

FOOD SAFETY CONSULTATIONS

GEMS/Food Total Diet Studies

**Report of the 4th International
Workshop on Total Diet Studies
Beijing, China
23 - 27 October 2006**



**FOOD SAFETY, FOODBORNE DISEASES AND ZOOSES DEPARTMENT
WORLD HEALTH ORGANIZATION**

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**World Health
Organization**

4th International Workshop on Total Diet Studies

**Cosponsored by WHO and the National Institute for Nutrition and Food Safety, Chinese Centers for Disease Prevention and Control
23-27 October 2006, Beijing, China**

Objectives

Overall objective

To promote and provide technical support on total diet studies (TDS) in all Member countries.

Specific objectives

- To help developing countries to conduct TDS, especially in Asia;
 - To update recent developments in the field of TDS;
 - To promote reliable and comparable TDS results through harmonized approaches of TDS;
 - To exchange of the current progression of TDS in countries; and
 - To promote electronic submission to and use of total diet study data from the WHO Global Environmental Monitoring System/Food Contamination Monitoring and Assessment Programme (GEMS/Food)
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Programme

The one-week international TDS workshop will be held 23-27 October 2006. It will be preceded by a one-week training course on TDS, 16-20 October 2006. The tentative programme is as follows:

Training Course on Total Diet Studies

Main contents:

1. Risk analysis paradigm
 - Risk assessment
 - Risk management
 - Risk communication
 2. Exposure assessment
 - Predicting versus assessing exposure
 - Monitoring commodities
 - Duplicate diet portion study
 - Total diet study
 - Biomonitoring
 3. Why conduct a total diet study?
 - Assessing intakes of chemicals in food
 - Assessing intakes of Nutrients
- Formulating priorities for risk management
 - Establishing standards and norms

- Identifying population subgroups at risk
 - Formulating/revising agriculture and manufacturing policies and practices
 - Assessing effectiveness of risk management interventions
4. Total diet study components
 - Food consumption survey and data
 - Food samples collection
 - Food samples cooked and prepared
 - Laboratory analysis, including methods and AQA
 - Data handling and exchange
 - Reporting
 5. Practical exercises in total diet study components
 - Constructing a total diet study timeline
 - Review of food consumption data
 - Develop own country TDS food list
 - Making sampling plan
 - Establishing analytical methods, including quality control and assurance
 6. Hands-on training in data handling in computer room
 - Contaminant in food data-OPAL I
 - Contaminant in diet data-OPAL II
 - Submitting data to GEMS/Food-SIGHT
- Generating reports
7. Models suitable for developing countries to conduct TDS (especial for developing countries in Asia) – method and practices introduction of Chinese Total Diet Study
 8. Field visits, e.g. food markets in Beijing.

International Total Diet Study Workshop

1. Matters of interest from WHO and FAO
2. Selected countries reports on current status of TDS and food contamination monitoring
3. Trends in selected chemical contaminants in foods and the use of TDS data in tracing sources - Junshi Chen
4. Studies on emerging contaminants in TDS in China - Wu Yun
5. Field visit to TDS-related laboratories at the Institute of Nutrition and Food Safety, China CDC
6. Other topics to be developed

Participants

- Part One: Training course on TDS – 30 participants¹
- Part Two: International TDS Workshop – 80 participants

Language

The official language of the workshop will be English.

Registration Fees

None

Accommodation and Workshop venue

Guangxi Hotel, Beijing (4 Star); RMB 600 (about USD 75) per standard room per night, includes breakfast every day and lunch during the training course and workshop.

Dates

- Part One: Training Course on TDS - 16-20 October 2006
- Part Three: International Workshop on TDS - 23-27 October 2006

¹ In addition, there will be a two-day training course for Chinese participants only on 21-22 October 2006.

Report on the 4th International Workshop on Total Diet Studies

23 – 27 October 2006, Beijing, China

1. INTRODUCTION

Monitoring chemicals in the food supply is essential to protect public health. Consumers are unable to assess the risks posed by toxic chemicals and nutritional imbalances in the foods they consume. Unlike microbiological hazards, cooking food is usually not effective in reducing chemical risks. Excessive exposure to chemicals is currently known or suspected to be responsible for a range of human health problems. These include promoting or causing cancer, kidney and liver dysfunction, hormonal imbalances, immune system suppression, musculoskeletal disease, birth defects, premature births, impeded nervous and sensory system development, reproductive disorders, mental health problems, cardiovascular diseases, genitor-urinary disease, old-age dementia and learning disabilities. Consequently, the protection of our diets from toxic chemicals and nutritional imbalances must be considered one of the most important public health services of any country. The identification and level of exposure to these hazards in the diet is the main purpose of total diet studies (TDS).

Since the establishment of the Global Environment Monitoring System (GEMS) in 1976, the World Health Organization (WHO) has been responsible for implementing the monitoring of food for potentially hazardous chemicals under what is commonly called the GEMS/Food Programme*. GEMS/Food recognizes the TDS approach as one of the most cost effective means for generally assuring that the dietary intake of chemicals is within safe limits and for setting priorities for further study. GEMS/Food in collaboration with national agencies has previously sponsored three International Total Diet Study Workshops: the first in Kansas City in July 1999, the second in Brisbane in February 2002 and the third in Paris in May 2004. Additionally, two regional TDS workshops were held in Buenos Aires in July 2002 and Brno/Prague in November 2002. The present workshop reflects the continued support by WHO and its Member States of the TDS approach and especially the promotion of TDS in developing countries.

2. OVERVIEW OF WORKSHOP

The workshop was co-sponsored by WHO and the National Institute for Nutrition and Food Safety, Chinese Center for Disease Control and Prevention (China CDC) in cooperation with the Food and Agriculture Organization of the United Nations (FAO). The programme for the workshop is given in Annex I. The workshop was preceded by a one-week training course, organised with the support of the New Zealand Food Safety Authority (NZFSA), on TDS for national participants from countries wishing to initiate TDS in their countries. The report on the training course is given in Annex II. Fifty-five participants from 27 countries were present at the workshop. The list of participants is given in Annex III.

The objectives of the workshop were to:

- promote and support TDS in all Member States;
- help prepare countries wishing to conduct or expand TDS;
- report on recent developments and results in the field of TDS;
- promote reliable and comparable TDS through harmonized approaches and exchange of international 'best practices' and expertise;
- discuss methods and resources needed to conduct dietary exposure assessments;
- establish a network of national counterparts for undertaking regional TDS projects; and

* Global Environmental Monitoring System/Food Contamination Monitoring and Assessment Programme (GEMS/Food)

- promote electronic submission of total diet study data to GEMS/Food.

Dr Junshi Chen, National Institute for Nutrition and Food Safety, China CDC, was elected as Chair of the workshop. He was assisted by Dr Richard Vannoort, Institute of Environmental Science and Research Ltd (ESR), Christchurch, New Zealand as Vice-Chair and Ms Katie Egan, US Food and Drug Administration (US FDA), as Rapporteur.

Opening Remarks

On behalf of the World Health Organization, Dr Gerald Moy, GEMS/Food Manager, WHO Headquarters welcomed the participants to the workshop and expressed his appreciation to the Chinese National Institute for Nutrition and Food Safety, Beijing, for cosponsoring the workshop with WHO. He noted that much progress had been made by Member States in implementing TDS in developing countries. For example, both Cameroon and Indonesia would be reporting on their national studies during the workshop. He encouraged workshop participants to continue to make the results of their total diet work more known to consumers and decision-makers and to share their results with GEMS/Food. Dr Moy noted that a brochure on TDS was prepared in cooperation with the Korean Food and Drug Administration following the previous international TDS workshop in Paris. The brochure is available on request or can be downloaded at <http://www.who.int/foodsafety/publications/chem/recipe/en>. He also noted that a book on TDS would be prepared in 2007 and invited workshop participants to contribute to this effort.

Welcome Addresses

Mr Zhao Tong Gang, Director General, Health Inspection Bureau, China Ministry of Health, offered congratulations to the workshop and gave a warm welcome to all attendees. He noted that WHO has been working hard on strengthening the monitoring of food hazards and improving food safety. GEMS/Food is an important part of WHO's efforts and TDS has proved to be a most effective tool in monitoring food contamination. In recent decades the Ministry of Health of China has focused much attention on food safety control and has undertaken a number of actions: strengthened national food safety regulations and standards; improved the food safety inspection system; strengthened the premarket approval of food additives and novel foods; developed a food safety action plan, with a recent emphasis on food contamination and foodborne illness; carried out food safety education and communication; and played a more active role in Codex. Data from food contamination monitoring and TDS are important basic activities that can reflect food safety status show trends and serve as a basis for assessing the effects of control measures. In China, a national food monitoring network was established in 2000 and now covers 16 provinces and 830 million people and TDS have been conducted three times, in 1990, 1992 and 2000. Data from the monitoring network and TDS have provided more complete information that has been very useful in developing national food safety policies, regulations, standards and control measures. Mr Zhao stated that China looks forward to sharing the achievements and experiences of its TDS during this workshop and he welcomed all delegates to participate in the Codex Committee sessions that will be hosted by China in the coming year.

Dr Ruth Charrondiere, FAO, Rome, expressed thanks to WHO and the National Institute for Nutrition and Food Safety, China CDC for organizing the workshop and training course and stated that FAO was very happy to collaborate in this event. She also thanked Dr Richard Vannoort, ESR, New Zealand, for his assistance in organizing the TDS training course. She noted the steady increase in the number of countries that recognize the value of TDS as a good method for assessing dietary exposures of populations. Dr Charrondiere stated that she was pleased that WHO has taken the lead in promoting TDS and that FAO and WHO were collaborating in this area by conducting training and providing technical and financial support. She expressed hope that more countries will develop the capacity for

generating good quality data and for conducting exposure assessment and risk analysis, which can be used for both local and international risk management and communication.

Dr Henk Bekedam, WHO Representative in China, welcomed the participants to Beijing and to the workshop. He thanked and congratulated the Chinese government for hosting the workshop and extended thanks to the organizers of the workshop and to NZFSA for support of the training session. Dr Bekedam stated that this gathering is a great example of international cross-sectoral collaboration, noting that around 30 countries were represented. He noted that food safety is a critical element of public health in every country, although many developing countries lack the technical expertise and financial resources to implement food safety policies. Food safety also has a significant impact on economic development, as disruption in food production and trade can be economically devastating. WHO and its Member States have developed a Global Strategy for Food Safety to reduce the health and social burden of foodborne disease through improved approaches to surveillance, risk assessment, new technology evaluation, risk communication, capacity building and international cooperation. WHO believes that conducting periodic TDS offers one of the most cost-effective means for establishing the safety of the food supply. Because TDS are technically demanding, WHO is pleased to sponsor this workshop and training course and hopes that they foster cooperation among countries conducting TDS and inspire other countries to consider undertaking them in the future.

Opening Remarks of the Chair

Dr Junshi Chen, National Institute for Nutrition and Food Safety, China CDC, highlighted two important goals of the workshop: to exchange information and expertise in order to promote and facilitate TDS worldwide and to expand the capability of countries to conduct dietary exposure assessments. He also noted the importance of submitting TDS data to GEMS/Food, in particular for use by the Joint FAO WHO Expert Committee on Food Additives (JECFA) in its evaluation of food contaminants. In the past, most data available to JECFA has been from developed countries; more data from developing countries is needed to ensure that international safety assessments are more representative of the global situation.

Summary of Activities

The workshop included presentations and discussions concerning TDS that were being planned or conducted around the world. Issues related to dietary exposure assessment and risk assessment were also discussed, such as food consumption data. Summaries of selected presentations are given in Annex IV. Among various activities, the workshop:

- reviewed the status of ongoing TDS in different countries;
- addressed technical points associated with them;
- reached consensus on certain issues of harmonization;
- focused on the urgent need for conducting TDS in all countries, especially developing countries;
- emphasized the importance of planning and conducting pilot studies prior to initiating a first TDS;
- discussed the importance of Limits of Detection (LOD) and handling of results below the LOD when assessing TDS output;
- noted the importance of documenting and describing TDS methodologies and their uncertainties when presenting results;
- promoted the importance of TDS for assessment of nutrient intakes;
- promoted the reporting of monitoring data and TDS results using OPAL I and II to the GEMS/Food databases;
- presented the inherent linkages of TDS with the assessment, management and communication of risks;

- urged involvement of risk assessors, managers and communicators in the TDS process to gain support and to share resources;
- recognized the importance of cooperation among health, agricultural and environmental sectors when planning and conducting TDS; and
- recommended further actions by national and international health authorities to support TDS.

Priority Chemicals for Total Diet Studies

The workshop discussed and revised the GEMS/Food list of priority contaminants recommended for inclusion in monitoring programmes. It was also agreed that the list should be renamed the list of 'Priority Chemicals for Total Diet Studies' to more accurately reflect its content and in recognition that some compounds are deliberately added to foods, while others are naturally occurring or present in the environment. The revised list is given as Annex V. The workshop also discussed the possible inclusion of other chemicals on the list, for example key nutrients and veterinary drugs. The discussion concluded that further discussion at national level should be encouraged to identify what nutrients or other chemicals might be included on the Priority list.

Closing Remarks

Dr Chen, Chair, congratulated the participants on a very successful and productive training course and workshop, and noted that this was a joint effort by both experienced countries and those in the initial stages of conducting TDS. He thanked the organizers of the workshop for their hard work and hoped that everyone had enjoyed their visit to Beijing.

Dr Vannoort, Vice-Chair, thanked WHO for organizing this and previous TDS workshops, in particular Dr Moy who has been the driving force, motivation and energy behind this effort. He also extended a special thanks to those who helped with organization of the workshop from the National Institute of Nutrition and Food Safety. Dr Vannoort also welcomed the participants of the training course who had become new members of the TDS family and encouraged them to think about how they want to move forward on conducting their TDS before getting back to their busy schedules. He expressed appreciation to China CDC for its warm hospitality and those who assisted with lectures during the training course, especially Ruth Charrondiere, Cherie Flynn and Larry Grant.

