59100 Kuala Lumpur, Malaysia.
	December 1987

CRITICAL EVALUATION: (continued)

1969, *66*, 113-21.

16. Karnaukhov, A.S.; Rylenkova, I.N.; Vasil'eva, S.I. *Tr. Yarosl. Gos. Ped. Inst.* 1979, *178*, 49-52.
17. Andronova, N.P. *Tr. Yarosl. Gos. Ped. Inst.* 1979, *178*, 7-10.
18. Ganina, G.I.; Pisarenko, O.N. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1976, *154*, 41-4.
19. Vasil'eva, S.I.; Rylenkova, I.N. *Sb. Tr. Smolensk. Gos. Ped. Inst.* 1979, 7-15.
20. Karnaukhov, A.S.; Bogachev, A.V. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1971, *95*, 27-31.
21. Karnaukhov, A.S.; Bogachev, A.V. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1973, *120*, 36-9.
22. Van-Valkenburgh, H.B.; McDaniels, W.B. *J. Colo. Wyo. Acad. Sc.* 1930, *1*, 44-5.
23. Sakk, Zh.G.; Rosolovskii, V.Ya. *Zh. Neorg. Khim.* 1972, *17*, 1783-4; **Russ. J. Inorg. Chem.* (Engl. Transl.) 1972, *17*, 927-8.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) Water; H_2O; [7732-18-5]	Lilich, L.S.; Dzurinsky, B.F. *Zh. Obshchei Khim.* 1956, *26*, 1549-53; **J. General Chem. U.S.S.R.* (Engl. Transl.) 1956, *26*, 1733-7.
VARIABLES: Temperature/K: 273, 293 and 313 Composition	PREPARED BY: K.H. Khoo

EXPERIMENTAL VALUES:

The solubility of $Ba(ClO_4)_2$ in water is expressed as the number of moles of anhydrous salt per kilogram of water as follows:

t/°C	soly/mol kg^{-1}
0	4.11
20	5.29
40	6.13

The solid phase is not stated, but is likely to be $Ba(ClO_4)_2.3H_2O$ (compiler).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE	SOURCE AND PURITY OF MATERIALS:
The salt was stirred with water in a thermostat. Equilibrium was established after continuous stirring for 1-4 h. Approach to equilibrium from above or below had no effect. No information is given on analysis of the saturated solutions and the nature of the solid phase.	Nothing specified.
	ESTIMATED ERROR: Nothing specified.
	REFERENCES: None.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	Willard, H.H.; Smith, G.F.
(2) Water; H_2O; [7732-18-5]	*J. Am. Chem. Soc.* 1923, *45*, 286-96.
VARIABLES:	PREPARED BY:
One temperature: 298.15 K	C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of barium perchlorate in water at 25.00°C :

mass %	g/100 cm^3 sln.	mol %	mol dm^{-3}	mol kg^{-1}	sat. sln. density/g cm^{-3}
66.48	128.99	9.606[b]	3.8362[b]	5.898[b]	1.9403

[a] The solid phase was a mixture of the anhydrous salt and the hydrate (not specified) that had crystallized from the saturated solution.

[b] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A sat. sln. of the salt was prepared at a temperature slightly above 25°C and sealed together with about 1 g of the anhydrous salt in a solubility tube, capacity 18-20 cm^3. This tube was then rotated end-over-end in the thermostat bath at 25.00°C for 24-48h and stood vertically to allow the solids to settle. Samples of the clear sat. sln were then analysed for solute content by an evaporation-to-dryness method using Pt crucibles. Duplicate soly determinations were made, those analyses with chloride (from thermal decomposition) found present being rejected.

SOURCE AND PURITY OF MATERIALS:

Hydrated barium perchlorate was prepared from very pure barium chloride and purified $HClO_4$ (ref.1) and recrystallized twice. The anhy. salt was obtained by heating the hydrate at 250°C in a current of dry air to constant weight.

ESTIMATED ERROR:

Precision in temp. was ±0.01°C; precision in soly. about ±0.05% .

REFERENCES:

1. Willard, H.H.; *J. Am. Chem. Soc.* 1912, *34*, 1480.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) *Alcohols*: (A) Methanol (*methyl alcohol*); CH_4O; [67-56-1] (B) Ethanol (*ethyl alcohol*); C_2H_6O; [64-17-5] (C) 1-Propanol (*n-propyl alcohol*); C_3H_8O; [71-23-8] (D) 1-Butanol (*n-butyl alcohol*); $C_4H_{10}O$; [71-36-3] (E) 2-Methyl-1-propanol (*iso-butyl alcohol*); $C_4H_{10}O$; [78-83-1]	Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1923, *45*, 286-96.
VARIABLES: One temperature: 298.15 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of barium perchlorate in various alcohols at 25.00°C, the solid phase being the anhydrous salt :

soly in :	methanol	ethanol	1-propanol	1-butanol	2-methyl-1-propanol
mass %	68.46	55.48	43.07	36.78	35.99
g/100 cm^3 sln.	119.85	78.543	52.309	41.716	36.667
mol %[a]	17.13	14.584	11.911	11.367	11.028
mol dm^{-3} [a]	3.5644	2.3359	1.5557	1.2407	1.0905
mol kg^{-1} [a]	6.455	3.706	2.250	1.7302	1.6722

[a] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
A sat. sln. of the salt was prepared at a temperature slightly above 25°C and sealed together with about 1 g of the anhydrous salt in a solubility tube, capacity 18-20 cm^3. This tube was then rotated end-over-end in the thermostat bath at 25.00°C for 24-48h and stood vertically to allow the	Hydrated barium perchlorate was prepared from very pure barium chloride and purified $HClO_4$ (ref.1) and recrystallized twice. The anhy. salt was obtained by heating the hydrate at 250°C in a current of dry air to constant weight. Alcohols were purified by (continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) *Alcohols*: (A) Methanol (*methyl alcohol*); CH_4O; [67-56-1] (B) Ethanol (*ethyl alcohol*); C_2H_6O; [64-17-5] (C) 1-Propanol (*n-propyl alcohol*); C_3H_8O; [71-23-8] (D) 1-Butanol (*n-butyl alcohol*); $C_4H_{10}O$; [71-36-3] (E) 2-Methyl-1-propanol (*iso-butyl alcohol*); $C_4H_{10}O$; [78-83-1]	Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1923, *45*, 286-96.

EXPERIMENTAL VALUES:(continued)

	methanol	ethanol	1-propanol	1-butanol	2-methyl-1-propanol
sat. sln. density/g cm^{-3}	1.7507	1.4157	1.2145	1.1342	1.1171
pure solvent density/g cm^{-3}	0.78705	0.78515	0.7989	0.8059	0.7981

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:(continued)
solids to settle. Samples of the clear sat. sln. were then analysed for solute content by an evaporation-to-dryness method using Pt crucibles. The salt was dried to constant wt. at 250°C in a current of air dried with P_2O_5. Duplicate soly determinations were made, those analyses in which chloride (from thermal decomposition) was found present being rejected.

SOURCE AND PURITY OF MATERIALS:
(continued)
refluxing with calcium and fractional distillation.

ESTIMATED ERROR:
Precision in temp. was ±0.01°C;

REFERENCES:
1. Willard, H.H.; *J. Am. Chem.Soc.* 1912, *34*, 1480.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) Acetone; C_3H_6O; [67-64-1]	Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1923, *45*, 286-96.
VARIABLES: One temperature: 298.15 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of barium perchlorate in acetone at 25.00°C :

mass %	g/100 cm^3 sln.	mol %	mol dm^{-3}	mol kg^{-1}	sat. sln. density/g cm^{-3}
55.49	81.054	17.719[b]	2.4106[b]	3.708[b]	1.4607

[a] The solid phase was the anhydrous salt.

[b] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A sat. sln. of the salt was prepared at a temperature slightly above 25°C and sealed together with about 1 g of the anhydrous salt in a solubility tube, capacity 18-20 cm^3. This tube was then rotated end-over-end in the thermostat bath at 25.00°C for 24-48h and stood vertically to allow the solids to settle. Samples of the clear sat. sln were then analysed for solute content by an evaporation-to-dryness method using Pt crucibles. The salt was dried to constant wt. at 250°C in a current of air dried with P_2O_5. Duplicate soly. determinations were made, those analyses in which chloride (from thermal decomposition) was found present being rejected.

SOURCE AND PURITY OF MATERIALS:

Hydrated barium perchlorate was prepared from very pure barium chloride and purified $HClO_4$ (ref.1) and recrystallized twice. The anhy. salt was obtained by heating the hydrate at 250°C in a current of dry air to constant weight. (2) was purified by refluxing with KOH and fractional distillation. Density of (2) at 25°C was 0.7852 g cm^{-3}; b.p. was 56.16-56.51 °C.

ESTIMATED ERROR:

Precision in temp. was ± 0.01°C.

REFERENCES:

1. Willard, H.H. *J. Am. Chem. Soc.* 1912, *34*, 1480.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) Ethyl acetate; $C_4H_8O_2$; [141-78-6]	Willard, H.H.; Smith, G.F. *J. Am. Chem. Soc.* 1923, *45*, 286-96.
VARIABLES: One temperature: 298.15 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of barium perchlorate in ethyl acetate at 25.00°C :

mass %	g/100 cm^3 sln.	mol %	mol dm^{-3}	mol kg^{-1}	sat. sln. density/g cm^{-3}
53.04	80.812	22.837[b]	2.4034[b]	3.359[b]	1.5236

[a] The solid phase was the anhydrous salt.

[b] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A sat. sln. of the salt was prepared at a temperature slightly above 25°C and sealed together with about 1 g of the anhydrous salt in a solubility tube, capacity 18-20 cm^3. This tube was then rotated end-over-end in the thermostat bath at 25.00°C for 24-48h and stood vertically to allow the solids to settle. Samples of the clear sat. sln were then analysed for solute content by an evaporation-to-dryness method using Pt crucibles. The salt was dried to constant wt. at 250°C in a current of air dried with P_2O_5. Duplicate soly. determinations were made, those analyses in which chloride (from thermal decomposition) was found present being rejected.

SOURCE AND PURITY OF MATERIALS:

Hydrated barium perchlorate was prepared from very pure barium chloride and purified $HClO_4$ (ref.1) and recrystallized twice. The anhy. salt was obtained by heating the hydrate at 250°C in a current of dry air to constant weight.
(2) was purified by refluxing with P_2O_5 and fractional distillation. Density of (2) at 25°C was 0.8923 g cm^{-3}; b.p. was 75.9 -78.7 °C.

ESTIMATED ERROR:

Precision in temp. was ± 0.01°C .

REFERENCES:

1. Willard, H.H. *J. Am. Chem. Soc.* 1912, *34*, 1480.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) Hydrazine; N_2H_4; [302-01-2]	Sakk, Zh. G.; Rosolovskii, V.Ya. *Zh. Neorg. Khim.* 1972, *17*, 1783-4; **Russ. J. Inorg. Chem. (Engl. Transl.)* 1972, *17*, 927-8.
VARIABLES: One temperature: 298.2 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

The solubility of barium perchlorate in hydrazine at 25.0 °C was 109.3 g (1) in 100 g (2). The corresponding mass %, mol % and molality values for (1), calculated by the compiler, are 52.22 %, 9.43 % and 3.25 mol kg^{-1} respectively.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
4-6 g of the salt and 8-11 cm^3 of hydrazine were thermostated at 25.0°C for 7-8 h with continuous stirring in a vessel isolated from atmospheric moisture. Samples for analysis were removed by drawing solution and part of the solid phase into a vessel fitted with a porosity no.4 filter at reduced pressure. After separating the phases, the solution was analysed for hydrazine. Replicate solubility determinations were made.	Barium perchlorate was 99.5-99.9 % pure. Anhydrous hydrazine was prepared following the procedure given in ref.1 .
	ESTIMATED ERROR: Absolute error in solubility value was 0.4 %. Temperature precision was ± 0.1 °C.
	REFERENCES: 1. Rosolovskii, V.Ya.; Sakk, Zh.G. *Zh. Neorg. Khim.* 1970, *15*, 2262.

COMPONENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]
(2) Perchloric acid; $HClO_4$; [7601-90-3]
(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Lilich, L.S.; Kurbanova, Z.I.; Chernykh, L.V.

Zh. Neorg. Khim. 1972, *17*, 812-6.
**Russ. J. Inorg. Chem.* (Engl. Transl.) 1972, *17*, 424-6.

VARIABLES:
Temperature/K: 273, 298 and 323 K
Composition

PREPARED BY:
C.C. Ho

EXPERIMENTAL VALUES:
Solubility of $Ba(ClO_4)_2$ in aqueous perchloric acid at 0.0 °C

Liquid phase composition						Solid phase
mass %		mol kg^{-1}		mol %[a]		
(1)	(2)	(1)	(2)	(1)	(2)	
61.12	-	4.68	-	7.768	-	$Ba(ClO_4)_2.4H_2O$
56.99	3.39	4.28	0.85	7.055	1.40	"
51.45	7.09	3.70	1.70	6.060	2.80	"
43.75	13.28	3.04	3.07	4.915	4.99	"
31.09	22.28	1.63 (1.98)[b]	4.75	3.186	7.641	"
23.59	28.28	1.46	5.84	2.321	9.311	"
13.26	37.25	0.80	7.49	1.249	11.74	"
7.69	42.78	0.46	8.61	0.715	13.32	"
3.81	49.13	0.24	10.39	0.364	15.71	"

[a] compiler's calculations.
[b] recalculated by compiler (original values are in error).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE
The isothermal method was used. Equilibrium was reached after 8-10 h. Ba^{2+} in the liquid and solid phases was determined by titration with a solution of Trilon B using fluorescein as indicator, $HClO_4$ by titrating the H^+ with borax solution using methyl red as indicator. The composition of the solid phase was found by Schreinemakers' method.

SOURCE AND PURITY OF MATERIALS:
"Chemically pure" grade $HClO_4$ and "pure" grade $BaCO_3$ were used to prepare the salt which was thrice recrystallized before use.

ESTIMATED ERROR:
Temp.: ±0.1°C at 0°C and 50°C; ±0.05°C at 25°C.
Relative error in analyses: ±0.05 %.

REFERENCES:
None.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	Lilich, L.S.; Kurbanova, Z.I.; Chernykh, L.V.
(2) Perchloric acid; $HClO_4$; [7601-90-3]	*Zh. Neorg. Khim.* 1972, *17*, 812-6.
(3) Water; H_2O; [7732-18-5]	*Russ. J. Inorg. Chem.* (Engl. Transl.) 1972, *17*, 424-6.

EXPERIMENTAL VALUES: (continued)

Solubility of $Ba(ClO_4)_2$ in aqueous perchloric acid at 0.0 °C

Liquid phase composition						Solid phase[a]
mass %		mol kg^{-1}		mol %[b]		
(1)	(2)	(1)	(2)	(1)	(2)	
3.92	50.12	0.25	10.62 (10.86)[c]	0.381	16.30	A + B
3.00	53.02	0.20	11.99	0.300	17.72	B
4.07	55.81	0.30	13.84	0.433	19.88	B + C
4.82	56.81	0.37	14.73	0.529	20.87	C
1.91	60.60	0.15	16.08	0.211	22.43	C
1.77	67.30	0.17	21.65	0.220	28.01	C
1.78	73.02	0.14 (0.21)[c]	28.17 (28.84)[c]	0.248	34.11	C
1.78	77.04	0.25	36.20	0.272	39.37	C

Solubility of $Ba(ClO_4)_2$ in aqueous perchloric acid at 25.00°C

Liquid phase composition						Solid phase[a]
mass %		mol kg^{-1}		mol %[b]		
(1)	(2)	(1)	(2)	(1)	(2)	
66.48	-	5.91	-	9.606	-	D
50.42	11.80	3.97	2.46 (3.11)[c]	6.342	4.968	D
35.25	23.35	2.53	5.61	3.978	8.820	D
25.35	31.16	1.73	7.13	2.693	11.08	D
14.76	40.73	0.98	9.10	1.503	13.89	D
9.64	47.23	0.66	10.90	0.991	16.25	D
8.41	51.11	0.62	12.56	0.903	18.30	D
7.21	52.11	0.52	12.76	0.766	18.54	C + D
5.57	53.74	0.40	13.14	0.589	19.04	C
4.90	54.46	0.36	13.33	0.518	19.28	C
2.34	59.51	0.18	15.52	0.257	21.85	C
2.02	64.12	0.16 (0.18)[c]	18.84	0.238	25.29	C
1.95	68.82	0.20	23.43	0.251	29.61	C
1.85	77.50	0.27	37.35	0.286	40.11	C

[a] A = $Ba(ClO_4)_2.4H_2O$; B = $Ba(ClO_4)_2.2H_2O$
C = $Ba(ClO_4)_2$; D = $Ba(ClO_4)_2.3H_2O$.

[b] compiler's calculations.

[c] recalculated by compiler (original values are in error).

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	Lilich, L.S.; Kurbanova, Z.I.; Chernykh, L.V.
(2) Perchloric acid; $HClO_4$; [7601-90-3]	*Zh. Neorg. Khim.* 1972, *17*, 812-6.
(3) Water; H_2O; [7732-18-5]	*Russ. J. Inorg. Chem.* (Engl. Transl.) 1972, *17*, 424-6.

EXPERIMENTAL VALUES: (continued)

Solubility of $Ba(ClO_4)_2$ in aqueous perchloric acid at 50.0°C

Liquid phase composition						Solid phase[a]
mass %		mol kg^{-1}		mol %[b]		
(1)	(2)	(1)	(2)	(1)	(2)	
73.90	-	8.44	-	13.17	-	A
68.53	3.78	7.33	1.35	11.46	2.12	A
53.61	14.64	5.03	4.59	7.712	7.049	A
48.91	18.60	4.49	5.69	6.816	8.676	A
29.95	33.08	2.41	8.90	3.605	13.33	A
28.07	34.50	2.21	9.16	3.333	13.71	A
27.42	35.32	2.08 (2.19)[c]	9.43	3.260	14.06	A + B
26.28	36.12	2.05	9.30 (9.56)[c]	3.096	14.24	B
17.52	44.89	1.38	11.88	2.015	17.28	B
6.29	55.45	0.49	14.42	0.694	20.49	B
2.62	60.51	0.22	16.40	0.293	22.67	B
2.98	62.04	0.25	17.65	0.345	24.05	B
2.38	65.66	0.22	20.45	0.291	26.85	B
2.17	71.08	0.24	26.45	0.294	32.18	B
1.93	80.74	0.33	46.40	0.324	45.37	B

[a] A = $Ba(ClO_4)_2.2H_2O$; B = $Ba(ClO_4)_2$.

[b] compiler's calculations.

[c] recalculated by compiler (original values are in error).

COMMENTS AND/OR ADDITIONAL DATA:

Ba^{2+} being weakly hydrated, there is a monotonic salting-out of $Ba(ClO_4)_2$. As the temperature is raised, there is a gradual disappearance of the highest crystal hydrate of the salt.

COMPONENTS:
(1) Lithium perchlorate; $LiClO_4$; [7791-03-9]
(2) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]
(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Ganina, G.I.; Pisarenko O.N.

Uch. Zap. Yarosl. Gos. Ped. Inst. 1976, *154*, 41-4.

VARIABLES:
One temperature: 298 K
Composition

PREPARED BY:
N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the system $Ba(ClO_4)_2$-$LiClO_4$-H_2O at 25° C

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
37.34	-	9.166	-	5.601	-	$LiClO_4.3H_2O$
29.90	15.77	8.405	1.403	5.173	0.863	"
19.52	33.43	6.339	3.435	3.900	2.113	"
14.71	42.96	5.286	4.885	3.270	3.018	"
11.49	51.21	4.634	6.534	2.895	4.083	"
6.16	58.24	2.623	7.847	1.626	4.865	$LiClO_4.3H_2O$ + $Ba(ClO_4)_2.3H_2O$
5.25	60.06	2.291	8.294	1.423	5.149	$Ba(ClO_4)_2.3H_2O$
1.41	62.17	0.597	8.330	0.364	5.077	"
-	62.63	-	8.240	-	4.984	"

[a] Editors' calculations.

AUXILIARY INFORMATION

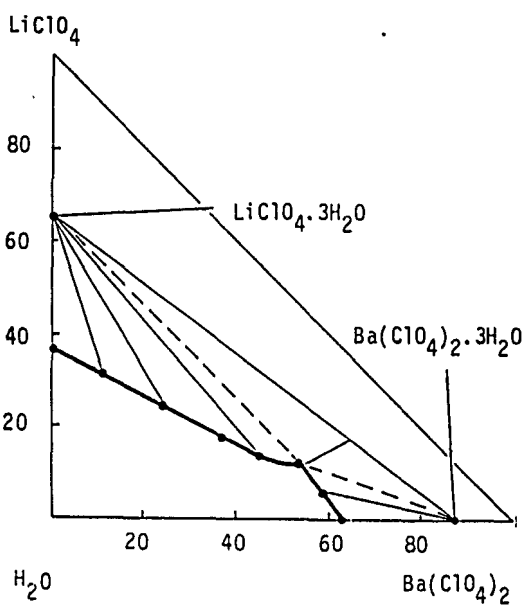
METHOD/APPARATUS/PROCEDURE
The isothermal method was used. The densities and viscosities of the saturated solutions were measured. No description of the chemical analysis was given but literature references were cited [1,2].

SOURCE AND PURITY OF MATERIALS:
Not stated.

ESTIMATED ERROR:
Not stated.

REFERENCES:
1. Willehrand, W.F.; Lundell, G.E.F. *Appl. Inorg. Anal.*, New-York-London, Wiley, 1963.
2. Pribil,R. *Komplexone in der chemischen Analyse. Berlin, Deut. Verl. der Wissens.*, 1961.

COMMENTS AND/OR ADDITIONAL DATA:
The solubility isotherm (mass %) is shown below. The eutectic composition is 6.16 % $LiClO_4$, 58.24 % $Ba(ClO_4)_2$ and 35.60 % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sodium perchlorate; $NaClO_4$; [7601-89-0] (2) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (3) Water; H_2O; [7732-18-5]	Zaitseva, S.N.; Lepeshkov, I.N. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1969, *66*, 113-21.
VARIABLES: Temperature/K: 298 and 323 Composition	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the system $Ba(ClO_4)_2$-$NaClO_4$-H_2O

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
			At 25°C			
-	66.89	-	9.767	-	6.008	$Ba(ClO_4)_2.3H_2O$
0.96	66.34	0.388	9.766	0.240	6.034	"
6.74	60.85	2.705	8.893	1.698	5.584	"
19.68	50.08	8.084	7.491	5.315	4.925	"
29.40	42.20	12.36	6.462	8.455	4.419	$Ba(ClO_4)_2.H_2O$
35.95	36.59	15.24	5.648	10.69	3.963	"
39.89	33.00	16.89	5.088	12.02	3.620	$Ba(ClO_4)_2.H_2O$ + $NaClO_4.H_2O$
40.67	32.19	17.17	4.949	12.24	3.527	"
40.67	32.73	17.43	5.107	12.49	3.659	"
41.32	32.90	18.08	5.243	13.09	3.795	"
41.30	32.02	17.63	4.977	12.64	3.569	"
41.30	32.33	17.78	5.068	12.79	3.646	$NaClO_4.H_2O$
42.22	29.15	17.06	4.290	12.04	3.028	"
47.04	23.69	18.48	3.388	13.13	2.407	"
56.45	12.92	20.96	1.747	15.05	1.254	"
61.46	4.45	20.85	0.550	14.73	0.388	"
67.48	-	23.39	-	16.95	-	"
			At 50°C			
-	72.52	-	12.39	-	7.849	$Ba(ClO_4)_2.3H_2O$
0.13	71.65	0.060	11.97	0.038	7.551	"
4.50	68.27	2.099	11.59	1.350	7.456	"
8.20	65.63	3.905	11.38	2.559	7.458	"
14.69	59.31	6.897	10.14	4.614	6.784	"
21.67	53.17	10.22	9.132	7.034	6.285	"
28.32	48.04	13.72	8.472	9.784	6.044	"

