OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

RESTRICTED

16132

29 December 1986
ENGLISH

BEIJING SPECIALTY GAS RESEARCH INSTITUTE (BSGRI)

DP/CPR/85/005/11-01

Second Status Report*

Prepared for the Government of the Peoples Republic of China
by the United Nations Industrial Development Organization
acting as executing agency for the United Nations Development Programme

Based on the work of Willard L. Ent
Chief Technical Advisor for UNIDO with BSGRI

436

* This document has been reproduced without formal editing

ABSTRACT

This second status report of the CTA for Beijing Specialty Gas Research Institute describes a fourteen day visit to Beijing to monitor the activities of the Institute as it begins to take form. Coupled with the fourteen days, were four additional days working as the expert for toxicology and safety data for specialty gases. Those activites are described in Annex C of this report. The basic report describes further work in the procurement of instrumentation and equipment for use in the research laboratory; the preparation of additional job descriptions for the experts to be used through October of 1987; the finalization of the plans for the study tours of the United States and Japan scheduled for May of 1987 and the final secheduling for the fellowships. A change or two in job descriptions from those as originally presented is also requested.

TABLE OF CONTENTS

INTRODUCTION

This report describes the activities of the Chief Technical Advisor during his second visit to Beijing, China to review and monitor the activities of Project DP/CPR/85/005; Beijing Specialty Gas Research Institute. It also includes an annex (C) which describes the CTA's activities in China in helping the institute to develop its "Center for Specialty Gas Safety and Toxicology". The basic report has four sections. These are Job Descriptions; Instrumentation and Equipment Purchases; Study Tours and Fellowships. The content of each section was reviewed with BSGRI personnel and they agreed with the CTA on how the information is presented herein.

As in the initial report on this project, one or two changes are requested due to the changing "climate" of the specialty gas industry in China.

JOB DESCRIPTIONS

As in the initial visit to Beijing to work with BSGRI personnel, additional changes and modifications were required in the job description portion of the project. Due to changes in requirements at BSGRI; their ability to solve some of their production and analysis problems; and other reasons the list of Job Descriptions as presented beginning on page 5 of the Initial Status Report of this project (dated 15 August 1986) should be modified and changed as follows (where appropriate, proposed dates for the visits of the experts to China are also listed):

1. #11.06; Expert in Anhydrous Hydrogen Chloride Purification.
   The problems associated with HCl purification and analysis of impurities have been solved by the BSGRI personnel; therefore, this expert is no longer required. It is requested that this expert requirement be changed to an expert in measuring particulates in specialty gas products. That job description will be prepared during the next visit of the CTA to China in October of 1987. Requirement will be in 1988,

2. #11.11; Expert in Gas Blending, Purification and Analysis.
   During the visit of the CTA, it was agreed that if this expert had already been recruited by UNIDO, Vienna that they should proceed - with the expert being in China in January or February of 1987. If recruitment had not been finalized, it should be held in abeyance until a future date.
   NOTE: This information (#11.11), as well as the cancellation of the requirement for #11.06 was telexed to Vienna during the early part of the CTA's visit.

3. #11.10; Expert in Specialty Gas Safety and Toxicology.
   This work was accomplished by the CTA during this visit. A complete report of the activities and results are included as Annex C of this report.

4. #11.01; Chief Technical Advisor.
   This report outlines activities of the CTA during this (November-December 1986) visit. A new Job Description for the CTA activities (probably in October of 1987) is included in the other new Job Descriptions in Annex A of this report.

5. #11.04; Expert in Carbon Dioxide, Purification and Applications.
   After the study tour in Europe, the Director of BSGRI, Mr. Chen, decided that more emphasis should be placed on applications of carbon dioxide. He recognized that Europe (and the rest of the world) has been utilizing CO_2 in many applications which are not being practiced in China but would be very beneficial and easily developed for use in China. He requested that one additional name (company) be placed on the list of potential experts for this position. This person (company) has abundant experience in carbon dioxide applications. They are: The Distillers Company (Carbon Dioxide) Ltd., Cedar House, 39 London Road; Reigate, Surrey RH2 9QE; United Kingdom. Attention: Mr. Tony Parfitt, Managing Director. The requirement for this expert is March of 1987.

6. #11.05; Expert in Gaseous Food Preservation and Ripening.
   No modification or changes from 15 August 1986 Report. Expert required in March of 1987.

7. #11.08; Expert in Equation of State for Gaseous Computer Program.
   No modification or changes from 15 August 1986 Report. Expert required in April of 1987.

8. #11.09; Expert in Standard and Calibration Gases.
   No modifications or changes from 15 August 1986 Report. Expert required in September of 1987.