On behalf of WHO, Dr Moy thanked the participants for their enthusiasm and contributions throughout the workshop. He emphasized that without TDS, it is difficult for countries to protect public health and to prioritize food safety efforts. In recognizing the excellent local arrangements, he acknowledged the efforts of Dr Chen and his staff at the National Institute for Nutrition and Food Safety in making the workshop run smoothly and pleasantly. He stated how gratifying it was to see the tremendous progress China has made in its TDS and noted that Dr Chen was instrumental in this progress. In addition, Dr Moy thanked the WHO Regional Food Safety Advisers from Europe, Eastern Mediterranean and Southeast Asia for participating in the training course and workshop as this will serve to promote TDS in those WHO Regions. He thanked Dr Vannoort for his energy and enthusiasm and acknowledged the support of the Government of New Zealand, through NZFSA, in providing resources for the training session. In conclusion Dr Moy expressed hope that each country would continue to contribute to this collaborative effort.

3. CONCLUSIONS AND RECOMMENDATIONS

Throughout the series of international TDS workshops, participants have discussed and unanimously endorsed key points and recommendations related to TDS for consideration by national and international health authorities. The workshop agreed that these key points and recommendations should be presented as a single whole as follows. Participants also agreed that updates on the status and progress of recommendations should be given at subsequent workshops. The workshop also urged countries to translate the recommendations into their official languages for dissemination to national authorities.

1 Need for a total diet study in each country

Scientific risk assessments are the fundamental basis of decisions dealing with both health and trade aspects of food. For scientific risk assessment it is essential to know background concentrations of chemicals in foods so that the actual dietary exposure to these chemicals can be assessed. Since diets and dietary customs are different in every country, conducting TDS in each country is important.

- All countries should conduct total diet studies to assess the safety and nutritional quality of their diets.
- All countries should advocate the benefits of TDS both within countries (i.e. health, agricultural and environmental sectors) and across the wider international community, particularly among developing and less developed countries.
- TDS should be expanded where resources are available to address emerging issues or other substances of interest such as veterinary drug residues, vitamins, cholesterol, *trans* fatty acids, et al.
- All workshop participants should be attuned to other countries that wish to participate in TDS discussions and may benefit from joining the TDS listserv.
- A book on TDS should be published to assist countries in planning and conducting TDS.

2 Support for total diet studies in developing countries

For various reasons, in many developing countries, there is little or no monitoring of the food supply for toxic chemicals. As a result, information about the safety of foods is often non-existent. With global trade, however, a food safety problem in one country may become a trade and health problem for many countries.

- Each developing country should be given international assistance to conduct its own total diet study. This may be considered on a regional basis to reduce costs and promote regional cooperation.
- A report on the situation in the developing countries with respect to chemical risks in food should be drawn up and strengths and weaknesses in the following areas should be identified: analytical capacity, personnel training and data on food consumption, data on food contamination and data on dietary exposure.
- Developed countries should encourage regional or subregional organizations in the developing countries to make the safety of food a priority and to strengthen regional training in total diet studies and evaluation of food risks.
- Technical assistance in the preparation of total diet studies projects at regional or subregional levels should be provided to take advantage of economies of scale.
- Priorities that are suited to regional circumstances should be set for groups of foods and contaminants (dietary composition and contamination of locally consumed foods).
- National working groups should be set up to prepare future total diet studies.

- All countries should provide the resources necessary to evaluate the risk of contamination of food and call upon technical assistance from international organizations, such as WHO, FAO and other donor organizations, to support their efforts.
- The Regional Offices of WHO (including both Regional Advisers for Food Safety and Nutrition) should be more involved in assisting and supporting national total diet studies.
- Developed countries and other donors should support national Codex committees to develop appropriate regulations on food contaminants.
- Participants in the workshop should help to inform consumers of food safety issues in order to develop better awareness of the need for risk assessment of contaminated food.

3 Design and structure of total diet studies

Numerous aspects of TDS can and should be harmonized if the results are to be comparable. However, it is important to also recognize that each study should reflect the health concerns and resources of the country in which it is conducted. The following recommendations deal with these aspects:

- All countries should cooperate and coordinate their activities in the development and harmonization of standard protocols for TDS.
- A team approach should be used when conducting TDS, with all team members, including those responsible for sample collection, sample processing, risk assessment, statistics and laboratory analysis, involved at the planning stage.
- Each total diet study should be documented in detail when it is reported. As a result of resource limitations or for strategic reasons, there will always be differences, such as analytical detection limits or choice of samples, in the design of studies in each country. These can have a major impact on the dietary intake results obtained for the survey and their interpretation.
- When comparing results of TDS from different countries, due care should be taken to ensure that the most recent data are used and to consider potential impact of individual differences in the design and implementation of the compared studies. Factors, such as different foods, age-sex groups, climates, agricultural practices, limits of detection / reporting and quality assurance and control practices, can affect results.
- Drinking water, taken as water, should be included in each total diet study except where resources do not allow for this. This should include bottled water and tap water taken from the sample pick-up areas. Thus, it is important that drinking water be included when food intake surveys are conducted.
- Where possible, distilled water should be used for sample preparation. Otherwise, the water used should be separately analysed.
- There are some chemicals which, because of their nature, limited distribution or homogeneity, are better assessed in commodity surveys rather than TDS. Some mycotoxins, for example, are not homogeneously distributed in foods and it would take a very large sample size to obtain a reasonable estimate of their concentration.
- Analytes for TDS should focus on those recommended by GEMS/Food (see Annex V).
- Prioritization when selecting analytes should be based on a) information available, e.g. whether the analyte had been included in a recent total diet study; b) toxicity, e.g. whether the analyte poses a health risk at low concentrations; c) susceptibility to technology changes, e.g. whether changes in processing may alter the chemical or its level in food; and d) potential for adventitious or deliberate contamination, e.g. whether chemical is a potential threat agent.
- When selecting chemicals for TDS, countries should consider less common chemicals which may pose a significant health risk to their population.
- Managers of TDS should define the limit of reporting required of the laboratory performing the analyses so that the exposure results will be meaningful and cost-effective.

- Dietary exposures can vary widely depending on how results at or below the limit of reporting are handled. Regardless of the approach taken, it should be clearly described when the total diet study results are reported. Managers of TDS should define how results below the limit of reporting are to be used in risk assessment. The technique used should be practical, logical, scientifically valid and consistently applied. While there is still no general agreement about how this should be done, the workshop drew attention to the GEMS/Food EURO workshop recommendations that appear as Appendix V to the GEMS/Food Instructions for Electronic Submission of Data on Chemical Contaminants in Food, available at the WHO Website <http://www.who.int/foodsafety/en>.
- Food consumption data used for TDS should be as recent as possible and maintained current. Because local dietary patterns may change quickly, the date and basis of the consumption data should be defined in each study.
- While national consumption data are critical for the highest accuracy of total diet study results, GEMS/Food Consumption Cluster Diets and FAO Food Balance Sheet data are useful starting alternatives for countries without their own individual food intake information.
- Appropriate quality assurance and control at all stages of a total diet study are critical and cannot be overemphasized.
- In addition to estimating exposure for adults or the general population, it is critical to estimate dietary intakes for infants and children who face the greatest risk due to their high consumption/body weight ratio. In addition, countries should conduct exposure estimates on other population subgroups, such as ethnic populations, if their diet patterns are expected to be different.
- Foods should be prepared as normally consumed and concentration data recorded as such. If not so, moisture content should be included in the data submitted.
- TDS should be planned so that food composites are analysed shortly after they are prepared. Even if the foods are kept frozen, some chemicals may gradually decompose over time or become bound to the food matrix.
- When dealing with the possibility of terrorist threats or other food safety emergency, each total diet study should contain an annex to deal with highly contaminated samples quickly, so that the source of contamination can be identified and managed.

4 Laboratory capacity and analytical training

Knowledge of background levels of toxic chemicals in foods is critical for knowing whether or not foods are safe. The chemical analyses required for TDS are among the most difficult of all food analyses because of the low detection limits which must be obtained. The numbers of laboratories capable of measuring background concentrations of toxic chemicals in foods are few and the costs of these analyses are relatively high. As a result, there is a paucity of background monitoring data. The costs for building up laboratory capacity, however, are minor compared with the health and economic consequences of not being able to deal with crises.

- Responsible authorities in all countries should substantially strengthen laboratory capacity to monitor baseline levels of toxic chemicals in foods and address weaknesses in surge capacity and emergency preparedness.
- Wherever possible, training should be provided by more experienced laboratories for those analysts with less experience. Special emphasis should be placed on providing support and training to analysts in developing countries.

5 Emergency preparedness

Food safety emergencies have occurred periodically, often with enormous health and economic costs. In addition, the food supply is a key target for terrorism and without the ability to monitor for chemical toxicants, the populations of countries and world trade are at risk.

- A system of regional surveillance of chemical contamination of food should be developed together with an early warning system.
- GEMS/Food should compile and maintain a global inventory of laboratory capacities by chemical, food matrix and detection limits.
- GEMS/Food should compile and maintain a list of individuals with analytical, toxicological and other expertise.
- WHO Collaborating Centres for Food Contamination Monitoring should consider expanding their terms of reference to address these issues.

6 WHO food safety databases

With the globalization of trade and harmonization of food safety standards, it is critical that global food safety databases be maintained. These should include background concentration data for chemicals in individual foods and food groups and dietary intake estimates from TDS conducted in individual countries.

- Existing GEMS/Food databases for aggregate food/contaminant data and dietary intakes (OPAL I and II and SIGHT) should continue to be supported and refined.
- Individual countries should support GEMS/Food databases by regularly submitting data in the OPAL format.
- Software should be developed to allow individual countries to calculate dietary intake of contaminants by integrating their concentration data with their food intake data.

7 Persistent organic pollutants in human milk

Humans accumulate persistent organic pollutants (POPs) in their stores of fat. Some of these are transferred into the fat portion of human milk. Thus, human milk is one of the few and least expensive mechanisms of assessing human exposure to these chemicals and monitoring this exposure with time can provide information on trends. Human milk surveys can also be used to identify environmental sources of these chemicals and to monitor the effectiveness of risk management measures.

- In the light of the Stockholm Convention on POPs, countries should endeavour to participate in the ongoing WHO-coordinated study of POPs in human milk.
- Countries should as a matter of balanced risk communication strongly emphasize the benefits of breast feeding whenever reporting the results of studies of this type.

8 Risk assessment

The primary user of total diet study results is the risk assessor. Internationally and in individual countries, there is an urgent need for risk assessments on many chemicals. High quality data such as those collected in TDS is invaluable for conducting these assessments.

- Risk assessors and statisticians should be consulted when a total diet study is designed so that the study results can be directly used in making scientifically valid risk assessments for at-risk population groups. Thus, it is important to be able to, as a minimum, estimate both average

and upper percentile intakes of chemicals for each target population group. For nutrients, the ability to estimate lower percentile intakes is also critical.

9 Risk communication

It is recognized that information on concentrations of chemicals in foods and the dietary intake of these chemicals can be misinterpreted by the public and thus discourage the public from eating foods which are nutritionally beneficial.

- Consultations should be conducted with all interested parties including government, academia, industry and consumer groups in the design of total diet studies.
- TDS results should be promptly, fully and openly reported in a format easily understandable to all.
- Risks to the public should be reported fully and in perspective by scientists with the best knowledge of the issue.
- The public must also be informed about the best management practices to minimize risk of the main identified chemical hazards.

10 International total diet workshops

TDS are complex and require expertise from many different areas, including management, analytical chemistry, nutrition, food consumption, food preparation and statistics. Transfer of this expertise to countries starting their own TDS and exchange of information among scientists already conducting studies are critical.

- The practice of holding regional and international workshops on total diet studies on a regular basis should be continued with the support of WHO Headquarters and its Regional Offices as well as other international and national organizations and donors.
- Workshops should focus on reporting and discussing:
 - progress of TDS, particularly success stories in developing countries;
 - proven strategies for gaining support and implementing TDS;
 - results of new and on-going TDS;
 - international dietary risk assessment issues; and
 - techniques of food analysis, consumption studies and exposure estimates as well as
 - providing training for less developed countries.
- Regional total diet workshops should also be held, especially where groups of developing countries are interested in initiating new TDS.
- On-line training software should be developed to supplement regional and international TDS training courses.

PROGRAMME
4TH INTERNATIONAL WORKSHOP ON TOTAL DIET STUDIES
23 – 27 October 2006, Beijing, China

Monday, 23 October

- 09:00 – 10:00 Registration
- 10:00 – 10:30 Welcome and Opening
- Ministry of Health - Mr Zhao Tong Gang, Director General, Health Inspection Bureau, Ministry of Health, Beijing
 - Food and Agriculture Organization of the United Nations – Dr Ruth Charrondiere, Rome
 - World Health Organization – Dr Henk Bekedam, WHO Representative to China, Beijing
- 10:30 – 10:40 Appointment of Chair, Vice-Chair and Rapporteur
- 10:40 – 11:00 Objectives, structure and housekeeping – Dr Junshi Chen, China CDC, National Institute for Nutrition and Food Safety, Beijing
- 11:00 – 11:30 Overview of GEMS/Food – Dr Gerald Moy, WHO, Geneva
- 11:30 - 12:30 Matters of interest from WHO and FAO
- 12:30 – 14:00 Lunch
- 14:00 – 15:30 National experiences with studies on chemical contaminants in food and total diet
- 15:30 – 16:00 Break
- 16:00 – 17:30 National experiences with studies on chemical contaminants in food and total diet
- Australia – Mr Peter Wallner, Food Standards Australia New Zealand (FSANZ), Canberra
 - Brazil - Ms Ligia Lindner Schreiner, National Health Surveillance Agency, Brasilia
 - Cameroon - Ms Marie Madeleine Gimou, Pasteur Center, Yaoundé
 - Czech Republic - “Exposure assessment: Comparison of both point and probabilistic assessments with TDS data”, Dr Jiri Ruprich, Institute of Public Health, Brno
 - China - Dr Junshi Chen, National Institute for Nutrition and Food Safety, Chinese CDC, Beijing

