KISR

**PROPOSAL**

# ESTABLISHMENT OF WEST ASIA REGIONAL CENTRE FOR PERSISTENT ORGANIC POLLUTANTS (POPs) IN KUWAIT

**KUWAIT INSTITUTE FOR SCIENTIFIC RESEARCH**
**P.O. BOX 24885**
**13109- SAFAT- KUWAIT**

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## Introduction

Persistent organic pollutants (Pops) are global pollutants. They are subject of concerted international effort to limit their production, and use, as well as the control and disposal of no longer used substances. Under the Stockholm Convention on POPS, 12 chlorinated chemical substances will be banned or severely restricted.

Paragraph 4 of Article 12 of the Stockholm Convention calls for Parties to establish appropriate arrangement for the purpose of providing technical assistance and promoting of technology to developing parties and parties with economies in transition relating to the implementation of this convention. These arrangements shall include regional and sub-regional centres for capacity-building and transfer of technology to assist developing country parties and parties with economies in transition to fulfil their obligations under this Convention.

Kuwait signed the convention on 23 May 2001 and became a party after Ratification on 12 Jun 2006. During the first Conference of the Parties (COP 1) of Stockholm Convention held in Uruguay 2005, Kuwait expressed its interest to host a regional POPs center. The recommendations of Arab team on Multilateral Environmental Agreements for hazardous waste and chemicals in its fifteen meeting held in Cairo 7-9 April 2004, welcomed Kuwait's proposal for hosting a regional centre. UNEP Regional West Asia office has also proposed that the Kuwait Institute for Scientific Research (KISR) stands as a strong candidate for hosting the centre due to its outstanding record in related technical capabilities and expertise.

## KISR Related Expertise and Capabilities

### General

Kuwait Institute for Scientific Research was established in 1967 by the Arabian Oil Company Limited (Japan) in fulfillment of its obligations under the oil concession agreement with the Government of the State of Kuwait. The Institute was established to carry out applied scientific research and technological consultations for both governmental and private institutions in Kuwait, the Gulf region and the Arab World. The main objectives of the Institute as declared in the Amiri Decree issued in June 1973 are to:

- Conduct scientific research and studies concerned with the progress of national industry and which facilitate the preservation of the environment;
- Explore and study natural resources and means for exploiting them, energy and water resources, and methods to improve agriculture and develop aquatic resources;
- Follow up the development of scientific and technological progress, and adapt it in ways that conform with the local environment; and
- Establish and foster relations, and carry out mutual research with higher education institutes, and the technological and scientific sectors in Kuwait and various parts of the world

**Record of Laboratory Management**

There is a proven track record of laboratory management at KISR. The main related laboratories are the Centralized Analytical Laboratory (CAL) augmented by a specialized Environmental Organic Chemistry laboratory and Environmental Ecotoxicology laboratory.

**The Central Analytical Laboratory (CAL)**

CAL has expertise in different fields and a group of well trained staff that supports the research activities of the Institute, the private clients and other governmental bodies in the Country.

Chromatography Lab within CAL have special capabilities for analyzing Pesticides, PCBs, and Dioxins in water samples, sealant samples, milk samples, insect killer samples, transformer oil samples, feed samples, sediment samples, medical waste incinerators and fresh fruits and vegetable samples using GC, GC/MS. GC/MS/MS and HPLC. It should be mentioned that KISR represented by CAL participated in inter-laboratory comparison studies from IAEA analyzing fish tissue, sediment and wheat flour samples for pesticides, PCBs and PAHs. CAL has the following up-to date instruments that have been used in the analyses of POPs:

Gas Chromatograph-Mass Spectrometers

- One Agilent 6890N Gas Chromatograph-Agilent 5973 Mass Spectrometer with EI and ECNCI ionization potential (Pu Dong, Shanghai, China)
- Two (2) Shimadzu 2010 Gas Chromatograph - Shimadzu 2010 Mass Spectrometer with EI and ECNCI ionization potential (Shimadzu, Tokyo, Japan)
- One Shimadzu GC-17A Gas Chromatograph - Shimadzu QP-5050A Mass Spectrometer with ionization potential (Shimadzu, Tokyo, Japan)