9. #11.07; Expert in Gaseous Sterilization.
   No modifications or changes from 15 August 1986 Report. Expert required in October of 1987.

As described in the 15 August 1986 Report, two additional job descriptions were to have been prepared during this visit (November-December 1986) by the CTA. They have been completed and are included in Annex A of this report. The numbering for these and discussion continues:

10. #11.03; Expert in Atomic Absorption Spectographic Analysis.
    The job description is self-explanatory. If delivery is made by Perkin-Elmer of the apparatus and it is installed and operating, the requirement for this expert is June of 1987.

11. #11.02; Expert in Gas Analysis by Vapor Phase Chromatography.
The job description is self-explanatory. Provided the VPC apparatus is installed and operating, the requirement for this expert is July of 1987.

INSTRUMENTATION AND EQUIPMENT PURCHASES

The major portion of all of the equipment specified for acquisition in the project document was procured during this visit of the CTA to BSGRI. Telex negotiations were required in some instances between BSGRI personnel and UNIDO personnel in Beijing and UNIDO purchasing personnel in Vienna. Local purchasing authorizations were also utilized with the use of MOD's in order to speed-up the process of procuring needed items.

The following is a summary of the understandings of the CTA, BSGRI personnel and UNIDO, Beijing personnel regarding these purchases:

1. Atomic absorption apparatus.
   Purchased by UNIDO, Vienna as ammended in telexes.

2. Water Cooler and Balance Accessories for Atomic Absorption Apparatus.
   Purchased by UNIDO, Vienna.

3. Water Purification Apparatus for Sample Processing in AA Analyses.
   Field purchase by UNIDO, Beijing.

4. Computer and Softwear Items.
   Purchased by UNIDO, Vienna.

5. Standard Gases and High Purity and Electronic Grade Regulators.
   Purchased by UNIDO, Vienna.

6. Other Analytical Accessories (Tubing, Syringes, Fittings).
   Field purchase by UNIDO, Beijing.

7. Safety and Toxicological Data.
   Field purchase by UNIDO, Beijing.

8. Vapor Phase Chromatrography Apparatus.
   To be purchased by UNIDO, Vienna.
   Note that Quotation includes $3,500 for installation costs in People's Republic of China. This is duplication of expert requirement #11.02. Recommend using Expert #11.02 for this activity rather than purchasing this expertise from instrument manufacturer.

The procurement of all of the aforementioned equipment will leave a balance in the equipment purchases portion of the project of approximately $25,000. It is

proposed that this should be used to purchase a particulate counting analytical apparatus for use in performing this measurement in ultra-high purity gases. Specifications for the purchase of this apparatus will be developed and finalized during the CTA's next (October 1987) visit to BSGRI.

STUDY TOURS

The first study tour to Europe had been completed in the month of September 1986. Based on the results of that tour, the director of BSGRI, Mr. Chen,had several suggestions which should be considered in planning the second study tour to the USA and Japan. These included:

1. Time at each location or facility was limited such that there was a very limited amount of time to review activities and decisions for future relationships with the locations which were visited. The USA-Japan study tour should allow more time at each location visited.

2. Based on what was seen in Europe, the activities in the tour related to specialty gases should concentrate on product used in the electronics, environmental, food and medical areas with emphasis on production technologies associated with blending, analysis techniques and handling and distribution systems.

3. Mr. Chen also felt that more time on the USA-Japan study tour should be devoted to learning about new applications for specialty gases. In this regard, he estimated that China was at least fifteen years behind the western world in developing and applying new applications.

Based on all of the foregoing, it is recommended that some changes be made in the original project document regarding the USA-Japan study tour. These are:

1. In order to accelerate the acquisition of "western" technologies in specialty gases, move the schedule for the tour to an earlier date. Originally scheduled for the Fall of 1987. Requested to be changed to May of 1987.

2. Change the length of duration of the tour from four weeks to five weeks. This will allow for more time between visits to the various activities for review and consultation.

Annex B depicts a comprehensive description of the proposed study tour for USA and Japan in May of 1987. The report of Mr. Chen on the proposed study tour is being submitted separately. That report is essentially the same as that in Annex B. Both have been reviewed by both parties and there is agreement between the parties as to the content of each. Mr. Chen's report goes into greater detail regarding the exact agenda times and dates.

FELLOWSHIPS

In the first final report dated 15 August 1986 of the CTA, a modest description of the proposed fellowship activities was presented (commencing on page 15).

The final proposal for the fellowships does not deviate too significantly from what was originally proposed, and follows:

A. Section 31.01/02

1. Participants:

   a. Mr. Meng, Wen-Zhi
      Recent graduate of Beijing Chemical Industrial College, Department of Chemical Engineering. 4 year degree.

   b. Mr. Luo, Gang
      Recent graduate of Xian Jiso Tomb University. Air Separation Unit Department. 4 year degree.