Tuesday, 24 October

- 09:00 - 10:30 National experiences with studies on chemical contaminants in food and total diet
- Hungary - Dr Maria Szeitzne Szabo, Hungarian Food Safety Office, Budapest
 - Indonesia - “Food Contamination Monitoring Programme and Preparation of the Total diet Study in Indonesia” Drs Winiati P. Rahayu and Roy A. Sparringa, Ministry of Health, Jakarta
 - Republic of Korea - “Recent monitoring activities and status of TDS in Korea” Dr Hae Jung Yoon, Korean Food and Drug Administration, Seoul
- 10:30 - 11:00 Break
- 11:00 - 12:30 National experiences with studies on chemical contaminants in food and total diet
- New Zealand – Dr Richard Vannoort, Institute of Environmental Science and Research (ESR), Christchurch
 - United Kingdom of Great Britain and Northern Ireland- Dr Simona Origgi, Food Standards Agency, London
- 12:30 - 14:00 Lunch
- 14:30 - 17:30 National experiences with studies on chemical contaminants in food and total diet
- United States of America – Ms Katie Egan, Center for Food Safety and Applied Nutrition, US Food and Drug Administration, College Park, MD
 - Egypt – Dr Emil Salama, Ministry of Agriculture, Giza
 - Malaysia - Dr Asma Zakaria, Ministry of Health, Malaysia
 - Japan - Dr Fujio Kayama, Jichi Medical University and Takeshi Satoh, Food Safety Commission, Tochigi
 - Hong Kong - Ms Anna Man-ching Wong, Centre for Food Safety, Food and Environmental Hygiene Department, China, Hong Kong SAR
- 17:30 - Poster Session on Food Contamination, Consumption and TDS topics

Wednesday, 25 October

- 09:00 – 09:45 Update on GEMS/Food international databases – Mr Lawrence Grant, WHO Consultant, Geneva
- 09:45 – 10:30 Nutrient results of the 2003/04 New Zealand TDS and mandatory fortification of the food supply with iodine - Dr Richard Vannoort, ESR, Christchurch and Ms Cherie Flynn, New Zealand Food Safety Authority, Wellington
- 10:30 – 11:00 Break

11:00 – 11:30	Linking nutrition surveys with TDS – Dr Junshi Chen, National Institute for Nutrition and Food Safety, China CDC, Beijing
11:30 - 12:00	Comparison of risk assessment and management of chemical and biological agents - Dr Jaap Jansen, WHO, Geneva
12:00 – 12:30	Aquaculture fish survey in Australia - Dr Peter Wallner, FSANZ, Canberra
12:30 - 14:00	Lunch
14:00 – 14:30	First total diet study in the Taiwan area - Dr Sue-Sun Wong, IUPAC Representative
14:30 – 15:00	Heavy metals in bread in Egypt - Dr Mona Korshid, Cairo
15:00 - 15:30	Reporting and modelling of results below the limit of detection - Dr Philippe Verger, National Institute for Agricultural Research, Paris
15:30 – 16:00	Break
16:00 – 17:30	Dealing with uncertainty in TDS: Group Discussion - Dr Peter Wallner, FSANZ, Moderator

Thursday, 26 October

09:00 – 09:30	An Internet-based method for assessing food consumption - Ms Chunling Wang, Exponent, Washington, DC
09:30 – 10:00	Emerging contaminants in TDS in China - Dr Yongning Wu, National Institute for Nutrition and Food Safety, China CDC, Beijing
10:00 – 10:30	Probabilistic assessment of exposure to glycoalkaloids: Case of solanine and chaconine in potatoes - Dr Jiri Ruprich, Institute of Public Health, Brno
10:30 – 11:00	Break
11:00 – 11:30	Cadmium intake assessment using TDS and probabilistic Monte Carlo simulation among the Japanese - Dr Fujio Kayama, Jichi Medical University, Tochigi, Japan
11:30 – 12:00	GEMS/Food Consumption Cluster Diets - Dr Gerald Moy, WHO, Geneva
12:00 – 12:30	United Kingdom acrylamide Total Diet Study - Dr Simona Origgi, Food Standards Agency, London
12:30 - 14:00	Lunch
Afternoon	Field visit to TDS-related laboratories at the Chinese Center for Disease Control and Prevention
18:00	Workshop Dinner

Friday, 27 October

- 09:00 – 09:30 Future directions for New Zealand’s TDS - Ms Cherie Flynn, New Zealand Food Authority, Wellington
- 09:30 – 10:00 WHO/UNEP global survey of human milk for persistent organic pollutants - Dr Gerald Moy, WHO, Geneva
- 10:00 – 10:30 FDA guidance for industry for estimating dietary intake of substances in food - Ms Katie Egan, US Food and Drug Administration, College Park, MD
- 10:30 – 11:00 Break
- 11:00 – 12:00 Recommendations and future activities – Dr Junshi Chen, China CDC, Beijing and Dr Gerald Moy, WHO, Geneva
- 12:00 – 12:30 Closing Remarks

**REPORT ON THE 4TH INTERNATIONAL TRAINING COURSE
ON TOTAL DIET STUDIES, BEIJING, CHINA
16-20 OCTOBER 2006**

Introduction

As with past international workshops on total diet studies (TDS), the 4th International Workshop on TDS was preceded by a one-week training course on TDS for national participants from countries wishing to initiate TDS in their countries. Fifty-five participants from 27 countries took part in the training course, including 6 facilitators. A list of participants is given in Annex III. The training course was opened by Dr Gerald Moy, GEMS/Food Manager, WHO Headquarters. Opening remarks were provided by Dr Junshi Chen, National Institute of Nutrition and Food Safety, China Center for Communicable Disease Control and Prevention, Beijing, China and Mr Jun Wu, Director General of Ministry of Health, China.

Objectives and Overview

The 4th International Training Course on TDS in Beijing, China was focused on the ‘basics’ and involved introductory lectures which were reinforced with practical tutorials. The training course also supported the objectives of the 4th International Workshop TDS, which were to:

- promote and support TDS in all Member States;
- help prepare countries wishing to conduct or expand TDS;
- report on recent developments and results in the field of TDS;
- promote reliable and comparable TDS through harmonized approaches and exchange of international ‘best practices’ and expertise;
- discuss methods and resources needed to conduct dietary exposure assessments;
- establish a network of national counterparts for undertaking regional TDS projects; and
- promote electronic submission of total diet study data to GEMS/Food.

Programme and Summary of Presentations and Exercises

The course programme is given in Appendix 1. The main presentations and exercises of the training course are summarized in Appendix 2.

Training Course Evaluation

Twenty-six participants completed or partially completed the training course evaluation. Twenty-five believed its objectives were clearly understood and, of these, four believed the objectives were entirely met and 20 felt they were almost entirely met. Eighteen felt the course was just the right length, with three feeling it was too long and five too short. It was interesting to note that of those who felt it was too long, there were also a number of topics they wish were treated in much more detail. The content of the course was ranked excellent (4), very good (15) and good (7). None thought it was fair or deficient.

It is apparent that the challenge of such training courses is providing crucial baseline information for people coming from such varied countries and cultures. Organizers and presenters had to cater for those who had minimal knowledge about risk analysis, exposure assessment or TDS, right through those who had some knowledge and up to those who had quite a good baseline knowledge of such

topics. Equally challenging was the need to provide for markedly different participants who came from ministries of agriculture and health and food safety agencies and whose professional backgrounds included policy development, analytical chemists, biologists, doctors, nutritionists and research officers.

The success of the training course is both reflected by the fact that very few topics included were considered unnecessary, whereas just about every component covered in the training course was identified by at least one of the participants as important and almost all also worthy of more depth, detail and practical examples. Some extra aspects wished for were lab tours, practical examples of sample preparation, presentations by developing countries doing TDS and also full TDS presentations, outcomes and policy implications. These were, in fact, all covered by the subsequent workshop and confirmed why the training course was held in advance of the workshop.

A strong but encouraging theme to come out of the evaluation questionnaire was that many participants said they would benefit from more time (even up to an extra week) going into more detail and working through practical examples of what is needed in planning, running and managing a TDS. Other issues for each different country such as how to actually do their own sampling plan, analytical plan, SOPs, shopping lists, calculate weights needed, understand LODs/LOQs, food consumption surveys, exposure estimates and links to other sectors and funders were also identified as needing to be worked through for their own situation. These are clearly opportunities for more in depth follow up consultation and possible regional workshops. The degree of interest of participants to plan for TDS in their countries was most encouraging. Support of GEMS/Food and international TDS experts to provide associated technical advice/training was seen as a key issue in making this crucial risk assessment tool available in more countries around the world.

PROGRAMME
4TH INTERNATIONAL TRAINING COURSE ON TOTAL DIET STUDIES
16 – 20 October 2006, Beijing, China

Monday, 16 October - Introduction

09.00	Registration	Participants
09.30	Official welcome	Dr Gerald Moy, WHO Dr Junshi Chen, China CDC Dr Jun Yu, MoH, China
10.00	Introduction of facilitators and participants	Everyone
10.20	Objectives and overview	Dr Richard Vannoort, ESR
10.30	Morning tea	
11.00	Risk analysis paradigm	Ms Cherie Flynn, NZFSA
11.45	Exposure assessment	Dr Gerald Moy, WHO
12.30	Lunch	
14.00	Why we do a total diet survey	Ms Cherie Flynn, NZFSA
14.45	Where and how to start a total diet study	Dr Richard Vannoort, ESR
15.30	Afternoon tea	
16.00 -17.00	Where and how to start a total diet study (cont.)	Dr Richard Vannoort, ESR

Tuesday, 17 October - Key Total Diet Study components

09.00	Food consumption data sources	Dr Ruth Charrondiere, FAO
10.00	Standard Operating Procedures (SOPs),	Dr Richard Vannoort, ESR
10.30	Morning tea	
11.00	Food sampling	Dr Richard Vannoort, ESR
11.45	Food sample preparation	Dr Richard Vannoort, ESR
12.30	Lunch	
14.00	Food analyses	Dr Richard Vannoort, ESR
14.30	Methods and practices in China TDS	Dr Junquan Gao, China
15.30	Afternoon tea	
16.00-17.00	Planning, design and release of NZTDS	Ms Cherie Flynn, NZFSA

Wednesday, 18 October – Group 1 / Thursday, 19 October – Group 2 - Practical exercises to help plan and initiate national total diet study

09.00	Developing a country total diet food list (hands-on Internet tutorial)	Dr Ruth Charrondiere, FAO with Dr Richard Vannoort & Ms Cherie Flynn
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10.30	Morning tea	
11.00	Developing a country total diet food list (cont.) (hands-on Internet tutorial)	Dr Ruth Charrondiere, FAO et al.
12.30	Lunch	
14.00	Sorting total diet study components and developing a total diet study timeline	Dr Richard Vannoort, ESR
15.30	Afternoon tea	
16.00	Total diet study sampling plan (hands-on tutorial)	Dr Richard Vannoort, ESR
16.45-17.00	Exposure estimates (worked example)	Dr Richard Vannoort, ESR

Wednesday, 18 October – Group 2 / Thursday, 19 October – Group 1 - Hands-on training in data handling

09.00	Electronic data handling, exchange and reporting	Mr Larry Grant, WHO
10.30	Morning tea	
11.00	OPAL I – Contaminants in foods (hands-on tutorial using laptop computers)	Mr Larry Grant, WHO
12.30	Lunch	
13.45	OPAL II – Contaminants in diets (hands-on tutorial using laptop computers)	Mr Larry Grant, WHO
15.30	Afternoon tea	
16.00-17.00	Submitting data to GEMS/Food and Internet access via SIGHT (hands-on tutorial using laptop computers connected to Internet)	Mr Larry Grant, WHO

Friday, 20 October

09.00	Visit to Beijing food markets (field visit)	
11.30	Course evaluation	Participants
12.00	Closing remarks (discussion & questions)	Dr Gerald Moy
12.30	Lunch	
14.00-17.00	Individual consultations	Participants and facilitators

SUMMARY OF PRESENTATIONS AND EXERCISES 4TH INTERNATIONAL TRAINING COURSE ON TOTAL DIET STUDIES 16 – 20 October 2006, Beijing, China

Risk Analysis Paradigm

Cherie Flynn, New Zealand Food Safety Authority

The presentation outlined the key components of risk analysis and in particular how risk analysis is understood and used in relation to food safety. Risk analysis was discussed within the context of the Codex Alimentarius Commission, GEMS/Food and the World Trade Organization. The definitions and principles developed by Codex were discussed, as was the importance of placing risk management within an overarching generic risk analysis framework. The importance of monitoring and review was also emphasized, as it is at this stage that an ongoing programme of total diet studies can be shown to be important in that they provide a way to collect information and trends over time.

From the mid 1990's risk analysis has been recognized as the most appropriate methods for making public policy decisions about food safety. Risk analysis makes appropriate use of the increasing amount of knowledge and information from modern science and technology and provides a structure that also those affected or interested to have the opportunity to contribute to the process.

Exposure Assessment

Gerald Moy, GEMS/Food Manager, WHO, Switzerland

The risk analysis paradigm identifies risk assessment as a key component and pivotal to this is exposure assessment. Paracelsus, the so-called father of modern toxicology first gave us the maxim that “every substance is a poison – it's only a matter of the dose.” So without exposure assessment, we are not able to assess the risk. The principle focus of TDS is chronic exposure assessment and this is defined for a food as the product of the concentration of a chemical of concern in a food times the consumption of that food. Dietary exposure is therefore obtained by summing each of these exposures for the foods across a typical diet.

Dietary exposures are estimates and should be derived using a tiered approach, with first estimates using single point consumption data such as model diets or regional diets and maximum levels from existing regulatory standards. Better estimates are progressively derived by using regional, national, household and individual diets for consumption data and using concentrations of chemicals in standards, raw commodities and foods as consumed.

Why do a Total Diet Survey

Cherie Flynn, New Zealand Food Safety Authority (NZFSA), New Zealand

Total diet studies (TDS) are the primary sources of information on the levels of various chemical contaminants and nutrients in the diet. A TDS can provide general assurances that the food supply is safe from certain chemical hazards. In addition, TDS results can be an indicator of environmental contamination by chemicals and can help in the development of priorities for possible risk management interventions by identifying what foods or food groups are the main sources of dietary exposure. Thus allowing decisions to be made on where to focus limited resources go achieve the greatest benefit in terms of public health.

A TDS can also be used to assess the effectiveness of the measures previously put in place to reduce the exposure of the population to the chemical hazard(s) or to address a nutrient deficiency. This can include measures taken that were not directly related to the food supply (e.g. reducing lead in petrol, which reduces emissions from vehicles leading to reduced opportunity for uptake by crops). A series of studies will also allow trends over time to be followed and facilitate comparisons with other countries.