[a] Editors' calculations

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal method was used [1]. Densities and viscosities of the saturated solutions were measured.	Not stated.
ESTIMATED ERROR:	REFERENCES:
Not stated.	1. Karnaukhov, A.S. *Izv. SFKhA AN SSSR*, 1954, *25*, 335.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sodium perchlorate; $NaClO_4$; [7601-89-0]	Zaitseva, S.N.; Lepeshkov, I.N.
(2) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1969, *66*, 113-21.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility in the system $Ba(ClO_4)_2$-$NaClO_4$-H_2O at 50°C

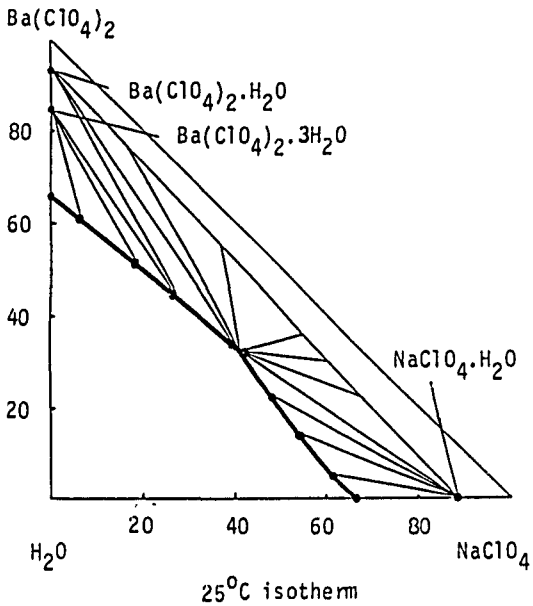
Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
30.39	46.21	14.73	8.158	10.61	5.873	A
34.05	43.02	16.56	7.621	12.13	5.580	A
34.67	42.89	17.10	7.701	12.62	5.684	A
35.35	42.74	17.69	7.789	13.18	5.802	A
35.85	41.87	17.70	7.528	13.14	5.589	A + B
35.83	40.90	17.15	7.130	12.58	5.227	A + B
35.40	41.71	17.17	7.367	12.63	5.419	A + B
35.14	41.84	16.99	7.366	12.47	5.405	A + B
36.68	41.76	18.49	7.664	13.90	5.761	B
37.43	40.19	18.33	7.168	13.66	5.341	B
43.50	33.34	20.42	5.699	15.34	4.281	B
47.97	28.00	21.66	4.603	16.30	3.465	B
51.46	22.79	21.92	3.535	16.32	2.632	B
61.01	13.31	25.38	2.016	19.40	1.541	B
64.15	10.01	26.35	1.497	20.28	1.152	C
68.79	4.14	27.05	0.593	20.76	0.455	C
71.50	2.23	28.50	0.324	22.23	0.252	C
73.15	-	28.62	-	22.25	-	C

[a] Editors' calculations.

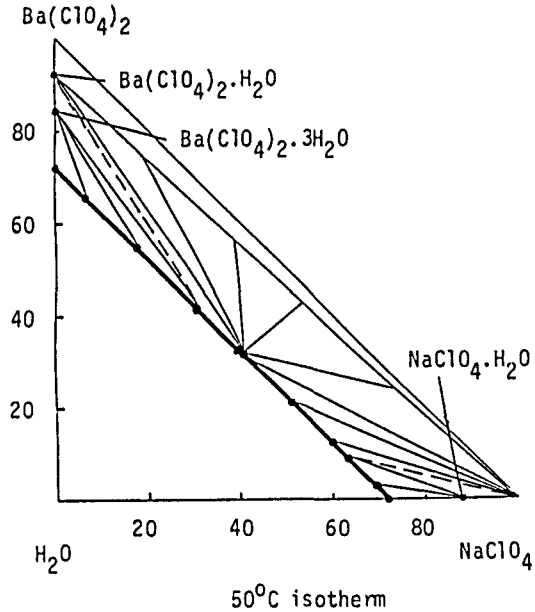
[b] A = $Ba(ClO_4)_2.H_2O$; B = $NaClO_4$; C = $NaClO_4.H_2O$

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherms (mass %) are shown below. No double salts or solid solutions are formed.



25°C isotherm



50°C isotherm

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	Karnaukhov, A.S.; Bogachev,A.V.
(2) Ammonium perchlorate; NH_4ClO_4; [7790-98-9]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1971, *95*, 32-5.
(3) Water; H_2O; [7732-18-5]	
VARIABLES:	**PREPARED BY:**
One temperature: 298 K	I.S. Bodnya ; N.A. Kozyreva
Composition	

EXPERIMENTAL VALUES:

Solubility in the system $Ba(ClO_4)_2$-NH_4ClO_4-H_2O at 25°C

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	20.00	-	3.692	-	2.128	NH_4ClO_4
12.08	13.77	0.842	2.745	0.485	1.581	"
24.40	9.09	1.889	2.014	1.091	1.163	"
43.54	4.11	4.217	1.139	2.474	0.668	"
57.13	1.97	6.915	0.682	4.154	0.410	"
63.73	1.76	8.940	0.707	5.492	0.434	NH_4ClO_4 + $Ba(ClO_4)_2.3H_2O$
66.75	-	9.711	-	5.970	-	$Ba(ClO_4)_2.3H_2O$

[a] Editor's calculations.

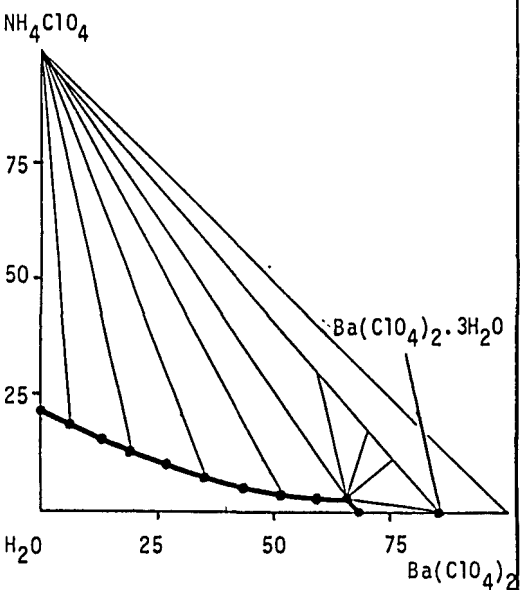
AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The isothermal method was used. The temperature was kept constant using a contact thermometer with an accuracy of ±0.1°C. Equilibrium was reached in 1 or 2 days. Ba^{2+} was determined by titrating with Trilon B in the presence of the indicator chrome blue black at pH 10-11; NH_4^+ by distillation of ammonia into saturated boric acid solution and subsequent titration with 0.2 mol dm^{-3} H_2SO_4. Viscosities and densities of the saturated solutions were measured. The compositions of the solid phases were determined by Schreinemakers' method of residues .

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is shown below. The eutectic contains 1.76 % NH_4ClO_4, 63.73 % $Ba(ClO_4)_2$ and 34.51 % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium nitrate; $Ba(NO_3)_2$; [10022-31-8]	Karnaukhov,A.S.; Bogachev,A.V.
(2) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1971, *95*, 27-31.
(3) Water; H_2O; [7732-18-5]	
VARIABLES: Temperature: 298 K Composition	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the system $Ba(ClO_4)_2$-$Ba(NO_3)_2$-H_2O at 25°C

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
9.58	-	0.725	-	0.405	-	$Ba(NO_3)_2$
8.10	13.75	0.703	0.927	0.397	0.523	"
6.83	36.73	0.800	3.342	0.463	1.935	"
6.01	53.06	0.938	6.434	0.562	3.855	"
6.17	63.82	1.255	10.10	0.787	6.325	$Ba(NO_3)_2$ + $Ba(ClO_4)_2.3H_2O$
2.07	65.98	0.400	9.922	0.248	6.142	$Ba(ClO_4)_2.3H_2O$
-	66.75	-	9.711	-	5.970	"

[a] Editors' calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The isothermal method was used [1]. Details were not given. Viscosity and density measurements were taken. The solid and liquid phases were analyzed volumetrically; Ba^{2+} by titration with Trilon B in the presence of the indicator chrome blue black at pH 10-11; NO_3^- by reduction to NH_3 with Devarda's alloy followed by distillation into 4 % boric acid and titration with H_2SO_4; ClO_4^- ion was determined by difference.

SOURCE AND PURITY OF MATERIALS:

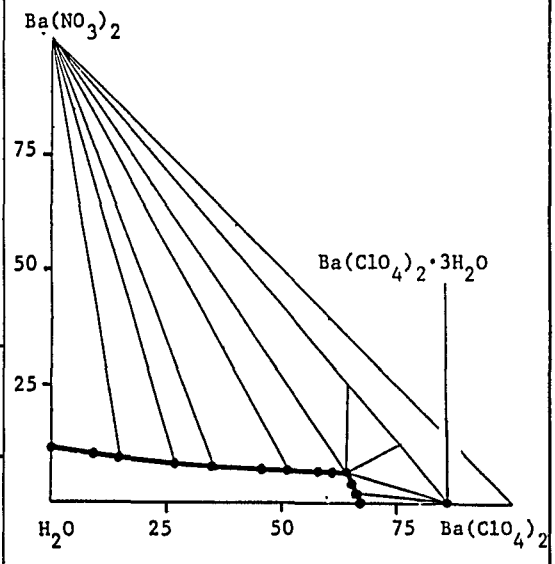
Not stated.

REFERENCES:

1. Karnaukhov, A.S.; Bitokov, V.T.; Bogachev, A.V. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *79*, 161-6.

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is shown below. The eutectic composition is 6.17 % $Ba(NO_3)_2$, 63.82 % $Ba(ClO_4)_2$ and 30.01 % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) Praseodymium perchlorate; $Pr(ClO_4)_3$; [13498-07-2] (3) Water; H_2O; [7732-18-5]	Bogachev, A.V. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1975, *144*, 37-9.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility in the system $Ba(ClO_4)_2$-$Pr(ClO_4)_3$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	64.98	-	7.072	-	4.224	A
2.80	63.98	0.417	7.290	0.251	4.385	A + B
7.68	60.67	1.191	7.202	0.722	4.364	B
20.21	44.50	2.835	4.778	1.703	2.871	B
29.25	32.41	3.800	3.223	2.269	1.924	B
48.27	14.91	6.463	1.528	3.899	0.922	B
58.43	5.64	7.968	0.589	4.836	0.357	B
66.81	-	9.735	-	5.987	-	B

[a] Editors' calculations.

[b] A = $Pr(ClO_4)_3.9H_2O$; B = $Ba(ClO_4)_2.3H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The isothermal method was used. Equilibrium was reached in 2-3 days. Pr^{3+} was determined by complexometric titration with Trilon B; ClO_4^- gravimetrically as nitron perchlorate. The composition of the solid phases was determined graphically by Schreinemakers' method of residues .

SOURCE AND PURITY OF MATERIALS:

The salts were chemically pure. $Pr(ClO_4)_3$ was prepared from Pr_6O_{11} (super pure grade) and 57 % $HClO_4$ (chemically pure). The dissolution was slow (6-8 h) with slight heating. Excess acid was removed with ether. The Pr^{3+} to ClO_4^- ratio was 1:3.0.

ESTIMATED ERROR:

Not stated.

REFERENCES:

None.

COMPONENTS:

(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]

(2) Samarium perchlorate; $Sm(ClO_4)_3$; [13569-60-3]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Guseva, A.D.; Golubkova, O.N.

Tr. Yarosl. Gos. Ped. Inst. 1979, *178*, 3-6.

