

MAR 5 1990

20 February 1990

Professor Matthew Meselson
Department of Biochemistry and Molecular Biology
Harvard University
7 Divinity Avenue
Cambridge, MA 02138
USA

Re: Report from the Pugwash-SIPRI meeting on the TDG Project

Dear Matthew,

Please find attached the report on the meeting in Geneva on 25–26 January 1990. It has been compiled by the members of the Steering Group (Kaplan, Kyriakopoulos, Lundin, Perry Robinson, Trapp) as agreed.

A copy of this report, minus the section on Results and the list of contributions brought to the meeting, will be sent to those who participated in the meeting of the Pugwash Chemical Warfare Study Group on 27–28 January. You will receive that version from the Pugwash Office; it will probably also be published in the *Pugwash News Letter*.

I take this opportunity to remind those members of the project who have kindly undertaken to provide further information to please do so at your earliest convenience. As soon as any information appears about the date of the summer industry meeting at the CD, I will advise you of the date of our own meeting.

As was also agreed during our meeting, the study will be published under SIPRI auspices. This means that the different background papers, material produced especially for the study and the final results of our deliberations should not be published elsewhere before the publication of the SIPRI study. Accordingly, I enclose 2 copies of the standard SIPRI copyright form. Please sign both copies, retain one for your records and return the other to me at your earliest convenience.

Best regards.

Sincerely yours,



Johan Lundin

Enclosures

Report of TDG Meeting
List of participants in the meeting
List of background material for the meeting
SIPRI copyright form

Pugwash-SIPRI Planning Meeting for the
Thiodiglycol Project
25-26 January 1990, Geneva, Switzerland

LIST OF PARTICIPANTS
26 January 1990

Prof. Rudolf Avenhaus, Universität der Bundeswehr München, Fakultät für Informatik, München, FRG [former Professor for Statistics and Operational Research; former Research Assistant, Nuclear Research Centre, Karlsruhe, and IIASA, Laxenburg]

Mr. Pierre Canonne, Scientific Counsellor, Delegation of France to the UN Conference on Disarmament, Chambésy-Geneva, Switzerland

Dr. Morton J. Canty, Physicist, Programmgruppe Technik und Gesellschaft der Kernforschungsanlage Jülich GmbH, Jülich, FRG

Dr. Will D. Carpenter, Vice-President, Technology, Monsanto Company, St. Louis, Missouri, USA

Major-General (ret.) Dr. Esmat Ezz, former Director of Scientific Research Branch of the Egyptian Armed Forces, Cairo, Egypt

Dr. Martin M. Kaplan, Consultant, World Health Organisation, Geneva, Switzerland [former Secretary-General, Pugwash Conferences on Science and World Affairs, Geneva, Switzerland]

Prof. Nicholas Kyriakopoulos, Department of Electrical Engineering and Computer Science, The George Washington University, Washington DC, USA [Expert, U.S. Arms Control and Disarmament Agency, Washington DC]

Dr. S. Johan Lundin, Senior Researcher, Head, CBW Programme, Stockholm International Peace Research Institute (SIPRI), Stockholm, Sweden [former Director of Research, Swedish National Defence Research Institute; former Adviser, Swedish Delegation to the Conference on Disarmament, Geneva, Switzerland]

Mrs. Sherry Mannix, Delegation of the USA to the UN Conference on Disarmament, Geneva, Switzerland [United States Arms Control and Disarmament Agency, Washington DC, USA]

Dr. Peter Markl, Institute for Analytical Chemistry, Vienna, Austria

../...

Dr. Robert Mathews, Principal Research Scientist, Materials Research Laboratories, Ascot Vale, Victoria, Australia

Prof. Jiri Matousek, Senior Research Fellow, Centre for Peace and Disarmament, Czechoslovak Academy of Sciences, Prague, Czechoslovakia [former Director, Chemical Defence Research and Development Establishment; former Member of the Czechoslovak Delegation to the UN Conference on Disarmament)

Prof. Matthew Meselson, Department of Biochemistry and Molecular Biology, Harvard University, Cambridge, MA, USA

Dr. Bernhard Odernheimer, Adviser, Delegation of the Federal Republic of Germany to the UN Conference on Disarmament, Geneva, Switzerland [former Analytical Chemist, NBC Defence Research Establishment]

Dr. Oleg Parenago, Head of Laboratory, A. V. Topchiev Institute of Petrochemical Synthesis, Academy of Sciences of the USSR, Moscow, USSR