WHO recognizes TDSs as one of the most cost effective way to assure people they are not exposed to unsafe levels of toxic chemicals through food. As world trade in food and food commodities increases importing countries need to be able to assure their consumers that the foods they are being offered are safe. With the rise in trade has also come an increase in concern about the potential for foods to be tampered with and for food not acceptable in one country to be moved to another where controls may be less strict or not exist. In this context knowing what is in the food people are eating can be a key piece of information in being able to provide assurances to both domestic and international consumers.

Where and How to Start a Total Diet Study

Richard Vannoort, ESR, New Zealand

A basic approach to planning a total diet study was outlined. The presentation focused on three key aspects: objectives, management and components of TDS. The objectives of TDS need to be clear, unambiguous, while also being realistic and achievable in the timeframe, with the resources and expertise available. The primary objective is to estimate dietary exposure to selected pesticides residues, contaminant and nutrient elements and thus assess any associated health implications. Other objectives relate to use of food concentration data and exposure estimates, whether considering trends over time, between countries, or submitting them to WHO GEMS/Food, stakeholders, Codex or using them in the setting of Food Standards. To manage TDS effectively there should be one leader, all members should have their roles clearly defined and lines of communication be well understood. TDS is a large and complex project, with many components. It very much involves a team approach, with the success of the overall project only being as good as the weakest link in the chain.

The many components of TDS were discussed, namely: planning, indicative budget, scoping the food list, which organic and inorganic analyses to do, specific analytical considerations such as the limit of detection being adequate to provide meaningful exposure estimates. The paramount importance of quality assurance and quality control was emphasized as another key component of TDS, as were the analytical plan (which foods for which analyses, which individually analysed and which composited), the sampling plan, sampling, sample preparation, sample containers and sample analyses. With such a large project, an effective risk minimisation strategy suggested was to do a small pretest of all systems for say 2-3 foods for sampling, preparation and analyses. Other key components of TDS identified were data evaluation, statistics, the possible need for re-analyses, consumption data, exposure/intake estimates and risk characterization. Of course it doesn't end there, interpretative reports need to be written, peer reviewed and then effective risk communication (and possibly risk management) undertaken. Standard operating procedures were seen as an important and fundamental component of a successful TDS.

Food Consumption Data Sources

Ruth Charrondiere, FAO, Italy

Food consumption and supply was defined and described. The uses of food consumption data was explained, also in the area of food safety. The different food consumption survey methods were presented with their advantages and inconveniences. Data representing individual food intake data are preferable for TDS even though they have inherent recall and recording bias. These derive from food

frequency questionnaires (FFQ), 24-hour dietary recalls (24-HR), dietary history and food records. The second best quality food consumption data derive from household budget surveys (HBS) because of the elevated level of factors used to calculate individual food consumption. Food supply data such as FAOSTAT or GEMS/foods diets should be used in absence of available food consumption survey data. Qualitative food consumptions data are not useful for TDS. Criteria to select foods for the TDS food list and for the analytical samples were briefly explained.

Standard Operating Procedures

Richard Vannoort, ESR, New Zealand

Standard Operating Procedures (SOPs), which are critical to the success of TDS, were presented. They ensure that the procedures used are documented and are useful for planning, training, clarifying ambiguities and leading to a more robust approach to differing aspects of TDS. TDS SOPs are important for the study management team, sampling officers, sample preparation staff and analytical lab managers and analysts. They explain the management structure and key contact details, promote consistent sampling between different centres and explain what, when and how to sample and prepare foods in TDS. The importance of getting SOPs reviewed by key participants before initiating TDS was seen as most useful, to clarify or remove any ambiguities and correct any possible errors. It also improves ownership of involvement in the future success of TDS.

Sampling in a Total Diet Study

Richard Vannoort, ESR, New Zealand

The varying components of sampling in a TDS were presented, namely, which foods, who samples and when, where and how and what should be the budget? In regards to which foods to sample, it was pointed out that the food list should identify the most important foods in regards to general population dietary consumption, as well as foods relevant to population subgroups and those of specific concern regarding contaminant content (e.g. liver, shellfish). The numbers of foods in the list and whether TDS were based on an individual foods approach or food groups composite approach was discussed for New Zealand, Czech Republic, Australia, UK and USA. Possible food groupings/subgroupings were also detailed.

Sampling can be carried out by sampling officers or contracted civilians, but it is important they know how important they are to the success of the TDS project and that they do their job effectively. Standard Operating procedures (SOPs) are seen as an important part of helping all concerned meet this objective. Sampling should be coordinated with sample preparation and analyses. It was suggested that if sampling occurs over a number of weeks, then this is usually most effective in regards to managing the large volumes of food. Sampling should ideally be at the beginning of the week to enable sample preparation later that same week. Sampling should consider regionally as well as nationally produced/distributed foods. Sampling should be as representative as possible. Weights of food samples to be purchased are worked back from amount needed for analyses, whether foods are to be analysed individually or composited and also considering extra needed for duplicates, reserve samples and processing losses. Suggested sample details to record were also suggested, as were sample ID labels, food purchasing tick lists, purchasing instructions, sample handling and transportation. The TDS budget must, of course, include purchase costs of foods, payment for samplers, chilli bins & coolant pads and transportation costs. Sampling is another critical part of a successful TDS and it must be planned and managed effectively.

Sample Preparation in a Total Diet Survey

Richard Vannoort, ESR, New Zealand

The point was reiterated that TDS are set apart from other 'agricultural commodity surveys', in that foods are prepared 'ready for consumption', so TDSs thus provide the best means of assessing the risk to consumers. Sample preparation is thus another critical link in the chain of success of TDS. To ensure consistency, Standard Operating Procedures (SOPs) are considered essential. SOPs should address such issues as sample receipt procedures, sample receipt tick lists, appropriate documentation that needs to be undertaken, pre-sorting samples and prioritising foods on receipt for sample preparation. SOPs need to explain suitable equipment to be used for sample preparation, acceptable containers and labels for prepared samples, the need for reserve samples, contamination control, whether an individual foods or food group composite approach is being undertaken. SOPs should provide explicit instructions on how to prepare each food, whether to keep brands/regions/seasons separate or to composite them and which foods are to go for which analyses. Prepared foods should be ticked off when dispatched and their receipt at the analytical laboratory confirmed.

The China Total Diet Study – Methods and Practices

Junquan Gao, National Institute of Food Safety and Nutrition, China

This presentation brought together the various aspects of TDS that have been discussed previously over the course of the training week. The China Total Diet Study (CTDS) conducted in 2000 used the consumption of 2030 foods by Chinese residents which were then aggregated into 662 representative individual foods. The 662 foods were further prepared to obtain four market baskets, each comprised of 12 food composites with a total of 48 composites. The dietary intake of chemical contaminants and nutrients is obtained for an average adult man in four geographical areas using analytical data from the 12 food composites and 10 specific age-sex groups in each of the 12 provinces using analytical data from 662 individual foods. In the case of unusual data from the composites samples, the geographical and food source could be identified by backtracking and analysing the individual foods making up those composites.

The history and development of the CTDS was briefly explained, with the first being in 1990 and the 2000 CTDS being the third. The food consumption data was derived from household weighing and recording (3 x 24 hr recall). The household data was used to calculate the food consumption data for the adult male and the individual data for the various age-sex groups. The 662 foods in the CTDS were grouped into 13 food groups – cereals and cereal products, legumes, nuts and their products; potatoes and their products; meat and meat products; eggs and egg products; aquatic foods and their products; milk and milk products; vegetables and their products; fruit and their products; sugar; beverages and water; alcohol beverages; and condiments and cooking oils. The aggregation process of the 2030 foods into 662 foods and provincial composites was detailed. The sampling, cooking and preparation undertaken in the Chinese TDS was explained and appropriately illustrated.

The analytes in the 2000 CTDS included the heavy metals lead, cadmium, mercury and arsenic, the pesticides HCH, DDT, methamidophos, dichlorvos, parathion, parathion-methyl, trichlofon, dimethoate, acephate, disulfoton, fenitrothion, malathion, fenthion and phosmet, the industrial contaminants dioxins and PCBs, the natural contaminants aflatoxins B1, B2, G1, G2 and M1, minerals and trace elements potassium, sodium, calcium, magnesium, phosphorus, iron, zinc, copper, manganese and selenium and the macronutrients lipid fat, cholesterol and fatty acids. It is anticipated that the next CTDS will commence in 2007.

The 2003/04 New Zealand Total Diet Survey - Planning, Design and Release

Cherie Flynn, NZFSA, New Zealand

This presentation also reinforced the various components involved in a Total Diet Study, with the 2003/04 New Zealand Total Diet Survey, the sixth such New Zealand survey, used as an example. The presentation gave the background to the NZTDS and outlined the objectives, structure and content of the 2003/04 NZTDS. Also discussed were the approach, process, participants, content, timeframes and results of the communication and consultation process undertaken in the development of the 2003/04 NZTDS and the final release of results. An overview of the costs of the NZTDS was also presented and how these had changed over time.

The NZTDS takes an individual food approach where each food is analysed separate from each other food. Dietary exposure is estimated based on simulated typical 2-week diets for various population subgroups. The structure of the NZTDS includes those analytes to be included in each NZTDS (specified chemical residues – agricultural compounds, persistent organochlorines, DTCs; contaminant elements – arsenic, lead, cadmium and mercury; and nutrient elements – iodine and selenium) and selected analytes included on an occasional basis (e.g. once every second or third NZTDS).

In 2003/04 samples of 121 foods, divided into 12 food groups and representing over 70% of the most commonly consumed foods in New Zealand, were collected twice over a 12 month period from 4 regional locations (58 foods) and 1 national location (63 foods). Simulated typical 2-week diets for eight different age and sex groups were then used to estimate the dietary exposure of each group to a range of chemical compound residues (including agricultural compounds, acid herbicides, DTCs); selected contaminant elements (arsenic, lead, cadmium and mercury); and selected nutrient elements (iodine, iron, selenium, sodium).

Electronic data handling, exchange and reporting tutorial

Lawrence Grant, WHO Consultant, Geneva

The GEMS/Food global databases were accessed and the procedures and software to enable data collection and dissemination were demonstrated. GEMS/Food collects (a) aggregate data on contaminants in individual food commodities, (b) dietary intakes of contaminants from TDS and (c) individual measurements of contaminants in food commodities. The structure and definition of these data collections were given. Emphasis was given to the harmonization between existing national databases and GEMS/Food to facilitate data transfer and promote data quality; formal procedures for data transfer were presented and are given in the document GEMS/Food Data Collections Including Instructions for the Electronic Submission of Data. The OPAL (Operating Programs for Analytical Laboratories) software was presented. This software provides a means for countries that have not automated their monitoring data systems to collect, collate, analyse and disseminate data at the national level. The suite of OPAL programs consists of OPAL I for individual and aggregate data on contaminants in foods and OPAL II for total diet studies. Contributions from national databases are stored in a global GEMS/Food database at WHO, Geneva. Dissemination of these data is enabled through the internet-based tool WHO/SIGHT, which allows navigation over statistical databases and document collections. Several examples of accessing GEMS/Food data by WHO/SIGHT were given.

Developing your own country TDS Food List tutorial

Ruth Charrondiere, FAO, Italy

A brief presentation on food consumption sources and needs were given, as well as available resources for retention and yield factors. An exercise to construct a total diet food list for participants own countries involved sorting data using GEMS/Food Consumption Cluster Diets, FAOSTAT or

household data, by cleaning up the preliminary list, applying edible and yield factors, selecting foods > 1g (perhaps higher weight) and low consumption foods that may be high sources of contamination (shellfish, offal) or consumed by specific population subgroups (infants, ethnic populations). The target number for countries initiating their first study was approximately 50 foods.

TDS Project Timeline

Richard Vannoort, ESR, New Zealand

While appreciating all the components of a TDS are important, the project timeline was essential in assuring that many actions involved take place at the right time. The components of a TDS were identified and the interdependence of some components recognized (e.g. one cannot prepare samples until after they have been sampled, obviously). The exercise involved sorting the TDS components into their correct order and preparing a TDS timeline using an Excel spreadsheet.

Sampling Plan

Richard Vannoort, ESR, New Zealand

The earlier lecture on sampling in a TDS was put into practice when workshop delegates were given a food list, asked to identify which foods would need cooking or special analyses and then they were asked to organise a 4 week sampling schedule. They had to try to keep foods of a similar group together as much as possible, while also bearing in mind the need to keep a relatively uniform distribution of weights of foods to be sampled (and transported) each week. In addition, they had to also consider keeping the amount of subsequent food preparation relatively even each week. It proved a thought provoking and useful exercise.

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SUMMARY OF SELECTED WORKSHOP PRESENTATIONS

Summaries of the presentations are listed in the order in which they were presented during the workshop.

Overview of GEMS/Food

Gerald Moy, WHO, Geneva, Switzerland

The Global Environment Monitoring System (GEMS) was established by the United Nations Environment Programme (UNEP) in 1976 and included three components, namely air, water and food. WHO, which was the lead agency for food, collaborated with UNEP and the Food and Agriculture Organization (FAO) to implement the GEMS Food Contamination Monitoring and Assessment Programme, which is widely known as GEMS/Food. The main purpose of the programme is to compile data on food contamination and human exposure for global synthesis, evaluation and presentation. The focus of GEMS/Food is on health-oriented population-based dietary exposure to major food contaminants. This is in contrast to trade-oriented targeted sampling and analysis programmes, which is used for compliance purposes. GEMS/Food currently includes institutions located in over 80 countries around the world. GEMS/Food is interested in levels of contaminants in individual foods and in the total diet as reflected in the software programs OPAL I and II, which have been developed expressly to collect and manage such data. SIGHT (Summary Information on Global Health Trends) was developed as a Web-based dissemination tool that offers the public and other specific users access to the GEMS/Food database. Among such users, JECFA and JMPR receive GEMS/Food data on chemicals that are scheduled for evaluation by these bodies. GEMS/Food also provides data to Codex Alimentarius Commission on request. GEMS/Food is also involved in the generation of data on chemicals in human milk and is organizing the Fourth Round of WHO Coordinated Studies of Dioxins, Dibenzofurans and Polychlorinated Biphenyls in Human Milk, which will be used in assessing the effectiveness of the Stockholm Convention on Persistent Organic Pollutants (POPs). GEMS/Food is responding to the potential intentional contamination of food by maintaining an inventory of monitoring capabilities of GEMS/Food institutions and other food laboratories in order to provide support in the event of terrorist incidents or other food safety emergencies.