VARIABLES:

One temperature: 298 K

Composition

PREPARED BY:

E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility in the system $Ba(ClO_4)_2$-$Sm(ClO_4)_3$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
66.85	-	9.751	-	5.997	-	A
51.15	11.56	6.768	1.146	4.079	0.691	A
39.71	21.14	5.051	2.015	3.017	1.203	A
14.47	43.29	1.732	3.884	1.019	2.284	A
5.19	56.91	0.687	5.647	0.407	3.347	A
4.68	62.47	0.704	7.044	0.424	4.238	A + B
4.71	62.43	0.708	7.037	0.426	4.234	A + B
-	64.98	-	6.933	-	4.135	B

[a] Editors' calculations.

[b] A = $Ba(ClO_4)_2 \cdot 3H_2O$; B = $Sm(ClO_4)_3 \cdot 9H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The isothermal recrystallization method was used. Equilibrium was reached in 5 or 6 days. Sm^{3+} and ClO_4^- were determined using a technique from elsewhere [1]. Ba^{2+} was determined by difference.

SOURCE AND PURITY OF MATERIALS:

Not stated.

ESTIMATED ERROR:

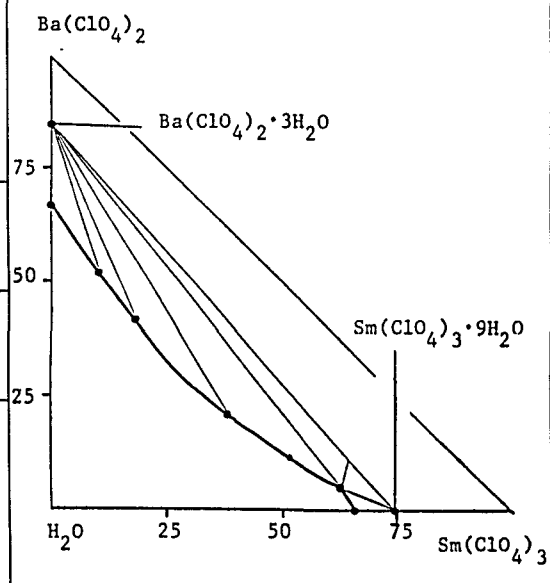
Not stated.

REFERENCES:

1, Guseva, A.D. *Sb. Fiziko-khimicheskie Issledovaniya Ravnovesii V Rastvorakh* 1977, *164*, 23-6.

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is given below.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) Terbium perchlorate; $Tb(ClO_4)_3$; [14014-09-6] (3) Water; H_2O; [7732-18-5]	Andronova, N.P. *Tr. Yarosl. Gos. Ped. Inst.* 1979, *178*, 7-10.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility in the system $Ba(ClO_4)_2$-$Tb(ClO_4)_3$-H_2O at 25°C

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
66.37	-	9.563	-	5.869	-	$Ba(ClO_4)_2.3H_2O$
56.51	9.45	8.087	0.996	4.937	0.607	"
52.19	13.22	7.377	1.374	4.487	0.836	"
29.30	29.16	3.547	2.596	2.098	1.535	"
15.85	42.33	1.915	3.761	1.127	2.214	"
9.68	49.93	1.210	4.588	0.713	2.703	"
4.46	57.95	0.596	5.692	0.353	3.371	"
4.46	63.79	0.693	7.284	0.418	4.394	$Ba(ClO_4)_2.3H_2O$ + $Tb(ClO_4)_3.9H_2O$
4.44	63.45	0.683	7.173	0.411	4.321	"
-	64.43	-	6.661	-	3.961	$Tb(ClO_4)_3.9H_2O$

[a] Editors' calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE

The isothermal method was used. The equilibrium liquid and solid phases were analyzed for terbium and perchlorate ions.

SOURCE AND PURITY OF MATERIALS:

Not stated.

ESTIMATED ERROR:

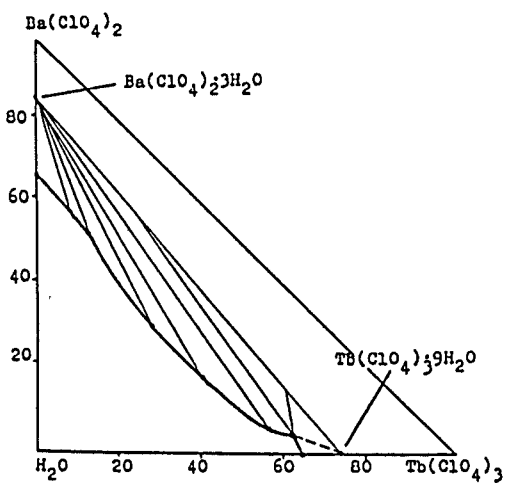
Not stated.

REFERENCES:

None.

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is shown below.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) Lutetium perchlorate; $Lu(ClO_4)_3$; [14646-29-8] (3) Water; H_2O; [7732-18-5]	Andronova, N.P.; Druzhinina, G.V. *Tr. Yarosl. Gos. Ped. Inst.* 1980, *185*, 9-12.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: I.S. Bodnya

EXPERIMENTAL VALUES:

Solubility in the system $Ba(ClO_4)_2$-$Lu(ClO_4)_3$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
66.37	-	9.563	-	5.869	-	A
43.21	18.00	5.540	1.639	3.313	0.980	A
26.08	33.34	3.231	2.934	1.911	1.736	A
15.22	42.60	1.828	3.634	1.073	2.134	A
8.98	50.12	1.111	4.407	0.653	2.589	A
4.82	55.40	0.613	5.003	0.360	2.942	A
3.53	59.62	0.481	5.773	0.285	3.418	A + B
3.46	62.74	0.510	6.565	0.304	3.922	A + B
-	64.78	-	6.543	-	3.886	B

[a] Editors' calculations.

[b] A = $Ba(ClO_4)_2 \cdot 3H_2O$; B = $Lu(ClO_4)_3 \cdot 9H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE

The isothermal method was used. Equilibration extended to 30 h. Lu^{3+} was determined gravimetrically as nitron perchlorate. The composition of the solid phases was determined by Schreinemakers' method.

SOURCE AND PURITY OF MATERIALS:

Not stated.

ESTIMATED ERROR:

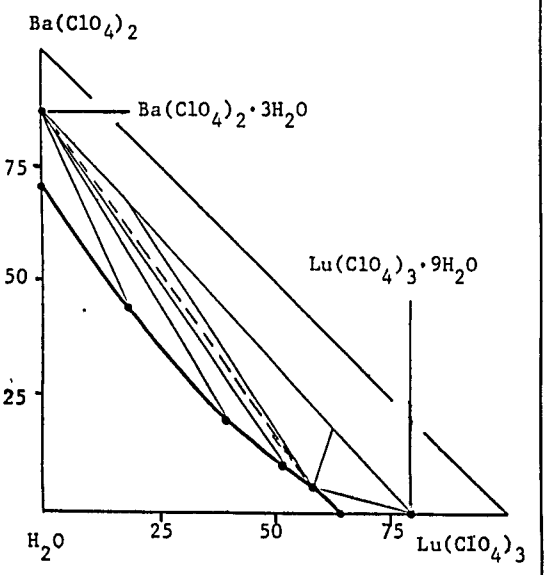
Not stated.

REFERENCES:

None.

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is shown below.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) Carbamide (*urea*); CH_4N_2O; [57-13-6] (3) Water; H_2O; [7732-18-5]	Zakharova, V.P. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1971, *95*, 95-7.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the system $Ba(ClO_4)_2$-CH_4N_2O-H_2O at 25°C

Liquid phase composition						Solid
mass %		mol %[a]		molality[a]/mol kg^{-1}		Phase[b]
(1)	(2)	(1)	(2)	(1)	(2)	
-	54.53	-	26.46	-	19.97	A
12.48	49.06	1.242	27.33	0.965	21.24	A
34.61	47.40	5.444	41.74	5.722	43.87	A
44.60	48.60	10.05	61.34	19.51	119.0	A + B
47.42	43.25	10.23	52.22	15.12	77.19	B
57.09	25.62	10.91	27.41	9.820	24.67	B
62.99	18.75	12.38	20.63	10.26	17.10	B + C
61.62	8.95	9.322	7.581	6.227	5.064	C
66.48	-	9.606	-	5.898	-	C

[a] Editors' calculations.

[b] A = CH_4N_2O ; B = $Ba(ClO_4)_2.3CH_4N_2O.H_2O$; C = $Ba(ClO_4)_2.3H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The isothermal method was used. Saturation conditions were not given. Carbamide was determined by the Kjeldahl method, $Ba(ClO_4)_2$ by complexometric titration in the presence of a magnesium salt [1]. The refractive index of the complex formed was measured.

SOURCE AND PURITY OF MATERIALS:

The (chemically pure) components were recrystallized before use.

ESTIMATED ERROR:

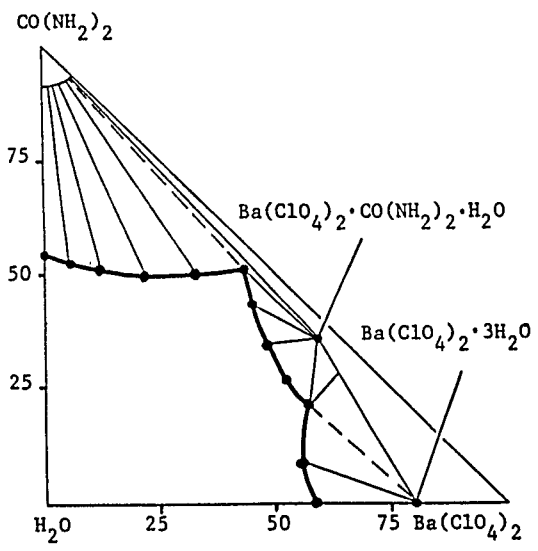
Not stated.

REFERENCES:

1. Vorob'eva, O.L.; Osonova, L.R. *Zh. Obshchei. Khim.* 1953, *23*, 68.

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is given below.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) Carbamide (*urea*) ; CH_4N_2O; [57-13-6] (3) Water; H_2O; [7732-18-5]	Abdukarimova F.M.; Nogoev, K.; Sulaimankulov, K. *Zh. Neorg. Khim.* 1973, *18*, 2275-9.
VARIABLES: One temperature: 303 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility in the system $Ba(ClO_4)_2$-CH_4N_2O-H_2O at 30°C

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	57.50	-	28.87	-	22.53	$CO(NH_2)_2$
6.71	54.97	0.652	29.89	0.521	23.89	"
14.45	52.54	1.563	31.81	1.302	26.50	"
21.67	53.33	2.754	37.95	2.578	35.20	"
28.72	51.16	4.158	41.47	4.245	42.34	"
32.28	52.15	5.250	47.49	6.166	55.77	"
37.44	53.02	7.308	57.94	11.67	92.54	"
42.77	54.67	10.78	77.17	49.69	355.6	$CO(NH_2)_2$ + $Ba(ClO_4)_2.2CO(NH_2)_2$
51.96	40.65	12.45	54.52	20.91	91.59	$Ba(ClO_4)_2.2CO(NH_2)_2$
52.10	40.51	12.50	54.41	20.97	91.28	"
53.00	35.84	11.47	43.44	14.12	53.48	"
55.12	31.40	11.42	36.44	12.16	38.79	"
58.29	26.06	11.75	29.40	11.08	27.73	"
59.95	23.01	11.83	25.42	10.46	22.49	"
67.28	17.22	14.85	21.28	12.91	18.50	$Ba(ClO_4)_2.2H_2O$
67.05	17.01	14.58	20.71	12.51	17.77	"
66.36	11.37	12.16	11.67	8.862	8.501	"
66.08	6.69	10.80	6.123	7.217	4.091	"
66.92	2.64	10.30	2.275	6.538	1.444	"
66.53	-	9.625	-	5.912	-	"

[a] Editors' calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal method was used.	Not stated.
	ESTIMATED ERROR: Not stated.
	REFERENCES: None.