- 6890N GC with 5973 inert MS fitted with a purge and trap injector
- 6890N GC with 5973N MS with EI potential
- Varian CP3800 GC-MS-MS (ion trap technology)
- LC-MS-MS 1100 Series
- HPLCs
- GCs fitted with other detectors like ECDs and FIDs, and HTD

Sample Preparation and Clean-up Facilities

- Accelerated Solvent Extraction Unit ASE® 300 (Dionex Corp, Sunnyvale, CA, USA)
- Pressurized Solvent Extraction Unit (*fast*-PSE™, Applied Separations, Allen Town, PA, USA)
- Several Soxhlet Extraction Units
- N-Vap (24 positions) (Organomation Association Inc. , Berlin, MA, USA)
- Turbovap *II* Concentration workstation (Zymark Corp., Hopkinton, USA)

Sample Storage Facilities

- Several explosion proof refrigerators
- Several Freezers
- Specialized cold room maintained at -4 $^{o}$C

CAL's analytical work is controlled by its quality control and quality assurance (QA/QC) unit through a quality assurance system. The QA/QC unit ensures that data generated are of the highest quality and meets international standards. All analytical methodologies and analysis systems are regularly checked to accuracy, precision and reproducibility by analysis of certified reference materials and participation in international inter-laboratory comparison programmes.

**Environmental Organic Chemistry Ecotoxicology Laboratories**

The Environmental Organic Chemistry of the Environmental Sciences Department (ESD) at KISR, has a program to measure the levels of certain classes of POPs, including polybrominated diphenyl ethers (PBDEs), polychlorinated naphthalene’s (Pins), organ chlorine pesticides (Rocs), in various environmental compartments using careful analytical method development, field sampling campaigns, and laboratory based experimentation. This is with the view to develop a mechanistic understanding of sources, atmospheric levels/behavior, and human exposure of POPs in Kuwait. Linkage and collaboration with

leading research groups on POPs at UK and USA is made to support the research program on POPs. The laboratory is equipped with two new benches top GC-MS, a GC equipped with an FID, FPD and ECD, a HPLC fitted with a fluorescence detector.

In addition, there is a very well equipped Ecotoxicology laboratory at the ESD of KISR that has developed the capacity to measures a range of biological markers in biota, sediments, and wastewater which can support the toxicological research on POPs.

**Selected Record of Scientific Work Related to POPs**

KISR has an excellent track of research projects and technical services in the various fields of specialization. In reference to POPs, several projects were carried out by KISR staff. A list of some of the recent R&D activities is given below, while Annex I gives a list of other related projects.

- Assessment of pesticides Residue level in Foods in Kuwait
- Assessment of the levels of chlorinated pesticides in breast milk in Kuwait.
- Assessment the impact of Air Pollution emitted from medical waste incinerators on the hospital environment and the surrounding areas.
- Establishment of Kuwait Municipality Central Food Control laboratory and a Risk-based system for Food Sampling and Analysis.
- Halogens in homes and the workplace: a preliminary survey of brominates flame retardants in indoor air in Kuwait.

Record of significant relevant publications by KISR is also given in Annex II.

**National Scientific & Technical Information Centre (NSTIC)**

KISR programs and projects in research and development are well supported by its unique and important National Scientific & Technical Information Centre (NSTIC) (housed at KISR) which provides the latest scientific and technological information (print and electronic) from resources available at the centre and worldwide including books, periodicals, technical reports, standards, indexes and patents.

**Training and Capacity Building**

The Division of training (DOT) at KISR plays a significant role in achieving KISR's goals, e.g., public relations development, marketing, and enhancing KISR's reputation at local and internationals levels. The main function of the department is developing and improving the capabilities of the staff at KISR, as well as those at local and regional organizations through various training programs in scientific and technical,

management and computers. The department's goals include preparation and execution of long- and short-term training plans to meet KISR's needs for human resources, in accordance with the Institute's strategic plans, in addition to implementing career development plans and other programs that encourage Kuwaiti youth to participate in scientific research. DOT conducts an average of 50 training courses per year for participants from KISR, local and regional authorities.