Matters of interest from WHO and FAO

Gerald Moy, WHO, Geneva, Switzerland

Ruth Charrondiere, FAO, Rome, Italy

FAO and WHO continue their efforts to provide relevant scientific advice to Codex and Member States in a transparent, sound and timely manner. The results of meetings implemented jointly by FAO and WHO with the objective of providing scientific advice are available on the FAO and WHO websites. This includes the regular meetings of JECFA and JMPR as well as JMRA. FAO and WHO have also completed a number of activities which constitute a follow-up to earlier expert meetings. These include, for example, the recent activities related to JECFA reported to the 38th session of the CCFAC in paper CX/FAC 06/38/3 (ftp://ftp.fao.org/codex/ccfac38/fa38_03e.pdf), in particular the issue of a new call for experts for JECFA rosters 2007 – 2011. Details on the scientific expertise required for the fields in which JECFA is mandated to perform risk assessment and the application procedure and process is available at http://www.fao.org/ag/agn/jecfa/experts_en.stm. The review of the FAO/WHO programme on the provision of scientific advice to Codex and Member countries continued with the implementation of some of the recommendations made by the FAO/WHO Workshop on the Provision of Scientific Advice to Codex and Member Countries held in Geneva, Switzerland, from 27-29 January 2004.

Report on the Australian TDS Programme

Peter Wallner, Food Standards Australia New Zealand, Canberra, Australia

The Australian Total Diet Study (ATDS) is a relatively mature study with the 22nd ATDS report currently in draft. Pesticide residues and contaminants had been the subject of the ATDS up until the 20th study however, the 21st and 22nd ATDS studied additives and nutrients respectively. The reasons for this shift in approach are explained. The main focus of the talk was to present selected findings of the two most recent ATDS:

- 21st ATDS - Additives: sulphites, benzoates, sorbates
- 22nd ATDS - Essential trace elements: iodine, chromium, molybdenum, selenium and copper.

Significant findings from these studies in relation to Australian's dietary exposure to sulphites and adequacy of dietary iodine were presented. The presentation also made some general conclusions in relation to the application of the TDS.

- That the TDS method is an effective tool for studying dietary exposure to additives and dietary intake to nutrients among the Australian population.
- Comparing the estimated dietary exposure of additives to the Acceptable Daily Intake (ADI) or dietary intake of nutrients to the Estimated Average Requirement (EAR) provides useful indications of the dietary exposure/nutritional status for different age/gender populations.
- Quantifying the contribution of specific foods to the dietary exposure/intake for different age/gender groups is a valuable outcome of the TDS approach.

Some hard copies of the 21st ATDS report were provided and it is also available on the FSANZ website: <http://www.foodstandards.gov.au>. The 22nd ATDS report is currently in preparation.

Brazilian Experience with Studies on Chemical Contaminants in Food and Total Diet

Ligia Lindner Schreiner, National Health Surveillance Agency, Brasilia, Brazil

The last major survey focused on food consumption was done in 1975/1976. However, the consumption habits have changed a lot since this date. The Brazilian population increased from 70 million in the 60s to more than 180 million in 2006. Furthermore, the profile of this population changed. In 1960 there were more people in rural areas than in urban areas. Nowadays, the urban population is 5 times higher than the countryside and the percentage of women working out of their homes increased strongly, from less than 20% to almost 50%. This implies an increase in the consumption of food out of the home. Because of this, it is not possible to use these data to estimate the diet.

All of the official surveys in Brazil have been done by the Brazilian Institute of Geography and Statistics (IBGE) (<http://www.ibge.gov.br>). In 2002/2003 IBGE did a survey called Family Budget Researches (POF), regarding which and how much food Brazilian families buy. It did not consider any specific group of consumers or food that is consumed out of home. Therefore, estimates of the intake of contaminants consider only the average scenario. These estimates are used mainly to set maximum levels and not to evaluate dietary intake in a realistic way. Some special evaluations are generally done by universities and research institutes. There are many ways to estimate consumption such as using dietary recalls of 24 hours, 4 days or 7 days. To verify if the contaminant exposure was through food, levels in urine or human milk may be measured. However, all surveys of food "as-consumed" have not been national surveys.

A food consumption survey will be conducted in 2007 by IBGE in coordination with the Ministry of Health. Groups will be stratified in the following: region, rural or urban areas, age and special groups (less than 10 years, more than 65 years etc). In addition, a national database on contaminants in food

will gather information from all official laboratories as well as universities and research institutes. Currently the Brazilian Health Surveillance Agency (ANVISA) has national programmes for pesticides residues and veterinary drugs. A programme to assess microbiological resistance in bacteria isolated from poultry also exists. Reports on these programmes are available at the ANVISA website (<http://www.anvisa.gov.br>).

Total Diet Study in Yaoundé – Cameroon: Preliminary Results

Marie-Madeleine Gimou, Pasteur Center, Yaoundé, Cameroon

The objective of this study is to estimate the level of dietary exposure of the Yaoundé population to a range of pesticide residues through food consumption. Yaoundé, capital of the country, has 1 600 000 inhabitants. It was chosen because it was representative of the whole country with its numerous ethnic groups and its very high diversity in terms of food habits. The food list was elaborated after the transformations of a Cameroonian inquiry to households dealing with data on food expenditures by individuals. Eighty-six different food items were selected representing about 90% of the diet consumed by the Yaoundé population. These foods were later analysed as 63 samples of individual or groups of food. Samples were collected from seven representative markets and main bakeries in the city for sampling food to avoid systematic bias. Forty-five pesticides including organochlorine, organophosphorous, organonitrogen, pyrethroids, dithiocarbamates and others were determined in these samples of food. Since the analyses are not yet completed, preliminary results indicate that 65% of the samples analysed contained no detectable pesticide residues and 7% had levels of pesticide residues above the limit of detection.

Total Diet Studies in the Czech Republic 2006

Jiri Ruprich, National Institute of Public Health, Brno, Czech Republic

The Czech TDS are realized as a part of the *Environment and Health Monitoring System*. Budget for TDS activities is covered by the Ministry of Health. TDS is independent on the food control system. The main objective is risk characterization and not checking of compliance with regulatory limits. TDS activities are closely related with food consumption studies. TDS started in 1994. The design of TDS has been slightly modified in 1999 and again 2004 to reflect changes in dietary patterns. Since 2004 a total of 143 food groups from 4 regions (3 towns) are used. The presentation focused on practical examples of the point and probabilistic exposure assessment. Traditional TDS output is a simple exposure assessment based on data processing from annual/biannual TDS runs. A point estimate is based on simple multiplying of average concentrations by average of food consumption (reality) and average concentrations by FBGD recommendations (model). This is because the concentration database per one TDS run is too small to use more advanced calculation methods. A novel TDS output is an advanced exposure assessment using a probabilistic estimate based on multiplying of distribution of concentrations by distribution of food consumption data (acute exposure = acute intake) and average concentrations by distribution of food consumption data (chronic exposure = usual intake). This advanced approach is used when there is a need to clarify 'uncertain point estimates' and when estimating extreme percentile groups. Examples for NDL-PCB, iodine and manganese were shown. *This work has been supported by the 6.FP EU (project 'SAFEFOODS')*

The Development of Total Diet Study in China

Junshi Chen, National Institute for Nutrition and Food Safety, China Centre for Disease Control and Prevention, Beijing, China

China has conducted 3 total diet studies covering 12 provinces (about 50% of total population). Samples comprised 4 regional market baskets. The development of the TDS methodology was summarized as follows:

- 1990 – 48 composite foods, adult males only, 22 contaminants and 76 nutrients;

- 1992 – 48 composite foods, adult males + 4 age-gender groups, Spring and Fall, urban and rural, 25 contaminant and 50 nutrients; and
- 2000 – 48 composite foods + 662 individual foods, adult males + 10 age/gender groups, around 30 contaminants and 19 nutrients.

The contaminant analytes included heavy metals and toxic elements, pesticide residues and aflatoxins as well as some emerging contaminants (e.g. dioxins and dioxin-like substances, chloropropanols, acrylamide and organic tin). The nutrient analytes included minerals and trace elements, cholesterol and fatty acids. The results of these TDS have been used in:

- Identifying outstanding food contamination issues (e.g. organophosphate pesticide residues in vegetables and fruits; lead intake in 2-7 year old children);
- Showing time trends (e.g. the reduction of HCH and DDT intakes);
- Identifying the source of contamination using a combination of composite food samples and individual samples (e.g. the high cadmium concentration in aquatic foods composite and high gamma-HCH concentration in river fish); and,
- Providing scientific data for the development of contaminant maximum levels in food (e.g. pesticides, lead, etc.).

Spices as Unexpected Sources of Contamination in the Hungarian Diet

Maria Szeitzne Szabo, Hungarian Food Safety Office, Budapest, Hungary

Situated in central Europe, many Hungarian nutritional customs are still preserved and have not been fully integrated into European cuisines. One example is that Hungarians consume larger quantities of spices, especially paprika, than other countries in Europe. To learn about the current dietary habits and food intakes in Hungary, three large dietary surveys were conducted as well as smaller pilot studies for different subgroups, including the following:

- The first representative Hungarian Dietary Survey (17 000 people) in 1985-88;
- A randomized national survey (3000 people) in 1992-94;
- A national survey for health status, including food consumption (1000 people) in 2003; and
- Pilot studies for different subgroups, e.g. medical students, high schools and elderly people.

These surveys took into account the relevant national and international guidelines for ethics and protection of personal data. They were based on a three-day Food Intake Diet Recall for two consecutive weekdays plus Sunday and included questions on food frequency, lifestyle and eating patterns. The data have been used to estimate intake of energy and nutrients, but have not yet been used for evaluating dietary intake of food. Available quantitative data on consumption of different food groups that would be useful for TDS or for conducting risk assessments are limited. To conduct a proper exposure assessment, reliable data on food consumption and food contamination are needed.

Data collected following an incident related to Hungarian paprika contamination helped to highlight the importance of spices in TDS as a possible source of exposure to contaminants. In 2004 routine surveillance discovered that products in Hungarian markets labelled as original Hungarian products were highly contaminated with aflatoxins. Illegal mixing with imported paprika was suspected because aflatoxins are not produced under Hungarian climatic conditions. Spices are also known sources of heavy metals, unauthorized colorants, pesticide residues and microbiological contamination. Since consumption of spices in Hungary is high, spices could pose a significant health risk for the consumers. According the Hungarian survey the mean consumption of spices was about 1.3 g/person/day. Therefore, countries should consider spices as a possible significant source of exposure and if necessary, include them in their TDS.

Food Contamination Monitoring Programme and Preparation of the Total Diet Study in Indonesia

Roy A. Sparringa and Winiati P. Rahayu, National Agency for Drug and Food Control
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The aims of the presentation were to demonstrate the food contamination monitoring programme and the progress report of preparation of the total diet study (TDS) in Indonesia. The existing food monitoring programme was reviewed via Food Intelligence Network and self-assessment to (i) assess whether or not the data can be utilized for the exposure assessment of toxic chemicals; and (ii) identify the weakness of the current monitoring programme according to the guideline proposed by GEMS/Food. This presentation discussed the rationale for conducting a national TDS and shared information about pilot projects and efforts to conduct the first National TDS.

The National Agency for Drug and Food Control Republic of Indonesia (NADFC) samples and analyses 30 000 samples annually, mostly for monitoring of food additives and illegal additives. Food contaminant data were lacking, whilst other agencies conducted fragmented surveys with limited sample number and consistency. Most data collected were for compliance purposes dominated by qualitative data and most surveys were not based on the sampling frame of the population. The food-monitoring programme did not follow GEMS/Food guidance, such as the priority of contaminants and foods to be monitored. Monitoring data of individual chemicals in raw commodity are expensive and may not provide a direct link to health assessment of the population. It is recommended that food inspection, monitoring and surveillance should be integrated with a food-chain approach; a risk analysis process should be implemented throughout planning and conducting food inspection, monitoring and surveillance, as well as during further action for the intervention; national food monitoring programmes should follow GEMS/Food recommendations; food recipe data are needed convert consumption data to RACs as well as for TDS for estimating exposure to contaminants; the TDS is needed to measure the actual dietary consumption of the concerned toxic chemicals and compare the intakes with toxicological reference points (e.g. ADI and PTWI); and the outputs of TDS can be utilized for targeted food monitoring programme and survey.

A step-by-step approach for the implementation of Indonesia's National TDS is being carried out, such as development of exposure assessment based on the maximum limit (Oct-Dec 2002); assessment of elementary school students to food additives with TDS (Dec 02-Dec 03); a pilot project of integrated individual dietary intake survey for purposes of exposure assessment and nutrition (Nov 03-04); technical meetings, seminars, workshops for TDS and its implementation in Indonesia (2004-2006); and the exposure assessment of elementary school students to contaminants and food additives with TDS (2006-2007). The latter study is in progress. Thirty-three schools and 792 respondents in Surabaya East Java were involved. The aims of this assessment are to develop models for individual dietary intake survey (food diary, food dietary recall and food frequency questionnaire); a model of individual food consumption data to be used for TDS; software for TDS implementation; and a model for the TDS implementation. A project for the implementation of a TDS in Indonesia funded by World Bank has been proposed for 2007-2009. The assessment of food consumption cluster diets and development of recipe database funded by the Government of Indonesia will be conducted in 2007. The outputs of these studies will be valuable for national food monitoring programme and the TDS in Indonesia.

Recent Monitoring Activities and Status of TDS in Korea

Hae Jung Yoon, Department of Food Safety Evaluation, Korea Food and Drug Administration,
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Food contamination monitoring results allow for developments that require a detailed evaluation of the situation. The objectives of the regulatory monitoring are to assess the effectiveness and

appropriateness of food regulatory measures by assessing the impact of implementation for the stakeholder groups and to provide evidence to inform future decisions on food regulation. The Korea Food and Drug Administration (KFDA) collects food monitoring data that include the results of general compliance testing and specially targeted surveys conducted in conjunction with the official agencies and their associated laboratories. The monitoring now is being strengthened by making it more risk-based and with a wide coverage.