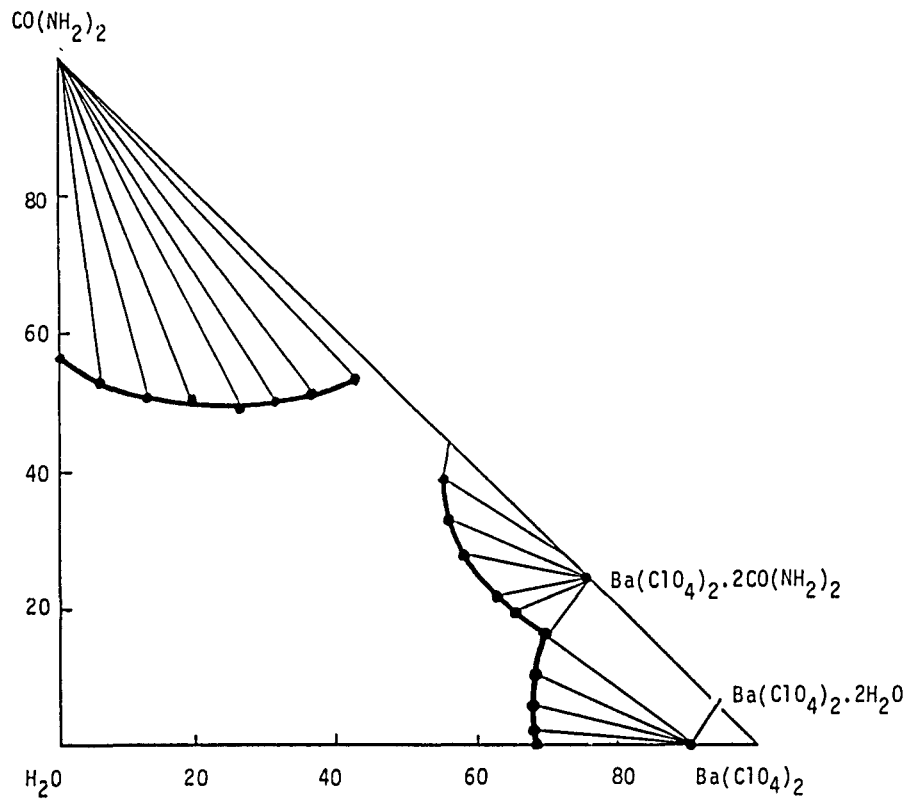
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) Carbamide (*urea*) ; CH_4N_2O; [57-13-6] (3) Water; H_2O; [7732-18-5]	Abdukarimova F.M.; Nogoev, K.; Sulaimankulov, K. *Zh. Neorg. Khim.* 1973, *18*, 2275-9.

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) shows three branches of crystallization corresponding to the separation into the solid phases of the component salts and a new compound of composition $Ba(ClO_4)_2.2CO(NH_2)_2$.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	Abdukarimova, F.M.; Nogoev, K.; Sulaimankulov, K.
(2) Carbamide (*urea*); CH_4N_2O; [57-13-6]]	*Zh. Neorg. Khim.* 1973, *18*, 2275-8; **Russ. J. Inorg. Chem.* (Engl.Transl.) 1973, *18*, 1203-5.
(3) Water; H_2O; [7732-18-5]	
VARIABLES:	PREPARED BY:
One temperature: 303 K	C.Y. Chan
Composition	

EXPERIMENTAL VALUES:

The solubility system $Ba(ClO_4)_2$-CH_4N_2O-H_2O at 30°C :

Liquid phase composition				Solid phase
mass %		mol %[a]		
(1)	(2)	(1)	(2)	
66.53	-	9.625	-	$Ba(ClO_4)_2.2H_2O$
65.92	2.64	9.876	2.21	"
66.08	6.69	10.80	6.12	"
66.36	11.37	12.16	11.67	"
67.05	17.01	14.58	20.71	"
67.28	17.22	14.85	21.28	$Ba(ClO_4)_2.2CO(NH_2)_2$
59.95	23.01	11.83	25.42	"
58.29	26.06	11.75	29.40	"
55.12	31.40	11.42	36.43	"
53.00	35.84	11.47	43.44	"
52.10	40.51	12.50	54.41	"
51.96	40.65	12.45	54.52	$Ba(ClO_4)_2.2CO(NH_2)_2 + CO(NH_2)_2$
42.77	54.67	10.78	77.17	$CO(NH_2)_2$
37.44	53.02	7.304	57.94	"
32.28	52.15	5.250	47.49	"
28.72	51.16	4.158	41.47	"
21.67	53.33	2.754	37.95	"
14.45	52.54	1.563	31.81	"
6.71	54.97	0.652	29.89	"
-	57.50	-	28.87	"

[a] Compiler's calculations.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
No details given.	Not given.
	ESTIMATED ERROR: Not given.
	REFERENCES: None.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) Thiocarbamide (*thiourea*); CH_4N_2S; [62-56-6] (3) Water; H_2O; [7732-18-5]	Karnaukhov, A.S.; Zakharova, V.P. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *79*, 107-14.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the system $Ba(ClO_4)_2$-CH_4N_2S-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	14.26	-	3.787	-	2.185	A
7.84	13.20	0.509	3.787	0.295	2.196	A
10.95	12.88	0.735	3.820	0.428	2.221	A
24.80	11.27	1.956	3.927	1.154	2.316	A
34.50	9.75	3.086	3.852	1.840	2.298	A
42.41	8.65	4.266	3.844	2.577	2.322	A
44.03	7.93	4.513	3.590	2.726	2.169	A
47.08	7.96	5.110	3.816	3.114	2.326	A
49.83	7.51	5.668	3.773	3.474	2.313	A
53.29	7.01	6.458	3.752	3.992	2.320	A
58.20	6.61	7.821	3.923	4.919	2.468	A
63.11	5.71	9.415	3.763	6.020	2.406	A + B
65.07	2.54	9.558	1.648	5.975	1.030	B
66.48	-	9.606	-	5.898	-	B

[a] Editors' calculations.

[b] A = CH_4N_2S ; B = $Ba(ClO_4)_2.3H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal method was used. Equilibrium was reached in 24-168 h. Ba^{2+} was determined gravimetrically in the presence of picric acid; thiocarbamide by the Kjeldahl method. The composition of the solid phases was determined by Schreinemakers' method. The densities, viscosities and electrical conductivities of the saturated solutions were measured.	Chemically pure thiocarmbamide and barium perchlorate trihydrate (reagent grade) were recrystallized.
	ESTIMATED ERROR: Not stated.
	REFERENCES: None.

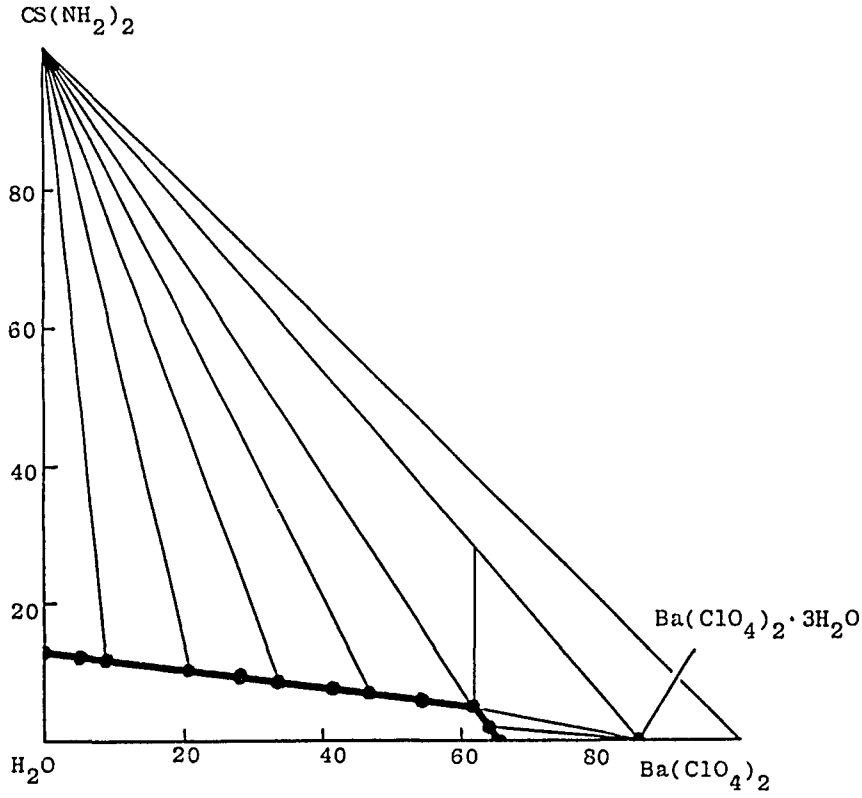
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	Karnaukhov, A.S.; Zakharova, V.P.
(2) Thiocarbamide (*thiourea*); CH_4N_2S; [62-56-6]	*Uch. Zap. Yarosl. Gos. Ped. Inst.* 1970, *79*, 107-14.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is shown below. The average eutectic composition is 5.71 % $CS(NH_2)_2$, 63.11 % $Ba(ClO_4)_2$ and 31.18 % H_2O.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) Thiocarbamide (*thiourea*); CH_4N_2S; [62-56-6] (3) Water; H_2O; [7732-18-5]	Abdukarimova F.M.; Nogoev, K.; Sulaimankulov, K. *Zh. Neorg. Khim.* 1973, *18*, 2275-9.
VARIABLES: One temperature: 303 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility in the system $Ba(ClO_4)_2$-CH_4N_2S-H_2O at 30°C

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	18.20	-	5.002	-	2.923	$CS(NH_2)_2$
7.36	15.45	0.485	4.501	0.284	2.629	"
16.26	14.32	1.182	4.600	0.697	2.710	"
26.80	12.41	2.204	4.507	1.311	2.682	"
36.12	10.53	3.350	4.311	2.014	2.593	"
48.86	9.47	5.626	4.817	3.487	2.986	"
61.20	8.38	9.189	5.558	5.983	3.619	"
61.46	8.10	9.237	5.377	6.005	3.496	$CS(NH_2)_2$ + $Ba(ClO_4)_2.2H_2O$
60.94	7.83	8.983	5.098	5.803	3.294	$Ba(ClO_4)_2.2H_2O$
62.57	4.65	9.004	2.956	5.677	1.864	"
66.53	-	9.625	-	5.912	-	"

[a] Editors' calculations.

AUXILIARY INFORMATION

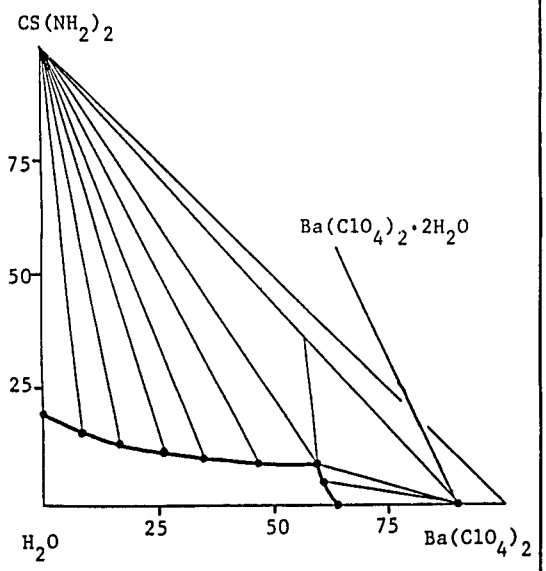
METHOD/APPARATUS/PROCEDURE:
The isothermal method was used.

SOURCE AND PURITY OF MATERIALS:
Not stated.

ESTIMATED ERROR:
Not stated.

REFERENCES:
None.