Mr. Julian P. Perry-Robinson, Senior Fellow, Science Policy Research Unit, University of Sussex, Brighton, UK

Dr. P.K. Ramachandran, Emeritus Scientist, Defence Research and Development Establishment, Gwalior, India [former Director, Defence Research and Development Establishment]

Dr. Marjatta Rautio, Director, Finnish Project on the Verification of Chemical Disarmament, Department of Organic Chemistry, University of Helsinki, Helsinki, Finland

Dr. Johan Santesson, Programme Manager, CW Defence, National Defence Research Establishment, Umea, Sweden [Technical Adviser, Swedish Disarmament Mission, Geneva, Switzerland]

Dr. Yuri V. Skripkin, Delegation of the USSR to the UN Conference on Disarmament, Geneva, Switzerland [Expert, Ministry of Chemical and Petrochemical Industry, Moscow]

Prof. Ronald G. Sutherland, Verification Research Unit, Arms Control and Disarmament Division, Department of External Affairs, Ottawa, Canada [Consultant, Arms Control and Disarmament; Adviser, Delegation of Canada to the UN Conference on Disarmament, Geneva, Switzerland]

.../...

Dr. Ralf Trapp, Deputy Director, Research Institute of Chemical Toxicology, Academy of Sciences of the GDR, Leipzig, GDR

Dr. Leo ZefTel, Consultant, E.I. Du Pont de Nemours, Inc., Wilmington, DE, USA [former Manager, Material Resources, E.I. Du Pont de Nemours, Inc.]

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Pugwash/SIPRI Planning Meeting
for the Thiodiglycol Project

25-26 January 1990, Geneva, Switzerland

LIST OF PAPERS
24 January 1990

Working Papers:

Random Sampling for Verification of Compliance to a Chemical Weapons Convention,
by R. Avenhaus, M.J. Canty (FRG)

Study on the Implementation of Possible International Verification Measures Regarding Thiodiglycol under a Chemical Weapons Convention,
by M.M. Kaplan (Switzerland), N. Kyriakopoulos (USA), S.J. Lundin (Sweden), J.P. Perry-Robinson (UK), R. Trapp (GDR)

Monitoring the Life-Cycle of Thiodiglycol,
by Nicholas Kyriakopoulos (USA)

The Pollutant Card-Index System - A Useful Tool for the Estimation of Analytical and Toxicological Data for Thiodiglycol,
by Karlheinz Lohs (FRG)

Tentative Basis for Identification of TDG Verification Scenarios,
by S. Johan Lundin (Sweden)

The Role of Analytical Chemistry in Verifying Production, Processing and Consumption of Thiodiglycol,
by Peter Markl (Austria)

Global Survey of Thiodiglycol - A Progress Report,
by Robert J. Mathews (Australia)

Thiodiglycol and the Chemical Weapons Convention,
by R.G. Sutherland (Canada)

Information Papers:

Extract from: Estimation of Tasks for, Size of, and Necessary Resources for a Technical Secretariat under a Chemical Weapons Convention,
by S.J. Lundin (Sweden)



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Professor Matthew Meselson

20 February 1990

Date

In order that we may accept for publication, through our publishers, Oxford University Press (Walton Street, Oxford OX2 6DP, UK), your contribution entitled

to the work provisionally entitled Study on the Implementation of Possible International Verification Measures Regarding Thiodiglycol Under a CW Convention.

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Dr Walther Stütze
Director of SIPRI



Author

Date

The Steering Group Report on the TDG-Project Meeting in Geneva, 24-25 January 1990

Introduction

The Thiodiglycol (TDG) Project is an international effort to study the technical issues arising in monitoring compliance with the projected Chemical Weapons Convention (CWC). The main objective is to use a case study to identify measures necessary for monitoring chemicals having both commercial applications and potential for chemical-warfare use. The intention is that the results of the study should directly assist the negotiations on chemical weapons in the Conference on Disarmament.

The project was conceived at the 38th Pugwash Conference in Dagomys in 1988, and initiated during the 14th Workshop of the Pugwash CW Study Group one year ago. The work was to be coordinated by a steering group comprising five persons, and would take the form of co-operation between Pugwash and SIPRI. Pugwash would provide a framework of experts and meeting facilities, and SIPRI would provide a project manager and publication resources.