2. Studies and Proposed Institution
   Advanced chemical engineering courses in unit operations, adsorption and absorption technologies at Lehigh University Chemical Engineering Department in Bethlehem, Pennsylvania.

3. Duration:
   9 months - Fall semester 1987 through Spring semester 1988.

4. Additional Comments.
   Each of the candidates has a good grasp of the English language and appears to have the proper educational background and philosophy to participate in the type of advanced education and training which is described. Both men are unmarried.

B. Section 31.03/04

1. Participants:

   a. Madam Chen, Chifen
      Graduate (1962) from Beijing University with a 5 year degree in Chemistry.

   b. Ms. Fan, Jin-Wen
      Recent graduate of Beijing Chemical Industrial College, Department of Analytical Chemistry. 4 year degree.

2. Studies and Proposed Institution.
   Advanced analytical chemistry techniques in a major U.S. university noted for analytical chemistry excellence.

3. Proposed Duration:
   9 months - Fall semester 1987 through Spring semester 1988.

4. Additional Comments.
   Each of the candidates has a good grasp of the English language and appears to have the proper educational background and philosphy to participate in the type of advanced education and training which is described. Madam Chen is married and Ms. Fan is unmarried.

C. Section 31.05/06

1. Participants:
   a. Mr. Li, Wei
      Recent graduate of Beijing Chemical and Industrial College, Department of Automation and Instrumentation. 4 year degree.
   b. Mr. Zhang, Ge
      Recent graduate of Beijing Chemical and Industrial College. Department of Automation and Instrumentation.

2. Studies and Proposed Institution
   Advanced computer classes with a major U.S. computer manufacturer such as IBM, Hewlitt-Packard, Motorola, Texas Instruments, etc. Studies concentrated on programming advanced technical and engineering systems.

3. Duration:
   Four to six months commencing in September of 1987.

4. Additional Comments.
   Each of the candidates has a good grasp of the English language and appearsto have the proper educational background and philosophy to participate in the type of advanced training which is described. Since joining BSGRI, both candidates have been attending computer courses at the Chinese Scientific Academy. Those courses will be completed in January of 1987. Mr. Li is married and Mr. Zhang is unmarried.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

JOB DESCRIPTION

DP/CPR/85/005/11.01

POST TITLE: Chief Technical Advisor

DURATION: 14 days

DATE REQUIRED: October 1987

DUTY STATION: Beijing, China and travel within the country

PURPOSE OF PROJECT:

To establish a national specialty gas research and development centre at the Beijing Specialty Gas Research Institute (BSGRI) in order to enhance the national technical capability in manufacture, analysis, storage, transportation, safe handling and use, and applications technology related to specialty gases and with particular reference to their applications in electronics, medicine, food industry and environmental protection.

DUTIES: To accomplish the purposes of the project.

More specifically:

1. Review the progress and status of the project.

2. Revise and adjust the project in accordance with approvals received from UNIDO, Vienna regarding requests contained in final report of second visit of CTA in November and December 1986, specifically:

   a. Developing the necessary data for the final equipment and instrumentation purchases.

   b. Revising the requirements for certain experts.

c. Reviewing the activities of the experts who have visited BSGRI in 1987.

d. Review the results of the Study Tour to the USA and Japan.

3. Prepare a final report covering how all of the duties were accomplished.

QUALIFICATIONS: High level scientist or engineer with extensive experience in the specialty gas industry including research and development work.

LANGUAGE: English

BACKGROUND INFORMATION:

1. The development of the Beijing Specialty Gas Research Institute is progressing very well.

2. Personnel of the institute are now in a position to begin learning from all of the experts scheduled in 1987 and utilizing the acquired technology in a formative manner.

3. BSGRI personnel are desirous to have the CTA continue to work with them.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

JOB DESCRIPTION

DP/CPR/85/005/11.03

POST TITLE: Expert in Atomic Absorption Spectrographic Analysis

DURATION: 14 days

DATE REQUIRED: June 1987

DUTY STATION: Beijing, China with travel within the country.

PURPOSE OF PROJECT:

1. To establish the capability to measure parts per billion levels of trace metals in electronic grade high purity gases at BSGRI.

2. To obtain an analytical accuracy in the aforementioned which is equivalent to that of the most advanced level in the world.

DUTIES: To develop the capabilities of BSGRI personnel to set-up, operate and utilize the atomic absorption apparatus as follows:

1. Develop a sampling system for the measurement of trace metals in gases recognizing the problems associated with flammable, explosive and toxic compounds.