COMMENTS AND/OR ADDITIONAL DATA:
The solubility isotherm (mass %) is given below.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) Ethanol (*ethyl alcohol*); C_2H_6O [64-17-5] (3) Water; H_2O; [7732-18-5]	Van-Valkenburgh, H.B.; McDaniels, W.B. *J. Colo. Wyo. Acad. Sc.* 1930, *1*, 44-5.
VARIABLES: One temperature: 293 K	PREPARED BY: C.Y. Chan

EXPERIMENTAL VALUES:

Solubility[a] of barium perchlorate in *ethyl alcohol*, containing trace amounts of water, at 20 °C :

% *alcohol*[a]	g(1)/100 cm^3 *alcohol*
95	64.99
97	66.01
98	71.99
99.8	93.21

[a] Not specified whether percentage by weight or volume.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The experimental procedure was not given. Analysis was probably by an evaporation-to-dryness method (compiler).	Not stated.
	ESTIMATED ERROR: Not stated.
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) Acetamide; C_2H_5NO; [60-35-5] (3) Water; H_2O; [7732-18-5]	Tarakanov, V.F. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1977, *164*, 35-6.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility in the system $Ba(ClO_4)_2$-C_2H_5NO-H_2O at 25°C

Liquid phase composition						Solid phase
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
66.44	-	9.590	-	5.888	-	$Ba(ClO_4)_2.3H_2O$
64.29	3.28	9.341	2.713	5.896	1.712	"
63.70	8.38	10.07	7.542	6.785	5.081	"
63.34	11.78	10.65	11.28	7.571	8.016	"
62.15	16.59	11.23	17.07	8.694	13.21	"
61.90	20.08	12.08	22.30	10.22	18.87	"
62.00	24.28	13.59	30.29	13.44	29.96	"
34.92	60.32	7.475	73.51	21.82	214.5	C_2H_5NO
23.63	62.92	3.734	56.60	5.225	79.20	"
21.18	63.51	3.169	54.08	4.114	70.23	"
9.47	67.12	1.143	46.12	1.203	48.54	"
-	71.22	-	43.01	-	41.90	"

[a] Editors' calculations.

AUXILIARY INFORMATION

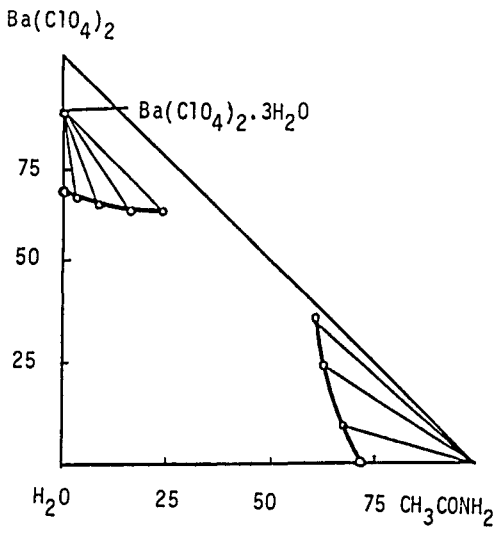
METHOD/APPARATUS/PROCEDURE:
The solubility was studied by isothermal recrystallization. Acetamide was determined by Kjeldahl's method and perchlorate ion was determined gravimetrically as nitron perchlorate.

SOURCE AND PURITY OF MATERIALS:
Not stated.

ESTIMATED ERROR:
Not stated.

REFERENCES:
None.

COMMENTS AND/OR ADDITIONAL DATA:
The solubility isotherm (mass %) is given below. It shows a discontinuity since melts are formed.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) Dimethylcarbamide (*Dimethylurea*); $C_3H_8N_2O$; [1320-50-9] (3) Water; H_2O; [7732-18-5]	Vasil'eva,S.I.; Rylenkova,I.N. *Sb. Tr. Smolensk. Gos. Ped. Inst.* 1979, 7-15.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility in the system $Ba(ClO_4)_2$-$C_3H_8N_2O$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	25.29	-	6.473	-	3.842	A
16.40	27.01	1.395	8.767	0.862	5.417	A
21.04	28.01	1.950	9.908	1.228	6.239	A
26.51	29.90	2.778	11.96	1.809	7.784	A
32.62	33.84	4.141	16.39	2.892	11.45	A
35.46	35.29	4.952	18.81	3.605	13.69	A
37.81	37.18	5.849	21.95	4.496	16.87	A
46.20	40.50	10.29	34.42	7.330	34.56	A + B
45.20	36.46	8.583	26.42	7.330	22.56	B
50.72	32.58	10.42	25.54	9.033	22.14	B
53.11	35.22	13.10	33.16	13.54	34.25	B + C
52.61	31.07	11.06	24.92	9.587	21.61	C
52.52	27.53	9.911	19.83	7.829	15.66	C
52.25	21.41	8.352	13.06	5.900	9.225	C
54.70	20.29	9.133	12.93	6.505	9.208	C
57.56	19.19	10.19	12.97	7.363	9.368	C + D
53.36	17.29	7.998	9.890	5.407	6.686	D
52.78	15.02	7.422	8.061	4.875	5.294	D
54.63	13.34	7.767	7.238	5.073	4.727	D
55.60	10.33	7.607	5.393	4.853	3.441	D
58.00	9.32	8.244	5.057	5.278	3.244	D
58.19	6.92	7.909	3.587	4.960	2.250	D
62.13	4.77	8.900	2.616	5.582	1.634	D + E
64.42	5.09	9.867	2.977	6.284	1.896	E

[a] Editors' calculations.

[a] A = $C_3H_8N_2O$; B = $Ba(ClO_4)_2.3C_3H_8N_2O$; C = $Ba(ClO_4)_2.2C_3H_8N_2O.H_2O$; D = $Ba(ClO_4)_2.C_3H_8N_2O.2H_2O$; E = $Ba(ClO_4)_2.3H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE	COMMENTS AND/OR ADDITIONAL DATA:
The isothermal method was used.	The following compounds are salted out with barium perchlorate: $Ba(ClO_4)_2.2C_3H_8N_2O.H_2O$ and $Ba(ClO_4)_2.C_3H_8N_2O.2H_2O$.
SOURCE AND PURITY OF MATERIALS: Not stated.	
ESTIMATED ERROR: Not stated.	

COMPONENTS:

(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]

(2) Dimethylcarbamide (*dimethylurea*); $C_3H_8N_2O$; [1320-50-9]

(3) Water; H_2O; [7732-18-5]

ORIGINAL MEASUREMENTS:

Karnaukhov, A.S.; Rylenkova, I.N.; Vasil'eva, S.I.

Tr. Yarosl. Gos. Ped. Inst. 1979, *178*, 49-52.

VARIABLES:

One temperature: 298 K

Composition

PREPARED BY:

E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility in the system $Ba(ClO_4)_2$-$C_3H_8N_2O$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	26.29	-	6.797	-	4.048	A
16.40	27.01	1.395	8.767	0.862	5.417	A
19.14	27.06	1.699	9.167	1.058	5.708	A
21.04	28.01	1.950	9.908	1.228	6.239	A
34.40	34.93	4.648	18.01	3.336	12.93	A
35.46	35.29	4.952	18.81	3.605	13.69	A
46.20	40.50	10.29	34.42	10.33	34.56	A + B
45.20	36.46	8.583	26.42	7.330	22.56	B
53.13	35.22	13.12	33.19	13.56	34.31	B + C
53.86	32.49	12.45	28.66	11.74	27.01	C
58.19	18.11	10.22	12.13	7.302	8.673	C + D
57.68	19.12	10.23	12.94	7.394	9.354	C + D
54.97	19.24	9.015	12.04	6.339	8.467	D
54.63	13.35	7.769	7.245	5.074	4.732	D
55.60	10.33	7.607	5.393	4.853	3.441	D
62.13	4.77	8.900	2.607	5.582	1.636	D
64.58	5.09	9.934	2.988	6.332	1.905	D + E
66.42	-	9.582	-	5.883	-	E

[a] Editors' calculations.

[b] A = $C_3H_8N_2O$; B = $3C_3H_8N_2O.Ba(ClO_4)_2$; C = $2C_3H_8N_2O.Ba(ClO_4)_2.H_2O$; D = $C_3H_8N_2O.Ba(ClO_4)_2.2H_2O$; E = $Ba(ClO_4)_2.3H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The isothermal method was used. Equilibrium was attained in 5 days. Ba^{2+} was determined by complexometric titration with EDTA in the presence of chrome black at pH 10-11. The equivalence point was detected by back titration [1,2]. Dimethylurea was determined by Kjeldahl's method. The densities, viscosities and refractive indexes of the saturated solutions were measured.

SOURCE AND PURITY OF MATERIALS:

Barium perchlorate was prepared from the oxide and perchloric acid. Asymmetric dimethylurea was chemically pure.

REFERENCES:

1. Pribil, R. *Komplexone in der chemischen Analyse. Berlin, Deut. Verl. der Wissen.* 1961.

2. Charlot. G. *Les methodes de la chimie anal. Masson, Paris.* 1961.

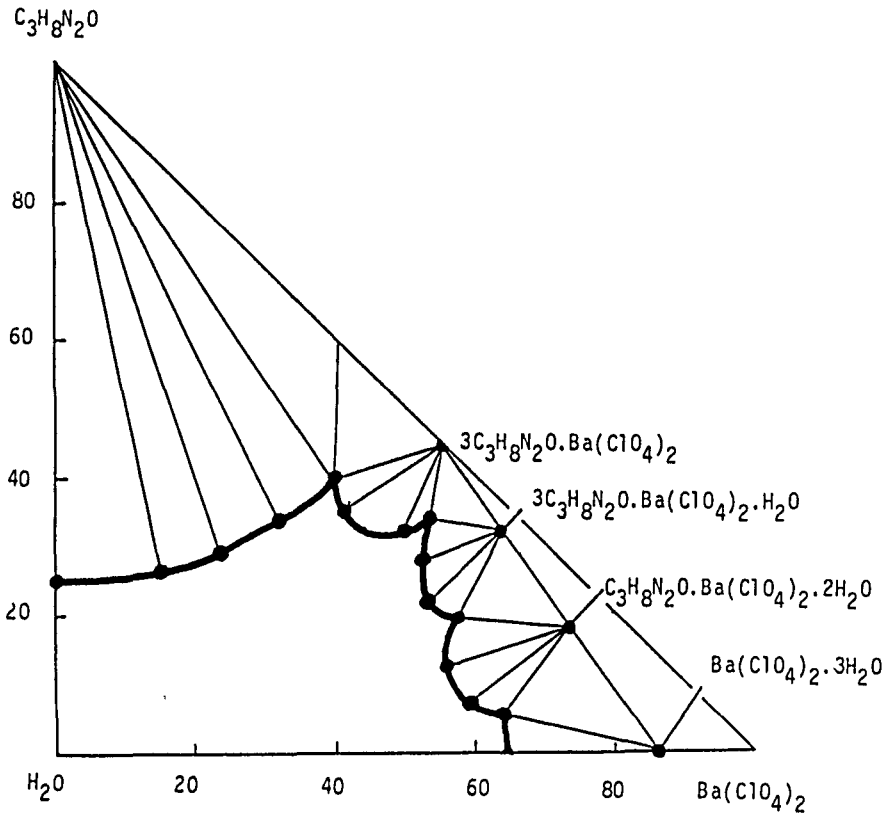
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	Karnaukhov, A.S.; Rylenkova,I.N.; Vasil'eva, S.I.
(2) Dimethylcarbamide (*dimethylurea*); $C_3H_8N_2O$; [1320-50-9]	*Tr. Yarosl. Gos. Ped. Inst.* 1979, *178*, 49-52.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is shown below. It shows five branches of crystallization, two for the crystallization of the components and three for the complexes formed. The solubility of dimethylurea increases considerably with increasing concentration of barium perchlorate, indicating complex formation in the system.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (2) Hexamethylenetetramine; $C_6H_{12}N_4$; [100-97-0] (3) Water; H_2O; [7732-18-5]	Bogachev, A.V. *Sb. Tr. Yarosl. Gos. Ped. Inst.* 1976, *154*, 55-58.
VARIABLES: One temperature: 298 K Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility in the system $Ba(ClO_4)_2$-$C_6H_{12}N_4$-H_2O at 25°C

Liquid phase composition						Solid phase[b]
mass %		mol %[a]		molality[a]/mol kg^{-1}		
(1)	(2)	(1)	(2)	(1)	(2)	
-	46.52	-	9.679	-	5.948	A
14.07	42.50	1.525	10.59	0.964	6.692	A
26.45	39.06	3.480	11.82	2.281	7.744	A + B
32.02	33.08	4.216	10.02	2.729	6.482	B
37.81	26.28	4.920	7.863	3.131	5.004	B
44.57	22.63	6.288	7.341	4.041	4.718	B + C
47.93	17.05	6.470	5.292	4.070	3.329	C
58.34	8.28	8.330	2.718	5.198	1.696	C
65.15	6.34	10.65	2.383	6.796	1.521	C + D
66.05	2.48	10.02	0.865	6.242	0.539	D
66.75	-	9.711	-	5.970	-	D

[a] Editors' calculations.