By incorporating such results, risk assessors can develop risk models that are used to evaluate alternative intervention and control strategies while the effect of risk management actions can be monitored through surveillance. The surveillances are usually directed at regions and commodities to determine compliance with the regulatory level. For the surveillance about 92 912 food samples from Korean domestic market were tested in 2005 and 1182 (1.3%) were found to be unsatisfactory.

In responding public health concerns about the potential for chemical contamination of food, KFDA also conducts various incidence monitoring. It is used to acquire information about particular compounds by analyzing certain foods. An attempt has been executed that the concerned compounds were prioritized in conjunction with reflecting raised specific health concerns and many monitoring are performing accordingly at present. Monitoring of DEHA migration from food packaging, an example of migration model diet, was conducted and the outcome has been provided to establish the new regulation based on existing toxicological information and factual matters.

TDS provide another approach to monitoring levels of contaminants in foods. In 2000 KFDA conducted the first total diet study of heavy metals and minerals intake. Since then KFDA has been developing proper models for inclusion of pesticide residues and mycotoxins as well as other food contaminants. In the current study, 84 core foods represent the foods most commonly consumed and those consumed in the great quantities by Koreans based on the National Health and Nutrition Survey conducted in 2001 and the supplementary seasonal Nutritional Survey conducted in 2002. The food lists was extended to include commodities specifically known as high level of certain contaminants. Rather than analysing commodity composites, individual commodities were prepared according to representative cooking methods prior to the analysis so that the obtained data may be comparable internationally. Although the study was not designed to screen for immediate food safety concerns or to enforce regulations, the results of TDS provided an invaluable baseline reference for ensuing the safety of chemicals in the diet.

2003/04 New Zealand Total Diet Survey – Key Contaminant Findings

Richard Vannoort, Institute of Environmental Science & Research (ESR), Christchurch, New Zealand

Six Zealand Total Diet Surveys (NZTDSs) have been carried out on a periodic basis dating back to 1974. In the latest NZTDS, there were 121 foods, of which 58 were ‘regional’ foods and 63 ‘National’ foods. All were sampled over two seasons, with regional foods sampled from four regional sites and national foods from one nationally representative site. In total some 4440 food samples were purchased and these were then prepared ‘as consumed’ before analysis of 221 pesticide residues and metabolites and four contaminant elements (arsenic, mercury, cadmium and lead). In the 2003/04 NZTDS individual food types were analysed separately (i.e. white bread, wheatmeal bread, rice etc) although resource constraints meant that some of the multiple purchases of each food type were composited before analysis. Wherever possible, regional and/or seasonal sample information was retained. In total 990 samples were analysed for pesticide residues and 968 for elements.

By combining the mean concentration data found in each of the individual foods with median consumption information from simulated fortnightly ‘typical’ diets for six different age–sex groups in the population, dietary exposures were estimated. Any potential risk to average consumers was

characterized by comparing these dietary estimates to international health standards such as the acceptable daily intake (ADI) for pesticides, provisional tolerable weekly intake (PTWI) for contaminant elements or recommended dietary intake (RDI) for nutrient elements.

For pesticides, 97% of estimated dietary exposures were less than 1% of the ADI and all were well within internationally established health standards. For the four contaminant elements, the estimated dietary exposures were all well within the PTWI. Since the PTWI represents a safe level for lifetime exposure, the contaminant dietary exposure in the 2003/04 NZTDS was considered to be unlikely to have any adverse health implications for the general NZ population. The lowering of the methylmercury PTWI by JECFA in 2003 means that the risk and benefits of fish consumption need to be effectively communicated and appropriate advisories given to at-risk population groups. The effectiveness of risk management strategies, such as discouraging use of lead solder in canned foods and phasing out of lead in petroleum products, was clearly evident in the downward trend of estimated lead dietary exposures found over successive NZTDSs. A situation of lead contamination in the New Zealand food supply via contaminated cornflour was also detailed and highlighted the need for ongoing surveillance and monitoring of ubiquitous environmental contaminants. The NZTDS reports can be found at: <http://www.nzfsa.govt.nz/science/research-projects/total-diet-survey/index.htm>.

United Kingdom Total Diet Studies Since 2000

Simona Origgi, Food Standards Agency, London, UK

A list of the latest United Kingdom Total Diet Studies (UKTDS) carried out for environmental contaminants by the Food Standards Agency is given below, along with selected findings from the surveys. More detailed results are included in the survey reports at: <http://www.food.gov.uk>.

Polycyclic Aromatic Hydrocarbons (PAHs) in UKTDS 2000 (FSIS 31/02) In general the highest concentrations of PAHs were found in the food groups bread, miscellaneous cereals, fats and oils and fish. The Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) reviewed average intakes for the PAHs of greatest toxicological concern (BaP, BaA and DBahA) and concluded that, although the estimated intakes do not fully allow for changing dietary habits the dietary intakes of PAHs have decreased over the past twenty years.

Metals in UKTDS 2000 (FSIS 48/04) The concentrations of metals in the food groups were lower than or similar to those reported in the previous UKTDS, conducted in 1997, with the exception of aluminium and mercury. Rises in aluminium intakes may be associated with the use of additives in cereal products. Population exposures to the elements have generally declined over the course of the TDS programme, with exposures to most of these elements now at the lowest level. The COT noted that the dietary exposure to lead, arsenic and mercury identified in the survey were unlikely to constitute a hazard to health. The COT also concluded that efforts should continue to reduce exposure to lead from all sources.

Dioxins and dioxin like PCBs in UKTDS 2001 (FSIS 38/03) The estimated total dietary intakes of dioxins and dioxin-like PCBs by all age groups fell by around 50 per cent between 1997 and 2001. Average adult intakes of the sum of dioxins and dioxin-like PCBs are well within the new UK safety limit (Tolerable Daily Intake - TDI). The percentage of adults estimated to exceed the TDI from the whole diet fell from 35 per cent in 1997 to 1.1 per cent in 2001. For schoolchildren and toddlers, the percent estimated to exceed the TDI diet fell from 62 per cent in 1997 to 10 per cent in 2001 and from 97 per cent in 1997 to 37 per cent in 2001, respectively.

Brominated Flame Retardants and other brominated chemicals in UKTDS 2003/4 (FSIS 10/06) Polybrominated diphenylethers (PBDEs), hexabromocyclododecanes (HBCDs) together with tetrabromobisphenol A (TBBP-A) and polybrominated biphenyls (PBBs), brominated dioxins and

furans, PBBs, HBCDs and TBBP-A were analysed in TDS samples in 2003 and 2004. Improved methods of analysis gave better limits of detection than had been achieved in the study on the 2001 samples. The COT concluded that the concentrations of PBDEs, HBCD and TBBP-A detected in this and the survey for brominated chemicals in farmed and wild fish and shellfish do not raise toxicological concerns.

PFOS and PFOA in UKTDS 2004 (FSIS 11/06) This was the first estimate of dietary intakes of PFOS and PFOA in the UK. PFOS was found at concentrations above the limit of detection in the potatoes, canned vegetables, eggs and sugars and preserves food groups. PFOA was detected only in the potatoes food group. The COT is reviewing the toxicity of PFOS and PFOA. However, given the considerable uncertainty in intakes, the survey results did not raise any immediate toxicological concerns.

Update on US FDA's Total Diet Study

Katie Egan, US Food and Drug Administration, USA

The US FDA's Total Diet Study (USTDS) has been conducted continuously since 1961. The design and scope of the USTDS has changed over time to include more foods and analytes. Currently, four regional market baskets of approximately 280 different foods each are collected each year. The list of foods collected in the USTDS, as well as the food consumption amounts (USTDS diets) used to calculate intakes from analytical results, are based on national food consumption surveys. Both are updated periodically as new consumption data become available. The most recent update was completed in 2002 and implemented with the first market basket of 2003. While the majority of USTDS foods are staples of the American diet and tend not to change over time, the updated list reflects the increase in the consumption of lower-fat products.

USTDS foods are routinely analysed for about 300 different substances including pesticides residues, metals, industrial chemicals and radionuclides. The majority of analytical results from 1991 to the present are posted on FDA's TDS website at (<http://vm.cfsan.fda.gov/~comm/tds-toc.html>). In recent years, USTDS foods have also been analysed for dioxin (since 1999) and acrylamide (since 2003). For both analytes, the main goals in analyzing USTDS samples were to obtain more comprehensive data on background levels in foods and to estimate the dietary exposure through the average American diet. Recent updates of dietary exposure estimates for both dioxins and acrylamide indicated a slight decrease from the previous results reported in 2004. A summary of ten pesticide residues detected most frequently in the USTDS indicated that dietary exposures for all population groups are well below the ADIs and have changed little since the mid-1980s. Exposures to toxic elements are also well below the PTWIs.

Total Diet Studies in Egypt

Emil Salama, Ministry of Agriculture, Giza, Egypt

Two studies were conducted in 2001 and 2002 to monitor the exposure of Egyptian people to pesticide residues (80 organochlorine, organophosphorous and some pyrethroides), 14 PCBs congeners, heavy metals (cadmium, copper and lead), nitrates and aflatoxins (B1, B2, G1 and G2). The first study was based on food consumption data from the GEMS/Food Regional Diets. Eighty-two commodities were collected from Cairo and Giza, two samples per location. All food items were classified into 15 composites according to their source of contamination, the dilution effect of food samples within the groups and suitability of analytical methodologies for each matrix. Four organophosphorous compounds (diazinon, profenophos, malathion and chlorpyrifos) were detected in the spices group and the estimated daily intakes were well below the ADI (0.08, 0.57, 0.001 and 0.004% of the ADI, respectively). The total estimated exposure to heavy metals were also well below tolerable limits at 7.9% PMADI for copper, 0.1% PTWI for cadmium and 0.03% PTWI for lead. For

nitrites, the mean concentrations found were 51-181 mg/kg. No aflatoxins were detected in pulses and spices and B1 was detected in cereals and nuts with concentration of 0.004, 0.02 mg/kg. The second TDS was carried out for 33 ready-to-eat samples collected from greater Cairo in 2002. This study was based on national food consumption data from the Institute of Nutrition, Ministry of Health, Egypt. The study showed that no residues were found for organochlorine and organophosphorous compounds. Exposure to copper, cadmium and lead were 3.7%, 3.5% and 3.2% of the tolerable levels, respectively. Exposure to nitrites was estimated to be 25% to the ADI.

Total Diet Study in Malaysia

Asma Zakaria, Ministry of Health, Malaysia

A total diet study is one of the recognized tools to assess the exposure of population to contaminants through food intake. This presentation is to share Malaysia's experience in conducting the first Malaysia Total Diet Study (MTDS). The MTDS began in 2006 and used consumption data from Malaysia Food Consumption Survey 2002/2003. With the current analytical capability, resources and expertise available, the focus of the MTDS was heavy metals (cadmium, lead, arsenic and mercury). The MTDS was preceded by a pilot project in 2005 conducted in the Central Zone (Selangor, Federal Territory of Kuala Lumpur). The objective of the pilot project was to pre-test all systems for foods sampling, preparation and analyses. Since the national food consumption data are only available for adult, the MTDS focuses on the adult diet. For the 2006 MTDS, a total of 126 types of foods from 11 food groups were included in the study. Different shopping lists were created based on the different zones in the food consumption survey. Sample purchasing was done in August 2006 by the State Health Department and samples were sent to the Food Safety Laboratory for sample preparation. A total of 25 composite samples were prepared and sent to the National Public Health Laboratory for analysis of cadmium, lead, total mercury and total arsenic. The results are expected to be compiled in early 2007.

Total Diet Study in Japan

Fujio Kayama, Jichi Medical University and Takeshi Satoh, Food Safety Commission, Japan.

Total diet studies in Japan have been conducted annually since 1977 and are based on GEMS/Food guidance. From nine to 11 regional institutes in nine districts participate and collect food samples in the local food markets. According to regional food consumption data collected by National Nutrition Survey (NNS), composite food samples in 13 food categories, including drinking water, were prepared and sent to the National Institute of Health Sciences (NIHS) in Tokyo. At NIHS, composites were analysed for residues of three HCH, four DDT-related compounds, three organophosphate pesticides, three organochlorines and PCBs and eight heavy metals, including cadmium, total mercury, total arsenic, lead, copper, manganese and zinc. Cadmium intake calculated from the data is 21.4 µg/day, or 46% of the PTWI; there has been no change in the last decade. Total mercury intake is 8.5 µg/day, which is 23% of the previous JECFA PTWI (3.3 µg/kg/week) but more than 50% of the current PTWI of 1.5 µg/kg/week. Arsenic intake is high among the Japanese due to considerably high intake of marine products, but there are some technical issues in extraction and measurement of inorganic and organic arsenic in various food matrices.

Food intake data, collected annually in the NNS in November, consists of food items (1194 food codes) and weights of each food ingredients for approximately 5000 families randomly sampled in all over the nation. The numbers of subjects participating in the NNS is approximately 13 000 annually. Physical data such as height and weight, physical activities and ratio of food consumption by each person in the family have been collected since 1995. This modification of the NNS enabled exposure assessment for 10 age groups and adults 20 years and older excluding pregnant women.

There are several limitations in the current TDS. It only provides average concentrations of the contaminants for composite samples. Because the NNS is a one-day study in November, it is impossible to evaluate seasonal changes of food items and individual daily variations of food intake. It is also impossible to evaluate intakes of sensitive sub-populations or high-exposure groups. This family-based NNS also provides limited information on dining-out, mixed dishes and processed food. To partially adjust for these limitations, NNS data have been compiled for several years for use in the TDS to estimate intake of contaminants such as cadmium dioxins and dioxin-like PCBs and pesticide residues. Epidemiological studies among high-risk subpopulation have been conducted in several areas in Japan. At the same time, 150 pesticides have been monitored in raw food commodities prior to the adoption of a positive-list system for residues of pesticides in food in 2006.

Population-based Food Consumption Survey in Hong Kong SAR

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Department, Hong Kong

Consumption data used for risk assessment in Hong Kong SAR (HKSAR) is based on a food consumption survey conducted in 2000 on about 1000 secondary school students by means of a self-administered food frequency questionnaire. These data have the limitation that only 93 food items were included and the subjects were limited to secondary school students. In March 2005, the Government of HKSAR started the first Population-based Food Consumption Survey of People of Hong Kong for supporting quantitative evaluation of population exposure to contaminants in risk assessment. The survey also aimed at identifying common dishes consumed locally and developing recipes for these dishes.