2. Develop the techniques for the measurement of parts per million trace metals using flame atomic absorption photometry; and flameless atomic absorption photometry for parts per billion levels of trace metals in gases.

3. Develop the techniques to separate the trace metals from the major metals in a matrix.

4. Prepare a final report describing the means whereby the duties were accomplished.

QUALIFICATIONS: High level scientist or technologist with abundant experience in the operation of an atomic absorption spectrophotometer for the measurement of trace metals in gases. This expert should also have developed or utilized an accurate sampling system for the above.

LANGUAGE: English or Chinese

BACKGROUND INFORMATION:

1. BSGRI is acquiring an atomic absorption spectrophotometer with the proper lamps, attachments and accessories for the measurement of trace levels of metals.

2. The electronics industry requires high purity electronic gases with extremely low metals content - hence, the requirement to be able to measure the metals to a very low (ppb) level.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

JOB DESCRIPTION

DP/CPR/85/005/11.02

POST TITLE: Expert in Gas Analysis by Vapor Phase Chromotography

DURATION: 14 days

DATE REQUIRED: July 1987

DUTY STATION: Beijing, China with travel within the country

PURPOSE OF PROJECT:

The establishment of the capability within BSGRI to determine trace contaminants at the level of parts per billion in other gases utilizing specialized vapor phase chromatography apparatus with a helium ionization detector.

DUTIES:

1. Instruct BSGRI analytical laboratory personnel in the installation and operation of a specialized vapor phase chromatography apparatus equipped with a helium ionization detector.

2. Instruct BSGRI personnel in sampling and handling systems so as to attain analysis capability in the ppb range for contaminants such as carbon monoxide and helium in nitrogen; nitrous oxide and acetylene in oxygen; and all trace contaminants in the other industrial and specialty gases.

3. Prepare a final report describing how the duties were performed.

QUALIFICATIONS: High level scientist or technologist with abundant experience in analytical chemistry and instrumentation and particular experience in vapor phase chromotography and the various types of detectors used with that apparatus.

LANGUAGE: English or Chinese

BACKGROUND INFORMATION:

1. Beijing Specialty Gas Research Institute has the requirement to determine trace contaminants at the ppb level in many of the industrial and specialty gases which are produced and used in China.

2. BSGRI originally anticipated procuring and utilizing a Fourier Transform Infrared Spectrophotometer (FTIR) to satisfy this analytical need. Financial constraints and recent knowledge of the availability of helium ionization detector equipped VPC's with the capability of ppb detection levels resulted in their decision to procure this latter instrument to satisfy the analysis need.

BEIJING SPECIALTY GAS RESEARCH INSTITUTE

DP/CPR/85/005

Study Tour Data for 1987

I. INTRODUCTION:

Much was accomplished and learned during the Study Tour to Western Europe in September of 1986. The purposes of that study tour were five-fold. These were:

A. The completion of the 5 year development plan for BSGRI and its technology policy. This purpose has been satisfied, but may be modified after the 1987 Study Tour.

B. To investigate the specialty gas market in W. Europe to determine what the most prudent investments for BSGRI would be in this market in China. This purpose has been partially satisfied (See D. below), but needs a great deal of additional study and investigation of the U.S. and Japanes markets and activities before final decisions on investments can be suggested.

C. Develop the detailed working plan of the project. This purpose has also been satisfied, but might be altered slightly after the U.S. - Japan Tour in 1987.

D. Establish relationships and contacts to possibly host training activities or to develop technical exchanges. This purpose has been reasonably well started but must be enhanced and expanded during the U.S. - Japanese Study Tour in 1987. In Europe, relationships were established with companies for technical exchanges as follows:

1. With Distillers Limited in England for food grade carbon dioxide applications in exchange for carbon dioxide market data in China.

2. With L'Air Liquid in France, for food presevation technologies and electronic mixture technology in exchange for specialty gas market data in China.

3. With Linde, AG in Germany for blending and calibration gas technology in exchange for specialty gas market data in China.

4. A general relationship with Meser-Grieshein, AG in Germany on the exchange of technical data for marketing data in China.

5. A relationship with Helium Gas and Equipment Co. in Scotland relating to establishing a liquid-gaseous helium transfill facility in China similar to the facility they presently have in Singapore.

6. Air Products, USA and England, has a joint venture in Shenzhen for supplying nitrogen in a float glass process. Technical data would

be exchanged in return for market data in China.

No relationships were established concerning the possibilities for training - fellowships which are to begin in September of 1987. This portion of this purpose must be pursued very strongly during the U.S. portion of the 1987 Study Tour.