[b] A = $C_6H_{12}N_4$; B = $Ba(ClO_4)_2 \cdot 2C_6H_{12}N_4 \cdot 6H_2O$;
C = $Ba(ClO_4)_2 \cdot C_6H_{12}N_4 \cdot 4H_2O$; D = $Ba(ClO_4)_2 \cdot 3H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Equilibration by the isothermal method was made in 12-14 days. Ba^{2+} was determined with Trilon B using chrome black as indicator at pH 9-10. Hexamethylenetetramine was determined by acid hydrolysis. The ammonia was distilled into a saturated solution of boric acid which was titrated with 0.2 mol dm^{-3} H_2SO_4. The solid phase composition was determined by Schreinemakers' "wet residue" method as well as analytically.	Not stated. ESTIMATED ERROR: Not stated. REFERENCES: None.

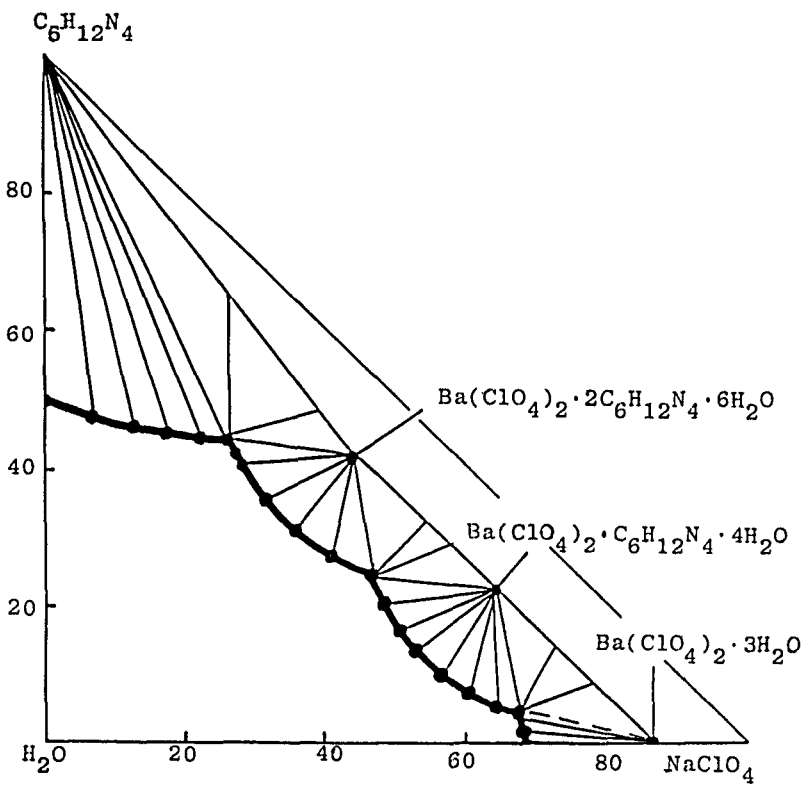
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	Bogachev, A.V.
(2) Hexamethylenetetramine; $C_6H_{12}N_4$ [100-97-0]	*Sb. Tr. Yarosl. Gos. Ped. Inst.* 1976, *154*, 55-58.
(3) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The solubility isotherm (mass %) is given below. It has four branches of crystallization. The first and the last branches correspond to the crystallization of the pure components. The third branch corresponds to the crystallization of a congruently soluble compound of formula $Ba(ClO_4)_2 \cdot 2C_6H_{12}N_4 \cdot 6H_2O$ and the fourth branch is for the crystallization of the other congruently soluble compound of formula $Ba(ClO_4)_2 \cdot C_6H_{12}N_4 \cdot 4H_2O$. These compounds are white crystalline substances which are stable in air and non-hygroscopic. They have different densities and are readily prepared from aqueous solutions of hexamethylenetetramine and barium perchlorate of definite ratios. The density and viscosity isotherms have three extrema and confirm crystallization of the two components and two compounds.



COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sodium chloride; NaCl; [7647-14-5]	1. Zaitseva, S.N.; Karnaukhov, A.S.
(2) Sodium perchlorate; $NaClO_4$; [7601-89-0]	*Uch. Zap. Yarosl. Gos. Ped.Inst.* 1969, *66*, 107-12.
(3) Barium chloride; $BaCl_2$; [10361-37-2]	2. Zaitseva, S.N.; Karnaukhov, A.S.
(4) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	*Uch. Zap. Yarosl. Gos. Ped.Inst.* 1970, *78*, 86-91.
(5) Water; H_2O; [7732-18-5]	
VARIABLES: Temperature/K: 298 and 323 Composition	PREPARED BY: E.S. Gryzlova

EXPERIMENTAL VALUES:

Solubility in the system $Na^+, Ba^{2+}//ClO_4^-, Cl^- - H_2O$ at 25°C

Liquid phase composition								Solid phase[b]
mass %				mol %[a]				
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
24.72	-	3.12	-	9.519	-	0.337	-	A + B
23.38	3.16	3.04	-	9.198	0.593	0.336	-	"
19.38	12.83	2.97	-	8.417	2.599	0.354	-	"
17.77	16.61	3.18	-	7.755	3.460	0.389	-	"
9.00	38.06	2.62	-	4.709	9.504	0.385	-	"
6.07	43.02	2.43	-	3.289	11.13	0.370	-	"
4.96	49.25	1.66	-	2.882	13.66	0.271	-	"
2.26	53.08	1.24	-	1.339	15.01	0.206	-	"
1.30	61.76	1.62	-	0.892	20.22	0.312	-	A + B + C
1.35	66.18	-	-	0.976	22.85	-	-	B + C
1.80	61.39	-	4.14	1.306	21.26	-	0.522	A + C
-	47.17	2.58	1.74	-	14.45	0.400	0.167	A + C + D
-	45.84	4.23	1.93	-	12.22	0.663	0.187	A + D
-	38.07	5.90	1.49	-	9.223	0.840	0.131	"
-	32.37	7.31	1.84	-	7.444	0.989	0.154	"
-	8.63	22.11	0.25	-	1.759	2.649	0.019	"
-	1.54	23.87	1.18	-	0.299	2.726	0.083	"
-	0.48	24.78	1.70	-	0.094	2.845	0.121	"
-	-	26.18	1.74	-	-	3.043	0.125	"
1.37	59.15	-	10.11	1.082	22.29	-	1.388	C + D
1.43	44.35	-	21.76	1.086	16.08	-	2.872	"
1.57	40.84	-	25.75	1.219	15.13	-	3.474	"
1.52	35.67	-	34.84	1.318	14.76	-	5.250	C + D + E
-	41.32	-	32.90	-	18.08	-	5.243	C + F
-	32.53	2.61	27.74	-	10.97	0.518	3.407	D + E
-	28.01	1.91	32.68	-	9.488	0.380	4.031	"
-	23.05	4.08	33.25	-	7.512	0.782	3.946	"
-	18.42	7.84	29.84	-	5.544	1.387	3.270	"
-	8.84	6.84	33.71	-	2.395	1.090	3.326	"
-	-	6.78	50.82	-	-	1.283	5.957	"

[a] Editors' calculations.

[b] A = $BaCl_2.2H_2O$; B = NaCl ; C = $NaClO_4.H_2O$; D = n($BaCl_2$).m[$Ba(ClO_4)_2$] ; E = n[$Ba(ClO_4)_2$].m($BaCl_2$) ; F = $Ba(ClO_4)_2.H_2O$.

(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sodium chloride; NaCl; [7647-14-5]	1. Zaitseva, S.N.; Karnaukhov, A.S.
(2) Sodium perchlorate; $NaClO_4$; [7601-89-0]	*Uch. Zap. Yarosl. Gos. Ped.Inst.* 1969, *66*, 107-12.
(3) Barium chloride; $BaCl_2$; [10361-37-2]	2. Zaitseva, S.N.; Karnaukhov, A.S.
(4) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7]	*Uch. Zap. Yarosl. Gos. Ped.Inst.* 1970, *78*, 86-91.
(5) Water; H_2O; [7732-18-5]	

EXPERIMENTAL VALUES: (continued)

Solubility in the system $Na^+,Ba^{2+}//ClO_4^-,Cl^--H_2O$ at 50°C

Liquid phase composition								Solid phase[b]
mass %				mol %[a]				
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
23.96	-	6.58	-	9.541	-	0.735	-	A + B
20.13	3.46	5.97	-	7.989	0.655	0.665	-	"
18.30	11.29	5.25	-	7.736	2.278	0.623	-	"
15.12	16.13	5.25	-	6.566	3.343	0.640	-	"
10.85	27.74	5.19	-	5.218	6.368	0.701	-	"
9.35	28.49	3.65	-	4.374	6.361	0.479	-	"
6.30	40.15	3.68	-	3.346	10.18	0.549	-	"
2.44	53.51	3.93	-	1.532	16.04	0.693	-	"
1.53	54.26	3.62	-	0.956	16.17	0.634	-	"
0.08	61.28	3.37	-	0.055	20.22	0.654	-	"
0.08	63.84	2.90	-	0.058	21.92	0.585	-	A + B + C
1.35	67.25	-	2.91	1.068	25.40	-	0.400	B + C
1.30	69.27	-	2.47	1.063	27.05	-	0.351	"
1.35	71.19	-	1.27	1.120	28.20	-	0.183	"
1.37	69.00	-	-	1.050	25.25	-	-	B + D
-	55.16	2.82	3.89	-	17.38	0.522	0.446	C + E + F
-	49.84	3.91	5.29	-	14.99	0.692	0.579	A + F
-	41.26	5.93	3.13	-	10.76	0.909	0.297	"
-	32.53	8.60	3.38	-	7.821	1.216	0.296	"
-	24.39	12.36	6.15	-	5.780	1.722	0.531	"
-	17.84	16.82	6.88	-	4.173	2.313	0.586	"
-	10.22	22.05	4.16	-	2.238	2.838	0.332	"
-	0.75	25.19	3.97	-	0.152	3.002	0.293	"
-	-	27.24	4.14	-	-	3.310	0.312	"
-	61.01	-	13.31	-	25.38	-	2.016	C + D
1.25	45.36	-	20.74	0.944	16.35	-	2.722	C + D + F
1.32	35.30	-	30.68	1.019	13.00	-	4.115	D + F
-	36.21	2.03	37.53	-	16.78	0.553	6.334	D + F + G
-	35.40	-	41.71	-	17.17	-	7.367	D + E
-	24.27	4.32	37.85	-	9.033	0.945	5.130	F + G
-	11.50	4.76	49.38	-	4.326	1.053	6.765	"
-	4.37	4.88	53.05	-	1.545	1.015	6.831	"
-	3.99	5.20	52.90	-	1.405	1.077	6.784	"
-	5.26	-	54.20	-	1.750	-	6.567	"

[a] Editors' calculations.

[b] A = $BaCl_2.2H_2O$; B = NaCl ; C = $NaClO_4.H_2O$; D = $NaClO_4$; E = $BaCl_2.H_2O$; F = n($BaCl_2$).m[$Ba(ClO_4)_2$] ; G = n[$Ba(ClO_4)_2$].m($BaCl_2$).