In advancing the project, it was decided to choose as a model one particular dual-use chemical, and to map its role in the real world with respect to production and use, including trade. To build up such a body of information, a model of the process of production, distribution, and use of the chemical would be developed. Critical points in the process would be identified for gathering compliance-monitoring data. Then, taking the available facts as gathered, the study would evaluate the application of relevant prescriptions of the Draft Convention (as provided for in the so called rolling text), and assess their usefulness for ensuring compliance with the CWC during different phases of the life-cycle of the chemical.

Thiodiglycol was chosen as the model chemical for the following reasons:

1. It is a key precursor - i.e., a chemical one step from the formation of an important chemical-warfare agent, in this case mustard gas, which had just been used on a large scale in a war.

2. It is a substance with clear peaceful uses.

3. While not yet decided finally in the negotiations, TDG might be placed on the so called Schedule 2 under the CWC, to be subject to one kind of verification regime, or under Schedule 3, which presupposes another kind of verification regime. This widened the options for the study.

In preparation for the project meeting, a number of background papers and other compilations of information were produced; and CD delegations had been approached with requests for information on TDG.

The following issues to be discussed were on the agenda for the meeting:

1. Production, distribution and legitimate uses of TDG: This session was devoted to giving the participants a common understanding of the production and trade of TDG. The objective of the session was to develop a life cycle for TDG, to include types and quantities of materials, flows, transformation of materials, number and geographical distribution of facilities involved, etc.

2. Conversion to chemical warfare agents: The session was devoted to the chemistry and technology involved in using TDG as a chemical agent key precursor, and second to identifying the possible diversion paths in the model arrived at. The results formed the basis for construction of what we called verification scenarios.

3. Verification scenarios: Based on provided background papers and the preceding discussion, different verification scenarios with associated implications on the producers, distributors and users of TDG, as well as on the states and on the International Verification Organization, were to be worked out.

4. Planning session: Review of the three previous sessions to identify areas where more work has to be done, more information to be found and how the project should continue, including publication forms and dates.

Results

During the discussions two major avenues of inquiry were developed:

a) what would be required to detect a diversion from normal commercial use; and

b) how do the current provisions of the rolling text affect the verification of dual use chemicals such as TDG?

Since these discussions involved a large amount of technical details and assumptions, only a summary of the highlights of the discussions is presented here.

In order to investigate the detection of diversion a materials flow diagram was developed. This diagram included production, storage, distribution and use of TDG. It was the consensus of the group that the detection of diversion was possible only through a systematic materials balance approach. However, this approach requires a closed system over which materials balance can be performed. It was also concluded that it was impractical in such a closed system to include the end users. Therefore, materials balance, and consequently detection of diversion could be performed from the production through the distribution stages. To perform materials balance, it is necessary to establish a reporting system; the reported information would then be verified through a monitoring system which could include inspectors and instruments. It was left as an open question as to what type of information would be needed to perform materials balance for TDG.

It was also recognized that diversion could occur in the flow of materials from the distribution to end-use stages. The group felt that some other form of verification would be necessary to detect diversion at that stage of the process.

With respect to the reporting requirements contained in the current rolling text, the group arrived at two major conclusions:

a) the reporting only of current aggregate figures would not be sufficient in detecting diversion, and

b) if detection of diversion is to be accomplished the distribution and storage must be covered by the declarations.

A corollary question was whether it was necessary to even attempt to verify non-diversion; instead, the issue might only be how does one detect illegal production of mustard gas from TDG by other means such as ad hoc or challenge inspections or possible other approaches? This question was left open for further discussion. It should again be emphasised that these reports are related only to TDG.

Conclusions and Recommendations

The group concluded that the TDG project, as a case study for implementing verification of dual-purpose key precursor chemicals, should be further pursued. The present stage may be characterized as an interim phase where additional data and information are required.

In order to fill that gap it was proposed to approach chemical manufacturers associations to get a clearer if semiquantitative picture of the production, distribution and use patterns of TDG.

In the meantime it was suggested that a more detailed interim report be prepared which would record the substantive points made during the meeting, highlight open problems, and draw preliminary conclusions. If appropriate, a concise version of this interim report might be transmitted to the chairman of the Ad Hoc Committee on Chemical Weapons of the CD.

A follow up meeting was projected for June or July 1990 in Geneva to deal further with the interim report, the additional information and data from industry associations, and the evaluations to be done by the members of the TDG project group. The precise date for the meeting will be set at the end of February 1990.

There was consensus that the results of the Study should be published under SIPRI auspices.