E. Establish international relationships necessary to stay technologically current. This purpose must be accomplished in U.S. and Japan as well as it has been begun in Western Europe.

II. Purpose of the 1987 Study Tour to the United States and Japan.

The purposes of the 1987 Study Tour will be the same as those presented in the 1986 Study Tour to Western Europe. More emphasis will be placed on purpose #B, market investigation and potential investments; and on #'s D & E regarding investigating potential training institutions and establishing the necessary international connections to remain current in technology.

III. Content of 1987 Study Tour

The content of this study tour will be similar to that of the 1986 Western European Tour, but modified and expanded as follows:

A. Attempt to understand the relationships between the industrial and specialty gas industries in the United States and Japan. Determine where the future development and expansion in these industries is expected to be. Concentrate the investigations on four product areas. These are: the electronics industry; gases used in environmental applications; food grade and food preservation gases and atmospheres; and medical gases.

B. Technology investigations will involve attempts to better understand gas blending, analysis, packaging and handling, safety and toxicology.

C. Medical gas investigations will be concerned with the use of nitrous oxide as an anesthesia. A "bulk" hospital system should be reviewed in addition to cylinder applications as with a dentist.

D. Comments from each industrial gas supplier should be solicited on the state of the art in particulate counting so that the appropriate equipment can be purchased for this requirement.

E. Attempts should also be made to visit typical U.S. universitites which might be used for Fellowship Training.

IV. Sites of Study Tours.

A. United States of America

1. Linde Division of Union Carbide Corporation

   a. Investigation Object
      Specialty Gas Department

   b. Contact Address
      Keasby, New Jersey

   c. Contents

      (1) High purity gases and gaseous chemicals
      (2) Manufacturing processes
      (3) Quality control
      (4) Gas blending and calibration standards
      (5) Medical gases
      (6) Container treatment
      (7) Safety and environmental concerns

   d. Proposed duration: 1.5 days

2. Airco - BOC

   a. Investigation Object
      Specialty Gas Department

   b. Contact Address
      Riverton, New Jersey

   c. Contents

      Same as Linde Division of Union Carbide

   d. Proposed duration: 1.5 days

3. Amerigas (UGI)

   a. Investigation Object
      Matheson Gas Products

   b. Contact Address
      East Rutherford, New Jersey

   c. Contents

      Same as Linde Division of Union Carbide

   d. Proposed duration: 1.5 days

4. Air Products and Chemicals, Incorporated

a. Investigation Object
Specialty Gas Department

b. Contact Address
P.O. Box 538
Allentown PA 18105
Telephone: (215) 481-4911

c. Contents

Same as Linde Division of Union Carbide

d. Proposed duration: 2 days

5. Lehigh Valley Hospital Center

a. Investigation Object
Bulk Nitrous Oxide System

b. Contact Address
c/o Air Products and Chemicals, Inc.
P.O. Box 538
Allentown, PA 18105
Telephone: (215) 481-4911
Attention: Medical Products Division

c. Contents

Review installation and operation of the bulk nitrous oxide system.

d. Proposed duration: 0.5 days

6. Lehigh University

a. Investigation Object
Training-fellowships in advanced chemical engineering and advanced analytical chemistry and instrumentation.

b. Contact Address
Department of Chemistry and Chemical Engineering
Lehigh University
Bethlehem, PA

c. Contents

Investigate the potential for utilizing Lehigh University for Training-Fellowships for analytical chemists and chemical engineers.

d. Proposed duration: 1 day

7. United States Bureau of Standards

   a. Investigation Object
      Gas Standards Laboratory

   b. Contact Address
      USNBS
      Gas Standards Laboratories
      Gaithersburg, Maryland

   c. Contents
      Protocal for national gas standards (calibration) program.

   d. Proposed duration: 1 day

8. United States Department of Agriculture

   a. Investigation Object
      Food Preservation Atmospheres Section

   b. Contact Address
      USDA Experimental Station
      Food Preservation Atmosphere Section
      Greenbelt, Maryland

   c. Contents

      Use of carbon dioxide, ethylene, carbon monoxide and other gases.

   d. Proposed duration: 2 days

9. Microelectronics Center of North Carolina

   a. Investigation Object
      Advanced techniques in electronics

   b. Contact Address
      Microelectronics Center of North Carolina
      Research Triangle Park
      North Carolina, USA

   c. Contents

      Investigate latest techniques in manufacture, testing, operations of the electronics industry. Emphasis on the applications of specialty gases in the industry.

   d. Proposed duration: 1.5 days

10. U.S. National Bureau of Standards

a. Investigation Object
Fluids Pac Computer Program

b. Contact Address
National Bureau of Standards
Thermophysical Properties Laboratory
Boulder, Colorado, USA

c. Contents

Development of empirical and calculated properties for gaseous equation of state calculations.