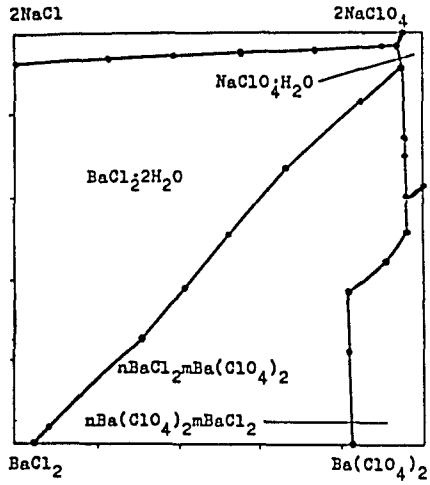
(continued next page)

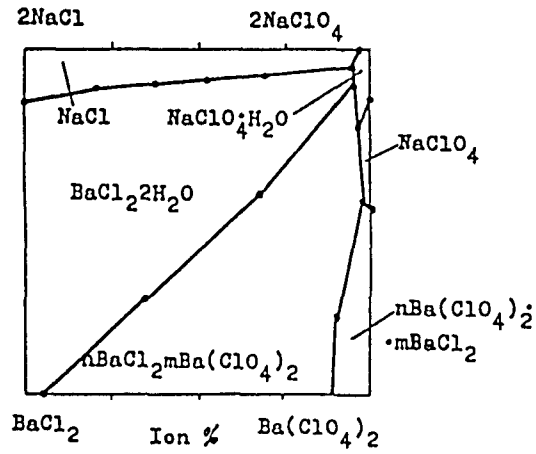
COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sodium chloride; NaCl; [7647-14-5] (2) Sodium perchlorate; $NaClO_4$; [7601-89-0] (3) Barium chloride; $BaCl_2$; [10361-37-2] (4) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (5) Water; H_2O; [7732-18-5]	1. Zaitseva, S.N.; Karnaukhov, A.S. *Uch. Zap. Yarosl. Gos. Ped.Inst.* 1969, *66*, 107-12. 2. Zaitseva, S.N.; Karnaukhov, A.S. *Uch. Zap. Yarosl. Gos. Ped.Inst.* 1970, *78*, 86-91.

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The Janecke diagrams are given below.





AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method of nonvariant points. To the solution corresponding to the transition point of the ternary system a third salt was added until a new solid phase appeared. Conditions of saturation not stated. Ba^{2+} was determined gravimetrically in the presence of picric acid; Na^+ gravimetrically as sodium zinc uranyl acetate; Cl^- mercurimetrically; ClO_4^- by difference.

SOURCE AND PURITY MATERIALS:	ESTIMATED ERROR:
The (chemically pure) components were recrystallized before use.	Temp.: ±0.1°C.
	REFERENCES: None.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium nitrate; $Ba(NO_3)_2$; [10022-31-8] (2) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (3) Ammonium nitrate; NH_4NO_3; [6484-52-2] (4) Ammonium perchlorate; NH_4ClO_4; [7790-98-9] (5) Water; H_2O; [7732-18-5]	Karnaukhov,A.S.; Bogachev,A.V. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1973, *120*, 36-9.
VARIABLES: Temperature: 298 K Composition	PREPARED BY: N.A. Kozyreva

EXPERIMENTAL VALUES:

Solubility in the system $NH_4^+, Ba^{2+}//ClO_4^-, NO_3^- - H_2O$ at 25°C

Liquid phase composition								Solid phase[b]
mass %				mol %[a]				
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	
6.17	63.82	-	-	1.256	10.10	-	-	A + B
5.84	61.57	-	2.20	1.169	9.582	-	0.980	A + B + C
5.07	46.62	-	3.98	0.731	5.227	-	1.287	B + C
4.64	26.34	-	8.12	0.501	2.109	-	1.949	B + C
3.28	18.32	-	14.13	0.334	1.451	-	3.203	B + C
1.87	12.16	-	18.94	0.182	0.921	-	4.107	B + C
8.12	-	3.72	16.65	0.742	-	1.110	3.383	B + C
9.02	37.10	-	9.75	1.289	4.121	-	3.099[c]	B + C
4.42	-	30.47	8.85	0.470	-	10.59	2.095	B + C
3.43	-	60.73	3.47	0.504	-	29.20	1.135	B + C + D
4.04	-	65.45	-	0.612	-	32.36	-	B + D
-	-	63.55	6.18	-	-	31.42	2.082	C + D
6.13	62.07	-	2.05	1.250	9.825	-	0.930	A + C
-	63.73	-	1.76	-	8.942	-	0.707	A + C

[a] Editors' calculations.

[b] A = $Ba(ClO_4)_2 \cdot 3H_2O$; B = $Ba(NO_3)_2$; C = NH_4ClO_4 ; D = NH_4NO_3.

[c] This experimental point appears to be in error (evaluator).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The isothermal method was used. To the sat. slns. corresponding to the composition of the nodal points (in the presence of excess solid phases) a third salt was added until a new solid phase appeared. Ba^{2+} was determined by complexometric titration with the indicator chromogen black at pH 8-9; NH_4^+ by distillation of NH_3 into a sat. sln. of boric acid and subsequent titration with H_2SO_4; NO_3^- as NH_3 by preliminary reduction to NH_3 using Devarda's alloy and ClO_4^- by difference. Solid phases were examined under a microscope and graphic representation was made using the horizontal projection of the crystallization field.

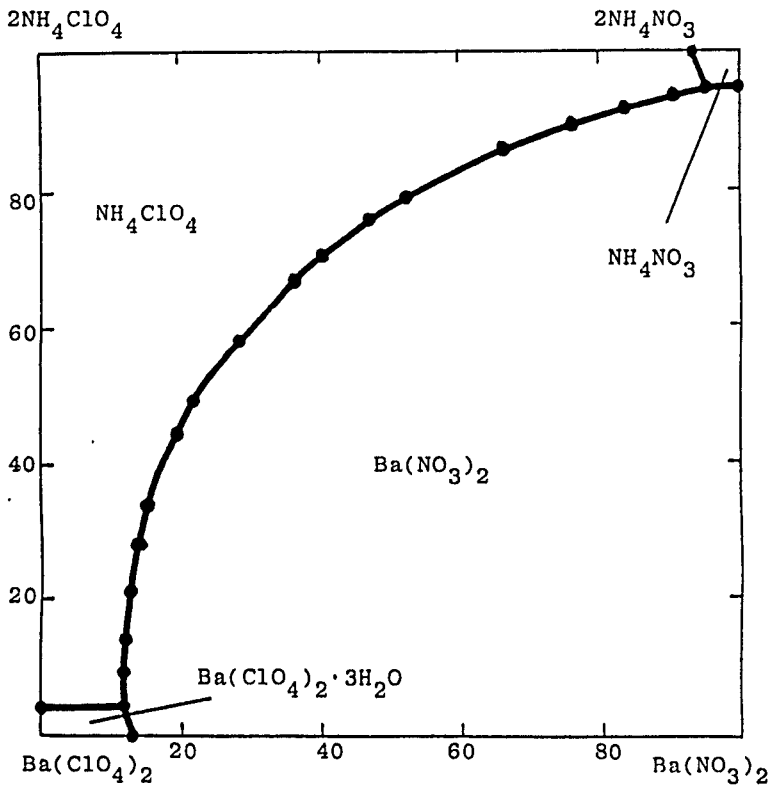
(continued next page)

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Barium nitrate; $Ba(NO_3)_2$; [10022-31-8] (2) Barium perchlorate; $Ba(ClO_4)_2$; [13465-95-7] (3) Ammonium nitrate; NH_4NO_3; [6484-52-2] (4) Ammonium perchlorate; NH_4ClO_4; [7790-98-9] (5) Water; H_2O; [7732-18-5]	Karnaukhov,A.S.; Bogachev,A.V. *Uch. Zap. Yarosl. Gos. Ped. Inst.* 1973, *120*, 36-9.

EXPERIMENTAL VALUES: (continued)

COMMENTS AND/OR ADDITIONAL DATA:

The Janecke diagram is shown below. $Ba(NO_3)_2$ is salted out to a great extent by NH_4NO_3 and $Ba(ClO_4)_2$.



SYSTEM INDEX

FORMULA/REGISTRY NUMBER INDEX

Page numbers preceded by E refer to evaluation texts.

REGISTRY NUMBER INDEX

Page numbers preceded by E refer to evaluation texts.

AUTHOR INDEX

Page numbers preceded by E refer to evaluation texts.

SOLUBILITY DATA SERIES

Volume 1	H. L. Clever, *Helium and Neon*
Volume 2	H. L. Clever, *Krypton, Xenon and Radon*
Volume 3	M. Salomon, *Silver Azide, Cyanide, Cyanamides, Cyanate, Selenocyanate and Thiocyanate*
Volume 4	H. L. Clever, *Argon*
Volume 5/6	C. L. Young, *Hydrogen and Deuterium*
Volume 7	R. Battino, *Oxygen and Ozone*
Volume 8	C. L. Young, *Oxides of Nitrogen*
Volume 9	W. Hayduk, *Ethane*
Volume 10	R. Battino, *Nitrogen and Air*
Volume 11	B. Scrosati and C. A. Vincent, *Alkali Metal, Alkaline Earth Metal and Ammonium Halides. Amide Solvents*
Volume 12	C. L. Young, *Sulfur Dioxide, Chlorine, Fluorine and Chlorine Oxides*
Volume 13	S. Siekierski, T. Mioduski and M. Salomon, *Scandium, Yttrium, Lanthanum and Lanthanide Nitrates*
Volume 14	H. Miyamoto, M. Salomon and H. L. Clever, *Alkaline Earth Metal Halates*
Volume 15	A. F. M. Barton, *Alcohols with Water*
Volume 16/17	E. Tomlinson and A. Regosz, *Antibiotics: I. β-Lactam Antibiotics*
Volume 18	O. Popovych, *Tetraphenylborates*
Volume 19	C. L. Young, *Cumulative Index: Volumes 1–18*
Volume 20	A. L. Horvath and F. W. Getzen, *Halogenated Benzenes, Toluenes and Phenols with Water*
Volume 21	C. L. Young and P. G. T. Fogg, *Ammonia, Amines, Phosphine, Arsine, Stibine, Silane, Germane and Stannane in Organic Solvents*
Volume 22	T. Mioduski and M. Salomon, *Scandium, Yttrium, Lanthanum and Lanthanide Halides in Nonaqueous Solvents*
Volume 23	T. P. Dirkse, *Copper, Silver, Gold, and Zinc, Cadmium, Mercury Oxides and Hydroxides*
Volume 24	W. Hayduk, *Propane, Butane and 2-Methylpropane*
Volume 25	C. Hirayama, Z. Galus and C. Guminski, *Metals in Mercury*
Volume 26	M. R. Masson, H. D. Lutz and B. Engelen, *Sulfites, Selenites and Tellurites*
Volume 27/28	H. L. Clever and C. L. Young, *Methane*
Volume 29	H. L. Clever, *Mercury in Liquids, Compressed Gases, Molten Salts and Other Elements*
Volume 30	H. Miyamoto and M. Salomon, *Alkali Metal Halates, Ammonium Iodate and Iodic Acid*
Volume 31	J. Eysseltová and T. P. Dirkse, *Alkali Metal Orthophosphates*
Volume 32	P. G. T. Fogg and C. L. Young, *Hydrogen Sulfide, Deuterium Sulfide and Hydrogen Selenide*
Volume 33	P. Franzosini, *Molten Alkali Metal Alkanoates*
Volume 34	A. N. Paruta and R. Piekos, *4-Aminobenzenesulfonamides. Part I: Non-cyclic Substituents*
Volume 35	A. N. Paruta and R. Piekos, *4-Aminobenzenesulfonamides. Part II: 5-Membered Heterocyclic Substituents*
Volume 36	A. N. Paruta and R. Piekos, *4-Aminobenzenesulfonamides. Part III: 6-Membered Heterocyclic Substituents and Miscellaneous Systems*
Volume 37	D. G. Shaw, *Hydrocarbons with Water and Seawater. Part I: Hydrocarbons C_5 to C_7*
Volume 38	D. G. Shaw, *Hydrocarbons with Water and Seawater. Part II: Hydrocarbons C_8 to C_{36}*
Volume 39	C. L. Young, *Cumulative Index: Volumes 20–38*
Volume 40	J. Hala, *Halides, Oxyhalides and Salts of Halogen Complexes of Titanium, Zirconium, Hafnium, Vanadium, Niobium and Tantalum*
Volume 41	C.-Y. Chan, I. N. Lepeshkov and K. H. Khoo, *Alkaline Earth Metal Perchlorates*