Several related training courses have been organized by DOT and executed by experts from CAL and ENV. Related topics included training on analytical instrumentation and application analysis, designing and developing analytical laboratories, quality control and quality assurance in analytical laboratory as well as issues related to environmental and ecotoxicoloigcal aspects of organic pollutants including POPs. List of Some related training courses and workshops organized by KISR is given in ANNEX III.

In conclusion, KISR capabilities include among other environmental expertise the following:

- Availability of the basic facility infrastructure (e.g. building, electric and water supply, computer and internet connection);
- Documented experience and accredited experts in the analytical hardware and POPs methods of sampling, measurements and analyses;
- Proven records of management of laboratories and R&D and monitoring facilities;
- Trained professionals, technicians and administrative/ finance personnel;
- Accumulated knowledge on regional environmental issues and long time involvement in the implementation of related international environmental conventions agreements; and
- International linkage and collaboration with leading research centres and research groups on POPs.

## The Proposed Regional POPs Centre at KISR, Kuwait

### Goal and Objectives

The main goal/ overall objective of the Regional Centre (RC) is to strengthen and further develop the capabilities of countries in West Asia region in implementing the Stockholm Convention through capacity building and the transfer of environmentally sound technologies under the Stockholm convention. Specific objectives will include:

- Provide data and analysis on POPs
- Monitor and assess progress towards POPs control in the region
- Provide technical and management training and capacity building on POPs related issues (formal training, workshops, expert group meetings, etc)
- Disseminate information to concerned stakeholders
- Enhance awareness
- Streamline activities and efforts on POPs among concerned organizations at the national, regional and international levels
- Deliver periodical reporting to concerned partners (member states, convention secretariat, regional intergovernmental organizations, etc)

**Hosting, Facilities and Overall Management**

The RC shall be hosted at KISR where basic and facilities are available including basic infrastructural needs and space for further development of the RC. KISR will act as an Umbrella for scientific and training aspects related to the implementation of the POPs RC convention. The Centre will be managed in accordance with the COP decisions and directives in close coordination with concerned national and regional authorities in the West Asia region and the secretariat of the convention as well as the United Nations Environment Programme – Regional Office for West Asia (UNEP/ ROWA). The management plan among other related issues shall be further discussed in the future with these partners to arrive at an agreed upon schemes.

**Activities**

The centre shall provide support including technical and capacity building needs for West Asia Member States to help them meeting their obligations for the Stockholm convention. In particular, the centre will act to deliver the following activities:

- Assistance to countries with respect to POPs monitoring;
- Capacity-building with respect to POPs analyses in all environmental media and/or industrial matrices;
- Assistance to countries in the region on POPs control projects;
- Developing and organizing specialized training workshop/ seminars on POPs related issues and Stockholm Convention;
- Gathering, assessing and disseminating information on POPs into the region;

- Assessment and selection of technologies for environmentally sound treatment and disposal of POPs;
- Assistance and advisory services;
- Promotion and public awareness;
- Dissemination of information; and
- Periodical reporting

**Resources Requirements**

In addition to the recruitment of a regional coordinator and support staff, the POPs RC team and laboratory facilities will be set-up from existing staff and amenities in the institute initially. These staff will require keeping abreast with new and emerging technologies in the field of POPs analyses. However, upgrading existing facilities and existing expertise will be crucial to the successful maintenance of the laboratory and cooping with sample analyses requests. Hence, acquisition of certain instruments and additional expertise to supplement the existing capabilities will be made as necessary. These equipments/ instruments may include:

- Additional dedicated freeze-driers for sample pre-treatment
- Additional accelerated Solvent Extractor for sample preparation of Dioxins, PCBs and pesticides;
- High Resolution HRGC / HRMS for dioxins, Polychlorinated Biphenyls (PCBs)

It is to be noted that a dedicated laboratory will cost about KD 184,400 for the establishment of all the facilities for the first year. A summary detail of the estimated budget is given in the table below.