d. Proposed duration: 1 day

11. Standford University

a. Investigation Object
Center for Integrated Systems (CIS)

b. Contact Address
Center for Integrated Systems
Standford University
Palo-Alto, California, USA

c. Contents

Same as Microelectronics Center of North Carolina

d. Proposed Duration: 1 day

B. Japan

1. Nippon Sanso

a. Investigation Object
Specialty Gas Department

b. Contact Address

Tokyo, Japan

c. Contents

Same as Linde Division of Union Carbide

2. Kanto Denka

a. Investigation Object
Hydrogen Chloride Production

b. Contact Address

c. Contents

Production of electronic grade hydrogen chloride.

d. Proposed Duration: 1 day

3. Daido Sanso

a. Investigation Object
Metals and piping engineering for the electronics industry.

b. Contact Address
Daido Sanso

Osaka, Japan

V. Schedule of Study Tours

A. 4 - 5 weeks beginning the first week in May 1987,

1. The tour could most logically progress as follows:

a. Beijing - New York City

(1) Specialty gas facilities in New Jersey

b. New York City - Allentown

(1) Allentown, PA and Bethlehem, PA locations

c. Allentown, PA - Washington, D.C.

(1) Gaithersburg and Greenbelt, Maryland locations

d. Washington, D.C. - Raleigh - Durham, North Carolina

e. Raleigh - Durham, North Carolina - Denver, Colorado

(1) Boulder, Colorado

f. Denver, Colorado - San Francisco, California

(1) Palo-Alto

g. San Francisco - Osaka, Japan

(1) Daido Sanso and Osaka Sanso

h. Osaka, Japan - Tokyo, Japan

(1) Kanto Denka, Nippon Sanso

i. Tokyo, Japan - Beijing, P.R.C.

VI. Study Tour Personnel

A. In accordance with the following table:

Classification of Expert	Number
Air Separation Technology and Cryogenics	1
Gas Analysis and Pollution Control	1
Gas Analysis and Applications Research	1
Chemical Engineering and Process Design	1
Gas Blending and Purification	1
Chemical Engineering and Enterprise Management	1
TOTAL	6

FINAL REPORT OF THE ACTIVITES OF THE EXPERT IN SPECIALTY GAS SAFETY AND TOXICOLOGY

DP/CPR/85/005/11-10

The duties for this job were performed both in Allentown, PA and in Beijing working with BSGRI personnel. The CTA performed both tasks and coupled them with the normal visit to BSGRI to save travel costs.

The work in Allentown (USA) involved the preparation of Toxicological and Safety Data Sheets. These were prepared for a total of 140 specialty gas compounds. The work in Beijing involved establishing systems and procedures to utilize the data in a manner suitable to the Chinese culture. Lectures were also given to BSGRI personnel explaining the legal ramifications of the Safety and Toxicology of these compounds as they apply in "Western" countries.

As a result of the foregoing activities, BSGRI personnel are attempting to develop a relationship with certain Chinese government activities to further the development of BSGRI as a Toxicological and Safety Center for specialty and industrial gas compounds.

TOXICOLOGICAL AND SAFETY DATA SHEETS

These sheets were prepared in Allentown (USA) by the CTA prior to departure for China. To save mailing costs, they were taken in the personal luggage to BSGRI. Data sheets were prepared for a total of 140 compounds. These compounds are listed below.

1. Acetylene
2. Air
3. Allene
4. Ammonia
5. Argon
6. Liquid Argon
7. Arsenic Pentafluoride
8. Arsenic Trifluoride
9. Arsine
10. Benzene
11. Boron Tribromide
12. Boron Trichloride
13. Boron Trifluoride
14. Boron-II Trifluoride