Using the frame of living quarters maintained by the Hong Kong Census and Statistics Department, replicates of households were selected and one member from each household was invited to participate. Eligible participants were those aged 20-84 living in Hong Kong who could speak Cantonese, Mandarin or English. Data collection was done with three interviews. The first one was on a brief questionnaire called Food Behaviour Questionnaire, in which demographic data and questions about diet behaviour and diet/disease knowledge were asked. The second interview was face-to-face and included the multiple-pass 24-hour dietary recall, Food Frequency Questionnaire and height and weight measurements. The third interview was done as a telephone interview during which information on Day 2 would be collected using a 24-hour dietary recall. The survey is still in progress and it is aimed to be completed by the end of 2007. Publicity activities were organized to enhance awareness of the survey among the population and to solicit their cooperation.

State of GEMS/Food Databases

Lawrence Grant, WHO Consultant, Geneva, Switzerland

The GEMS/Food global databases on (a) individual measurements of chemical contaminants in food commodities, (b) aggregated data on chemical contaminants in food commodities and (c) dietary intakes of contaminants from total diet studies were presented. The structure and definition of these data collections were described. The presentation emphasized the contents of these data collections. The collection on aggregated data on chemical contaminants in food commodities comprises more than 75 000 records, dietary intakes of contaminants from total diet studies data collection contains more than 3700 records of measurements of contaminants on specific cohorts, there are more than 59 000 individual data records on chemical contaminants in food commodities and more than 1300 aggregate records on acrylamide. Graphs were shown which depict the composition of the data collections with regard to contaminant type, geographical region, food type and year. The submission of data to GEMS/Food is showing a substantial increasing trend since the introduction of the electronic submission protocol and the OPAL software.

The OPAL software has been extended to allow the capture of individual measurements and to convert these measurements into aggregated records on contaminants in food commodities. This improvement should allow countries to easily submit data to GEMS/Food and thereby continue the trend of database growth. The utility of these data is illustrated by examples aiding the decisions of Codex, survey design for determining presence of POPs in human milk, construction of indicators on children's exposure to chemical hazards in food and assessment of human exposure to chemical contamination through the food-chain. Dissemination of the aggregated chemical concentration data and the total diet exposure data is enabled through the WHO SIGHT system, which has been enhanced to facilitate access and allow sorting of the result table

2003/04 New Zealand Total Diet Survey – Key Nutrient Findings

Richard Vannoort, Institute of Environmental Science & Research (ESR), Christchurch, New Zealand

Detailed findings for four key nutrients (iron, selenium, sodium and iodine) in the 2003/04 New Zealand Total Diet Study (NZTDS) were presented. Even with recently fortified grain products, 25+ year females have a mean iron intake of only 51% of the RDI. Concentrations of sodium in New Zealand foods ranged from <10 to 42 000 mg/kg. Mean daily sodium intakes exceeded the upper intake limits for 7 of the 8 age-sex groups.

The 2003/04 NZTDS confirmed that mean daily intakes of iodine in New Zealand have continued their steady decline of the past 20 years. Mean iodine intakes based on the simulated diets were only 40-57% of RDI for the eight population groups. Dairy, other animal products and infant weaning foods were the main dietary sources. The iodine content of most foods was less than 0.02 mg/kg. Nonetheless, the NZTDS identified one brand of soymilk with 9.14 mg/kg iodine. For iodine, intakes are below the Australian and New Zealand RDI, but discretionary salt was not considered in the NZTDS, so intakes may be underestimated. Continued monitoring of iodine intake and status is considered imperative. The NZTDS reports can be found at: <http://www.nzfsa.govt.nz/science/research-projects/total-diet-survey>

Iodine fortification in New Zealand

Cherie Flynn, New Zealand Food Safety Authority, Wellington, New Zealand

The results of New Zealand total diet surveys over the last 30 years have shown a continuous fall in iodine status across all age groups of the New Zealand population. Studies of urinary iodine levels in New Zealand adults and children and a study of thyroglobulin concentration in bloods of New Zealand children have all confirmed that a large majority of the population have mild to moderate iodine deficiency. Similar results have also been found in parts of Australia. Although New Zealand has had iodised table salt available since 1924 – and parts of Australia have taken action to increase iodine intake over the last 50-60 years – the evidence clearly indicated that this is no longer sufficient given.

Food Standards Australia New Zealand (FSANZ) is the body charged with establishing food composition and labelling standards for both countries. Consideration of mandatory fortification with iodine by FSANZ resulted in the Draft Assessment Report, circulated for comment in August 2006. The draft identified salt as the most appropriate food vehicle for iodine fortification of the food supply and recommended the mandatory replacement of non-iodised salt with iodised salt in all breads, breakfast cereals and biscuits – the iodisation level to be in the range of 20-45 mg per kg of salt. Also recommended was the retention of the current voluntary fortification of table salt but at a lower iodine level, to match that proposed as the mandatory level in breads, breakfast cereals and biscuits.

The New Zealand Food Safety Authority (NZFSA) contributed to the FSANZ draft assessment by ensuring that up-to-date and comprehensive baseline and fortification level data for New Zealand adults and children was available to undertake the dietary modelling work that identified salt as the fortification vehicle. This involved drawing together the iodine information specifically collected in the 2003/04 NZTDS and the food consumption data from the New Zealand Adult and Children's National Nutrition Surveys; and ensuring the New Zealand food composition database was updated and complete. The NZFSA supports the mandatory fortification of bread and breakfast cereals at the level proposed. The addition of iodine to biscuits is not being supported, as such products are not seen as a suitable vehicle because of the high fat high sugar content and also there is quite a bit of trade with third countries in such products. The retention of the voluntary iodination of table salt is also supported, however the level at which iodine is added may need to be retained at the current level of 25-65 gm per kg rather than the proposed lower level, to ensure that adequate levels are achieved in the diet across all the population groups. Final decisions on iodine fortification are expected to be made in the next few weeks and if accepted a 12 month transition period is likely to commence in early 2007.

Linking Nutrition Survey with TDS in China

Junshi Chen, National Institute for Nutrition and Food Safety, Chinese Centre for Disease Control and Prevention, Beijing, China

Macronutrients, minerals, vitamins, cholesterol and fatty acids were analysed in the three previous total diet studies conducted in 1990, 1992 and 2000. Several examples of obtained results were presented. The dietary intakes of macro- and micronutrients from TDS and regular dietary survey (nutrient intake estimated from food composition table) were compared in the same population. The results showed that the intakes of energy, protein, fats and carbohydrate were quite similar from the two methods. The intakes of most micronutrients from the two methods were reasonably close with the exception of ascorbic acid. TDS results for ascorbic acid intake were significantly lower than the dietary survey results because of cooking loss. Individual food samples (n=662) were analysed for copper concentration and the distribution of copper intakes from individual subjects were obtained. The Chinese Adequate Intake (AI) for copper was equivalent to the 66th percentile of copper intake in 2-7 year-old children, which showed that a significant proportion of those young children had insufficient copper intake. The cholesterol intake of the average Chinese showed significant upward trends between 1990 and 2000. Average cholesterol intakes in three out of the four regions exceeded 300 mg/person/day; only one poor region had average intake below 300 mg/person/day. Egg was the major source of cholesterol intake followed by meats. In conclusion, TDS could also serve as a tool for monitoring nutrient intake. For micronutrients that usually show significant geographical variation in concentrations in the same food, TDS could provide more accurate estimation of dietary micronutrient intakes than regular dietary survey that relies on food composition table.

Chemical Residues in Aquaculture Fish Survey

Peter Wallner, Food Standards Australia New Zealand, Canberra, Australia

In 2005 Food Standards Australia New Zealand (FSANZ) conducted a survey of both imported and domestic aqua-cultured fish to determine whether residues of illegal antimicrobial agents, PCBs and heavy metals were present. While the survey is not a total diet study relevant lessons can be learned from this survey. This presentation outlined the reasons for conducting the survey, how the survey was implemented and its findings. Overall, the survey found good compliance with 54 out of 56 chemicals not being detected in any of the 60 samples tested. Only malachite green and its metabolite, leucomalachite green, was detected at low levels in 10 of the 60 samples analysed. Dietary exposure to malachite/leucomalachite green was estimated and a risk assessment, using a margin of exposure approach, concluded that the risk to public health was very low. A number of outcome management

actions that were taken are also explained. A full report on the survey has been published on the FSANZ website: www.foodstandards.gov.au.

First Total Diet Study in the Taiwan Area

Sue-sun Wong, Sinetics Associates International, Taiwan, Province of China

The first Taiwan Total Diet Study (TTDS) was authorized by the Department of Health and carried out by the Taiwan Agricultural Chemicals and Toxic Substances Research Institute (TACTRI) in 2003/2004. The first TTDS involved sampling 130 food items that were split into three groups: 20 core foods, 66 national foods and 44 regional foods. The food lists were derived mainly from 1993-1996 Nutrition and Health Survey data. A dietary risk assessment model defined 10 age-sex groups as 13-16, 16-19, 19-31, 31-51, 51-65 years (male and female) with different body weights and dietary intakes. A total of 4551 samples were collected during four seasons from 8 locations. After sample preparation, 1709 ready-to-eat food samples are analysed. 189 pesticides, 4 contaminant elements, 4 essential elements, aflatoxins and dioxins are selected as analytes in this study. Of the 1709 ready-to-eat food samples screened for the pesticides, 603 samples (35%) were found to contain detectable residues. Of the 130 food items analysed for pesticide residues, 56 were non-detectable. Of 189 pesticides screened, 134 were not found in any foods. Of the 8 elements analysed (mercury, arsenic, cadmium, lead, zinc, copper, chromium, and nickel, only arsenic, cadmium and lead contributed a significant risk from dietary intake based on this study. Of dairy samples, 56% contained detectable aflatoxin M1. A total of 245 food samples, including meat, fish, egg, dairy and oils, were selected for dioxin analysis and it is estimated that less than 36% PTMI is due to dietary intake.

Determination of Cadmium, Lead and Copper in Bread Sold in the Street from Different Governorates in Egypt

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Forty-one white bread samples were collected during 2005 from streets in different Egyptian local markets located in six governorates in Egypt. The samples were subjected to heavy metals analysis to determine lead (Pb), cadmium (Cd) and copper (Cu) levels. The bread samples were digested by wet digestion method, using concentrated nitric acid (65%) and measured by Atomic Absorption Spectrometer (AAS). Cadmium and copper were detected in all samples while lead was detected in 73% of the samples analysed. The highest mean concentration values of lead, cadmium and copper were from samples collected from Qaluobiya, Cairo and Qaluobiya governorates, respectively. However, the lowest mean values were found in samples collected from Minufiya, El Sharkiya and El Sharkiya governorates, respectively. Also, dietary exposures to these elements were mathematically estimated to evaluate the risk to consumer due to their dietary intakes. The estimated weekly intakes of lead, cadmium and copper for a 60 kg adult consuming 1507.1 g of white bread per week were 1.34, 0.3 and 42.7 µg/kg body weight/week, respectively. This corresponds to 5.4%, 4.3% and 1.2% of the respective PTWIs. In future, other foods will be investigated to estimate their contribution to dietary exposure to these heavy metals.

Reporting and Modelling of Non-detected Chemicals in Food

Philippe Verger, National Institute of Agricultural Research (INRA), Paris, France

Analytical methods are defined by a limit of detection (LOD) and a limit of quantification (LOQ). By definition the results below these limits cannot be expressed quantitatively with a sufficient level of certainty. Nevertheless, GEMS/Food recommends that for the purpose of dietary exposure assessments, analysts should try to quantify data between the LOD and LOQ (GEMS/Food EURO, 1995). It was clearly demonstrated that the management of non-detected samples in concentration data influence not only the median and mean dietary exposure but also the high percentiles of exposure

and, in case of probabilistic approach, the probability to exceed the tolerable intake (Tressou et al. 2004, 2006).

There are four different ways of dealing with the non-detected samples (Helsel, 2005). The first way consists simply in deleting these values. Such an approach should be avoided because it is based neither on any scientific rational nor on practical or pragmatic considerations because the resulting exposure could be unrealistically high.

The second way of dealing with non-detected samples corresponds to the current approach used in international scientific committees, i.e. the substitution of values for non-detected samples following the WHO recommendations:

If the number of non-detects is less than 60% of the analysed samples, the exposure is calculated by replacing results below the LOD by half of the LOD.

If the number of non-detects is more than 60% of the analysed samples, the value below the LOD is replaced by zero (0) first and then the detection limits in order to produce a lower and an upper bound for the estimated exposure.

The advantage of such an approach is its simplicity of implementation while its disadvantage is the fact that the approach is not considering the overall distribution of detected samples. In other words, having 1% v. 90 % of detected samples does not influence the management of non-detected although it is likely that in the reality the values should have different distributions.

The third way of dealing with non-detected samples is the parametric modelling consisting in assuming a distribution for chemical concentration in food. Such an assumption must be made on a large and homogeneous set of data or on robust knowledge about the average and standard deviation for chemical concentration. In those cases the parametric modelling is certainly the best way of modelling the distribution of chemical concentration prior to a dietary exposure assessment.

The last possibility for the management of non-detected samples is the non-parametric modelling. Such techniques were used in the past for environmental risk assessment and in particular consist in the use of Kaplan-Meier method which is a ranking of the values without assumption on the form of the distribution. This method is particularly useful for non-homogeneous dataset with multiple LOD values.

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Dealing with Uncertainty in Total Diet Studies: Group Discussion

Peter Wallner, Food Safety Australia New Zealand, Canberra, Australia

The TDS method is a powerful tool to collect actual food chemical concentration data and to estimate dietary exposure to chemicals of populations. As with all scientific studies, there are recognised limitations and areas of uncertainty that are encountered when actually conducting TDS and reporting

their findings. All countries attempt to work with their available resources to minimize uncertainty and optimise their TDS, so that it is as scientifically robust and credible as possible. Acknowledging the limitations of the study and the areas where uncertainty remains are seen as good practice. Uncertainty exists and may be managed in various phases of the TDS including:

- food consumption information
- survey design and contracting
- sample collection, transport and preparation
- analysis
- dietary modelling assumptions
- reporting

The panel discussed aspects of uncertainty in the conduct of TDS and exchanged information on the approaches different countries have taken to mitigate uncertainty in the different phases of their TDS. Participants noted that there was a need to acknowledge, estimate and report on uncertainty in their TDS. (Note that on 17 January 2007, a new report by the European Food Safety Agency Scientific Committee related to uncertainties in dietary exposure assessment was posted on the web at http://www.efsa.europa.eu/en/science/sc_committee/sc_opinions/uncertainty_exp.html).