15. Bromine
16. Bromine Pentafluoride
17. Bromine Trifluoride
18. 1,3-Butadine
19. Isobutane
20. 1-Butene
21. Cis-2-Butene
22. N-Butane
23. Trans-2-Butene
24. Isobutylene
25. Carbide-Lime
26. Carbon Dioxide
27. Carbon Dioxide, Refrigerated Liquid
28. Carbon Dioxide, Solid
29. Carbon Monoxide
30. Carbon Monoxide, Refrigerated Liquid
31. Carbon Tetrachloride
32. Carbonyl Sulfide
33. Chlorine
34. Chlorine Trifluoride
35. Cyclopropane
36. Deuterium
37. Diborane
38. Dichlorosilane
39. Diethyltelluride
40. Diethylzinc
41. Dimethyl Amine
42. Dimethyl Ether
43. Dimethylzinc
44. Disilane
45. Ethane
46. Ethane, Refrigerated Liquid
47. Ethyl Acetylene
48. Ethyl Chloride
49. Ethylene
50. Ethylene Oxide
51. 12% Ethylene Oxide 88% HC-12
52. 10% ETO 90% CO_2
53. 20% ETO 80% CO_2
54. 80% ETO 20% CO_2
55. Ethylene, Refrigerated Liquid
56. Fluorine
57. Germane
58. Germanium Tetrachloride
59. Germanium Tetrafluoride
60. Halocarbon 11
61. Halocarbon 12
62. Halocarbon 12-B-2
63. Halocarbon 13
64. Halocarbon 13-B-1
65. Halocarbon 14
66. Halocarbon 21
67. Halocarbon 22
68. Halocarbon 23
69. Halocarbon 113
70. Halocarbon 114
71. Halocarbon 115
72. Halocarbon 116
73. Helium
74. Helium, Refrigerated Liquid
75. Heptane
76. Hexane
77. Hydrogen
78. Liquid Hydrogen
79. Hydrogen Bromide
80. Hydrogen Chloride
81. Hydrogen Cyanide
82. Hydrogen Fluoride

83. Hydrogen Iodide
84. Hydrogen Selenide
85. Hydrogen Sulfide
86. Iodine Pentafluoride
87. Krypton
88. Methane
89. Methane, Refrigerated Liquid
90. Methanol
91. Methyl Bromide
92. Methyl Chloride
93. Methyl Fluoride
94. Methyl Mercaptan
95. Monoethyl Amine
96. Monomethyl Amine
97. Neon
98. Nitric Oxide
99. Nitrogen
100. Liquid Nitrogen
101. Nitrogen Dioxide
102. Nitrogen Trifluoride
103. Nitrogen Trioxide
104. Nitrous Oxide
105. Nitrous Oxide, Refrigerated Liquid
106. Octafluorocyclobutane
107. Oxygen
108. Liquid Oxygen
109. Pentane
110. Perfluoropropane
111. Phosgene
112. Phosphine
113. Phosphorus Oxychloride
114. Phosphorus Pentafluoride
115. Phosphorus Tribromide
116. Phosphorus Trichloride
117. Phosphorus Trifluoride
118. Propane
119. Propylene
120. Propylene Oxide
121. Rhenium Hexafluoride
122. Silane
123. Silocontetrachloride
124. Silicontetrafluoride
125. Sulfur Dioxide
126. Sulfur Hexafluoride
127. Sulfur Tetrafluoride
128. Tetrafluoroethylene
129. Toluene
130. Trichlorosilane
131. Triethylamine
132. Trimethylaluminum
133. Trimethylamine
134. Trimethylindium
135. Trimethylgallium
136. Tungsten Hexafluoride
137. Vinyl Bromide
138. Vinyl Chloride
139. Xenon
140. Xenon Difluoride

Each Safety Data Sheet contains safety and toxicological data on that particular compound. The following is a brief listing of the type data which is on each sheet:

1. Name of product, synonyms, chemical name, chemical abstract service number, chemical formula and chemical family.
2. Health Hazard Data.
    a. TLV or TWA exposure limits.
    b. Symptoms of exposure.
    c. Toxicological properties.
    d. Recommended first aid treatment.
3. Listing of potential hazardous mixtures of the compound with other solids, liquids or gases.
4. Physical Data.
    a. Boiling Point
    b. Liquid Density
    c. Vapor Pressure
    d. Gas Density
    e. Solubility in Water
    f. Freezing Point
    g. Appearance and Odor
5. Fire and Explosion Hazard Data
    a. Flash Point
    b. Autoignition Temperature
    c. Flammable Limits
    d. Extinguishing Media
    e. Special Fire Fighting Procedures
    f. Unusual Fire and Explosion Hazard Data
6. Reactivity Data
    a. Stability of Compound
    b. Incompatability (Materials to Avoid)
    c. Any Hazardous Decomposition Compounds
    d. Potential for Hazardous Polymerization
7. Spill or Leak Procedures

a. Waste Disposal Methods

b. Safety Measures in Event Material is Released or Spilled

8. Special Protection Information

a. Type Respiratory Protection

b. Ventilation

(1) Local Exhaust

(2) Mechanical Exhaust

c. Protective Gloves

d. Eye Protection

e. Other Protective Equipment

9. Special Precautions

a. Labeling and Marking Data

b. Container and Product Handling Recommendations

c. Container and Product Storage Recommendations

d. Packaging Recommendations and Precautions

e. Other Recommendations and Precautions

THE BSGRI TOXICOLOGY AND SAFETY DATA CENTER

An organization has been established within BSGRI to assimilate the Safety Data Sheets into useable data for China. The work will be supervised by Mr. Li, Yiling, Section Chief for Information Systems. He will be assisted by Ms. Yen, Xiaoxue, who has a University Degree in environmental protection.

Individual files will be established for each compound with the idea of eventually placing the data from the files on a computer. The data will be kept current through contacts with the American Conference of Governmental Industrial Hygienists. Additional data in each file will include USA Governmental requirements for each product such as DOT Marking, Classification, and Labeling; OSHA precautions; NIOSH Data; etc.

The final intent will be to print Safety and Toxicology Data Sheets for each compound in a proper Chinese format for use as the standard for these compounds throughout China.

LECTURE ON TYPICAL "WESTERN" LEGISLATION ON SAFETY & TOXICOLOGY

China is just beginning to develop laws and rules which relate to toxicology and safety. In order for BSGRI personnel to better understand how these items are "legislated" in Western countries, a four hour lecture was delivered on the legislative measures of this type in the USA. How the various departments and branches of Government in the U.S. control safety and toxicology problems was explained. The lecture was given to approximately 25 BSGRI personnel. An outline of the lecture follows:

1. Department of Labor
   a. Occupational Safety and Health Administration (OSHA). Involved in worker protection through the establishement of TWA's, hazard warning and labeling systems and general workplace safety rules.
2. Department of Transportation
   a. Interstate Commerce Commission (ICC). Controls shipping of hazardous products.
   b. Hazardous Materials Transportation Office. Specifies Container, Labels, Hazard Class, and other Shipping Regulations.

3. National Institute of Health (NIH).
   a. National Institute of Occupational Safety and Health (NIOSH). Is the "research"branch of Government to perform studies, establish standards, etc.
4. Environmental Protection Agency (EPA).
   a. Resource Conservation and Recovery Act (RCRA) - Cleans up old chemical dumps.
   b. Toxic Substances Control Act (TSCA) - Responsible for controlling manufacturing of toxic substances; establishes toxic substance list, etc.
5. Department of Commerce
   a. National Bureau of Standards (NBS) - Established protocal for the production of gaseous calibration standards used in EPA pollution monitoring programs.
6. Food and Drug Administration (F&DA) - Controls the production of medical gases and the various food ripening and food preservation atmospheres and gases.

FUTURE ACTIVITIES

In order to determine how the BSGRI Safety and Toxicology section could better serve the Government of PRC, a study was conducted to see where this activity would best "fit in". The Chinese government has (in 1986) begun to establish a parallel organization; however, it is for solids and liquids and not for gases. This organization has been formed as the Hygenic Section of the Bureau of Protection which is a Bureau of the National Government's Ministry of Labor and Personnel. Since the Hygenic Section has just been formed in 1986, they have devoted most of the year to organization meetings. They have had 3 meetings. The first was in Xindao and was the establishment or organization meeting. In May of 1986, they met in Beijing and decided to classify all hazardous compounds in accorance with their hazard level. This classification resulted in four categories as follows:

1. Lethal Compounds - Mercury and Mercury compounds; arsenic, vinyl chloride, etc.
2. Highly adverse compounds - Explosives (TNT); Corrosives (hydrogen fluoride, chlorine); Chlorinated compounds (carbon tetrachloride); etc.
3. Medidum adverse affects - Strong acids (sulfuric, nitric); Alcohols; Benzene compounds, etc.

4. Light adverse effects - Gasoline, acetone, ammonia, etc.

The third meeting was in November of 1986 wherein they determined the type instrument to use in monitoring the compounds. The Ministry of Labor and Personnel has decided to establish 40 measurement stations throught the country. Each of these locations has been allocated funds for the construction of a building (laboratory) and the purchase of measurement instruments. Each station is required to:

1. Determine what materials and compounds to regulate as poisonous substances.
2. Develop analytical techniques for "future" substances to be measured.
3. Establish a data base for poisonous substances.
4. Be arbitrators for those compounds for which they do not have data.

Each station will purchase a toxic gas monitoring system (Model MDA 7100).

Based on all of the foregoing, it was determined that BSGRI is in a unique position to work with the government to establish measurement stations for specialty gas products. They will begin trying to meet with the proper persons within the Ministry of Labor and Personnel, stressing:

1. BSGRI has a complete toxicology data file on all specialty gas products.
2. BSGRI has the analytical chemical technology necessary to monitor and measure these compounds.
3. BSGRI has the sole "pipeline" to USA and Europe for standards for measurement systems.
4. BSGRI should be established as a government designated organization to perform monitoring of specialty gas type products.