An Internet-based Method for Assessing Food Consumption

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This cross-cultural study focuses on understanding how acculturation to American culture influences dietary patterns of Chinese. It examines the interrelationships among dietary intake, nutrition knowledge and attitude, self-efficacy and acculturation. A self administered web-based survey was conducted among 4 groups of Chinese employees in high-tech industries including Chinese-born immigrants, American-born Chinese in the USA and 2 control groups in China: employees of Chinese companies and employees of American companies. Development of a bilingual food frequency questionnaire (FFQ) was part of the project. The FFQ (143 food items in 8 categories) was developed based on 4 validated FFQ used for Chinese, Chinese-Americans and Americans. The FFQ contained both Chinese and American foods so that the same tool can be used to assess the dietary intake of Chinese in both countries. The food lists, frequency options and translation were reviewed and revised based on the feedback from a panel of experts and cognitive interviews. To assist respondents in estimating food portion accurately, a set of pictures that visualized food servings with containers were created so that people in both countries could apply the same measurements. A nutrient database was developed based on USDA SR17 and a Chinese food-composition database. The online FFQ was further evaluated with 24-hour diet recall interviews. This research applied the Tailored Design Survey Method and used cluster-sampling method. All the participants were recruited through their employers, which were high-tech companies. The results suggested that US-born women had higher intakes of total fat and fat as a percentage of energy. No significant difference of total fat and fats as a percentage of energy was observed among men. Chinese born male immigrants had the lowest BMI and lowest percentage of overweight individuals of the 4 male groups. The mean age of overweight Chinese men was 32 years in China and it was significantly younger than the mean age of overweight Chinese men in the USA (36 years). This study suggested that internet-based dietary intake assessment is an efficient tool for research. This research revealed the current problems of increased dietary fat intakes and BMI of Chinese in high-tech industries in China; and discovered the beneficial characters of the cross-cultural Chinese-born immigrants in high-tech industries in the USA.

Probabilistic Assessment of Exposure to Glycoalkaloids: Case of Solanine and Chaconine in Potatoes

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Glycoalkaloids in potatoes can be hazardous for human health. Based on the available human data, an intake of >1 to 3 mg TGA/kg bw was considered a toxic dose for humans (JECFA, 1993). More recent studies in volunteers estimated a provisional minimum acute toxic dose of 1 mg of α -solanine+ α -chaconine/kg bw/day. Children may be more sensitive than adults. An exposure assessment study for glycoalkaloids was organized in the Czech Republic in 2004 and 2005. Concentration data on α -solanine and α -chaconine were determined in potatoes collected from communal markets in Czech during all seasons of the year giving 200 analytical results. Consumption data on potatoes in the Czech Republic were from the 2003-2004 national study on individuals, which used 24h recalls, twice repeated on each individual and which included 2658 persons ages 4 to 90 years of both genders. Probabilistic assessment of the glycoalkaloids intake has been done with the MCRA software (RIKILT, NL). Bootstrapping has been done for consumption and also for residual data. Non-detects were replaced by $\frac{1}{2}$ value of LOQ. The number of potato consumers was 2637, number of consumption days was 2658. Total number of simulations was 1 million, per bootstrap 10 000, number of calc. chunks 50. The probabilistic estimates of exposure suggest that a possible risk for the upper 0.01% of population. Taking into account a fact that potato is consumed by about 50% of population in the age range of 4-90 years daily, some level of abdominal cramps, perhaps nausea or headache from glycoalkaloids intake could be expected in about 500 of those persons daily in the country. This would be expected even when concentration of glycoalkaloids are never higher than 200 mg/kg of potatoes. The most exposed people are children at age 4-12 years where intake can be around 1,1-1,3 mg TGC/kg bw/day. *This work has been supported by the 6.FP EU (project "SAFEFOODS")*.

Cadmium Intake Assessment Using Total Diet Studies and Probabilistic Monte Carlo Simulation among the Japanese.

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Total diet studies based on recommendations of GEMS/Food have been conducted in Japan annually since 1977 to assess dietary intake of contaminants. Daily cadmium intake was 45 $\mu\text{g}/\text{day}$ in 1977, decreased gradually to less than 30 $\mu\text{g}/\text{day}$ since 1985 and is sustained at about half of Provisional Tolerable Weekly Intake (PTWI) of 7 $\mu\text{g}/\text{kg}$ bw per week. Estimates of total intake of cadmium around the world range from 2.8 to 4.2 $\mu\text{g}/\text{kg}$ bw per week, which equates to approximately 40–60% of the current PTWI. The seven commodity groups that contributed significantly to total intake of cadmium included: rice; wheat; roots, tubers, leafy and other vegetables; and molluscs. These commodities accounted for 40–85% of total intake of cadmium in the five GEMS/Food Regional Diets. A study was conducted in 2004 to estimate dietary cadmium intake among Japanese using probabilistic statistical methods, setting several different maximum levels (ML) of these commodities. The food intakes used were derived from a database of the National Nutrition Survey and compiled for six years from 1995 to 2000. The amounts ingested by approximately 53 000 adult males and females, excluding pregnant women, were converted to amounts ingested per kg body weight per week. The cadmium concentrations of agricultural and marine products, derived from surveillance data collected by the Ministry of Agriculture, Forestry and Fisheries of Japan, were converted to those of food items by multiplication of conversion factors for cooking and processing the foods. A Monte Carlo simulation was used to estimate cadmium intake distributions assuming seven different MLs for cadmium in food items mentioned above. When no MLs were assigned, the mean, median and 95 percentile of the estimated cadmium intake were 3.47, 2.93 and 7.33 ($\mu\text{g}/\text{kg}$ bw/week), respectively. When MLs for rice, wheat and soybeans were set at 0.4, 0.3, 0.5 mg/kg, respectively, the mean, median and 95 percentile of the estimated cadmium intake were 3.37, 2.89, 6.95 $\mu\text{g}/\text{kg}$ bw/week. According to the total diet study, average cadmium intake was 192 $\mu\text{g}/\text{person}/\text{week}$ in the period of

1995-2000. The mean cadmium intake based on the current market control on rice was 3.44 µg/kg bw/week, or 199 µg/person/week. This closely agrees with the result of the total diet study.

UK Acrylamide Total Diet Study

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Acrylamide is known to cause cancer in animals and to be neurotoxic in humans. It is considered probable that it could also cause cancer in humans, although this is not certain. The aim of this study was to estimate the amounts of acrylamide people are exposed to from food and to identify whether previously unconsidered food categories contributed significantly to acrylamide exposure. Acrylamide levels were measured in UKTDS samples; these food samples represent the average UK diet and sampled foods are prepared according to normal domestic practice. The UKTDS is made up of 119 categories of foods purchased from 24 locations throughout the UK each year (total of 480 samples) that are combined into 20 groups of similar foods. Once combined the groups are thoroughly homogenized. The types of food included in each group and their relative proportions reflect consumption data, largely based on household food purchases. This is updated annually to reflect changes in eating habits.

Acrylamide was quantified in 7 of the 20 food groups: bread (12 micrograms/kg), miscellaneous cereals, which includes products such as biscuits and breakfast cereals (57 micrograms/kg), carcass meat, the majority of which were baked (10 µg/kg), meat products, including sausages and pies, which were all prepared for consumption (13 µg/kg), poultry which have been mostly baked or grilled (6 µg/kg), sugars and preserves, including chocolate and confectionery (23 µg/kg) and potatoes, which contains a range of cooked fresh and processed potatoes (112 µg/kg). Acrylamide was not quantified in samples of offal, fish, oil and fats, eggs, green vegetables, other vegetables, canned vegetables, fresh fruit, fruit products, beverages, milk, dairy products and nuts. No new sources of dietary acrylamide were identified. These results have been used to estimate dietary exposure to acrylamide for average and high level UK consumers and identify those foods that contribute to total dietary exposure. Overall the estimated levels of exposure that the survey found were at least 1000 times lower than the doses reported to cause cancer in laboratory rats. UK consumers' estimated exposure to dietary acrylamide, based on the survey results, was similar to exposure estimates in other countries.

Future Directions for New Zealand's Total Diet Survey

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Following the completion of the 2003/04 New Zealand Total Diet Survey a review of the whole project was undertaken by the New Zealand Food Safety Authority, the body responsible for the funding, overall direction of the survey, the release of results and taking of any follow-up action. The review outcome objective was to identify: the key lessons learnt, what we would do again and what not; where incremental improvements could be made; recommendations for future TDSs (relating to the timing, content and methodology); and ideas for the future. As a consequence of consideration of the review report by NZFSA it has been agreed that New Zealand is committed to undertaking a TDS every 5 years (unless there is a specific decision to amend this).

New Zealand TDS will continue to use the key methodology components that have largely been used in the past. That is, we will continue our commitment to involve our stakeholder interest groups in the design and content of the survey. Foods will be sampled based on a food list made up of national and regional foods that represent around 70-75 % of the most commonly consumed foods by the New Zealand population. New Zealand TDS will continue to estimate dietary exposures for a range of age and sex groups using simulated diets and maintaining continuity with previous surveys as much as possible. The analytes to be included in the survey will be in two parts – core features that are undertaken in each NZTDS and 'add-ons' being those additional features included from time to time.

All procedures will be documented and pre-tested prior to commencement of the full survey. Finally there will be regular release of information and results to stakeholders and the general public. The timing for NZTDSs will be linked to the timing of the New Zealand Adult National Nutrition Survey and the New Zealand Child National Nutrition Survey, undertaken by the New Zealand Ministry of Health to the greatest extent possible. Thus ensuring that the most up-to-date consumption and food choice information available is used in the NZTDS.

The NZTDS will continue to be managed using 'project management' methodologies, in recognition that a TDS is a major undertaking with highs and lows of activity and financial expenditure that need to be appropriately structured and managed with regular reports and monitoring of progress. The 5 year cycle for NZTDSs will have a specified work programme for each year meaning that some aspect or component of a TDS is always being undertaken, thus making conducting a NZTDS 'business as usual'.

FDA Guidance for Industry for Estimating Dietary Intake of Substances in Food

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The Office of Food Additive Safety (OFAS) in the US FDA's Center for Food Safety and Applied Nutrition (CFSAN) first developed a guidance document on the methods used to estimate dietary exposure in 1996. This document was recently updated and expanded and has been posted on the CFSAN website. The document is intended primarily to assist industry in preparing submissions for food additive approvals, but it also provides a more general discussion of methods and data requirement for estimating dietary exposure. Sources of chemical concentration data and food consumption data are described. Characteristics of different types of food consumption data are provided as well as their usefulness and limitations. There is a discussion of important points to be considered when selecting an appropriate model for calculating intakes, including the populations of interest, toxicity of the substance (chronic versus acute) and the most appropriate concentration value to use. Several examples of calculated intake estimates are provided. The document is available on the CFSAN website at <http://www.cfsan.fda.gov/~dms/opa2cg8.html>.

PRIORITY CHEMICALS FOR TOTAL DIET STUDIES

Group	Contaminant	Usual Limit of Determination
Pesticides	Aldrin DDT (total) o,p'-DDD p,p'-DDD o,p'-DDE p,p'-DDE o,p'-DDT p,p'-DDT Dieldrin Endosulfan (total) Endosulfan Endosulfan epoxide Endrin (total) Endrin Endrin ketone Hexachlorocyclohexane (HCH) (total) Alpha-HCH Beta-HCH Gamma-HCH Hexachlorobenzene Heptachlor (total) Heptachlor Heptachlor-epoxide Diazinon Fenitrothion Malathion Parathion Methyl parathion Dithiocarbamates (total) (as CS₂ equiv.)	
Heavy Metals	Cadmium Lead Methylmercury Arsenic (inorganic)	
Industrial Chemicals	Polychlorinated biphenyls (PCBs) (total expressed in WHO TEFs) Marker PCBs IUPAC No. 28 IUPAC No. 52 IUPAC No. 101 IUPAC No. 138 IUPAC No. 153 IUPAC No. 180 Polychlorinated Dibenzodioxins	

	<p>(PCDDs) (total expressed in WHO TEFs)</p> <p>2,3,7,8-TCDD 1,2,3,7,8-PeCDD 1,2,3,6,7,8-HxCDD 1,2,3,4,7,8-HxCDD 1,2,3,7,8,9-HxCDD 1,2,3,4,6,7,8-HpCDD 1,2,3,4,6,7,8,9-OCDD</p> <p>Polychlorinated Dibenzofurans (PCDFs) (total expressed in WHO TEFs)</p> <p>2,3,7,8-TCDF 1,2,3,7,8-PeCDF 2,3,4,7,8-PeCDF 1,2,3,6,7,8-HxCDF 1,2,3,4,7,8-HxCDF 1,2,3,7,8,9-HxCDF 2,3,4,6,7,8-HxCDF 1,2,3,4,6,7,8-HpCDF 1,2,3,4,7,8,9-HpCDF 1,2,3,4,6,7,8,9-OCDF</p> <p>Polychlorinated Biphenyls (PCBs) (total expressed in WHO TEFs)</p> <p>Mono-ortho PCBs</p> <p>IUPAC No. 105 IUPAC No. 114 IUPAC No. 118 IUPAC No. 123 IUPAC No. 156 IUPAC No. 157 IUPAC No. 167 IUPAC No. 189</p> <p>Non-ortho PCBs</p> <p>IUPAC No. 77 IUPAC No. 81 IUPAC No. 126 IUPAC No. 169</p>	
<p>Mycotoxins</p>	<p>Aflatoxins (total)</p> <p>Aflatoxin B₁ Aflatoxin B₂ Aflatoxin G₁ Aflatoxin G₂</p> <p>Patulin Fumonisin B₁ Ochratoxin A</p>	