**Potential Sources of Funding**

In kind funding will be provided by KISR. This would include utilizing KISR premises and laboratory facilities, providing some trained personnel to carry out the activities of the centre, providing accounting and logistic support as necessary. Funding from organization within Kuwait will be sought from Kuwait Foundation for the Advancement of Sciences (KFAS) and from Kuwait Environment Public Authority (EPA) that goes with their mandate. Some contribution from the secretariat of the Stockholm convention will be also sought. Furthermore, the centre will sustain its activities from the income generated from services provided to WA Member States (sample analysis, training, consultancies, others).

## Estimated Budget

| Items | Cost (KD) (1KD = 3.4 $) |
|---|---|
| **MANPOWER** | |
| Coordinator | 24,000 |
| Administrative Assistance | 4,000 |
| **Subtotal** | 28,000 |
| **FACILITIES SET-UP** | |
| High Resolution HRGC/ HRMS for Dioxin analysis (*) | 130,000 |
| Administrative equipments ( computers & printers) | 3,400 |
| **Subtotal** | 133.400 |
| **OPERATING EXPENSES** | |
| Cost for up keeping the laboratory | 15,000 |
| Missions | 4,000 |
| Miscellaneous | 4,000 |
| **Subtotal** | 23,000 |
| **TOTAL** | 184,400 |

**(*) One time cost**

## ANNEX I

**List of samples of some related projects completed at KISR**

- ► Assessment of Risk Associated With Air Pollutants Resulting From Kuwait Oil Fires. Part 1: Hazard Identification.
- ► Estimation of Risk associated with consumption of oil-contaminated seafood by Kuwait's population.
- ► Preliminary Toxicity Assessment of Industrial Effluents in the Marine Environment of the Shuaiba Industrial Area Using Microtox Bioassay.
- ► An Air Pollution Index for the Shuaiba Industrial Area.
- ► Study of the Chemical Composition of Oil in the Oil Lakes and Effects of Weathering on Aromatics.
- ► Distribution of Pollutant in Soils, Sediments and Marine Waters in the SIA.
- ► Assessment of Chemical s Contamination in the costal area in Kuwait.
- ► Degradation Kinetics & Assessment of Pesticides on Vegetables grown in Kuwait.
- ► Toxicity of Wastewater effluent in the Shuwaikh Area.
- ► Assessment of Risks Associated with Polycyclic Aromatic Hydrocarbons from Kuwait Oil Lakes.
- ► Water soluble fraction of different crude oil & refined petroleum products phase I: Composition & Relative Toxicity.
- ► Fate of conventional/priority organic pollutants of wastewater in soil.
- ► Induction of Hepatic Microsomal Cytochrome p-450 & Bile metabolites as indicators of Petroleum + Pollution in Hamoor.
- ► Toxicity and bioaccumulation of crude oil and partially combusted oil by selected marine organism in Kuwait.
- ► Assessment of Sediment Quality in Kuwait's Territorial Water Part I: Kuwait Bay.
- ► Fish as indicators of ecosystem health at contaminated sites in Kuwait.
- ► The potential impact of draining the southern Iraqi Marshes on the sediment budget and associated pollutants in northern Arabian Gulf.

- Factors governing the photo degradation of oil –based pollutants in Kuwait's sea-water.
- Evaluation of the Toxicity of Marine Sediment Elutriate.
- Safety Evaluation of Oil Spill to be used in the Arabian Gulf.
- Halogens in homes and the workplace: A Preliminary survey of brominated flame retardants in indoors air in Kuwait.
- Impacts of air pollution episodes on the chest morbidity and lung functions of the Kuwait school children born the same time of the well fires.
- Quantifying the magnitude of mortality, morbidity, disability & deterioration of the quality of life among the Kuwait population as a result of the invasion and occupation of Kuwait by Iraq.
- Carrying out a human risk assessment study for the carcinogenic pollutants resulting from the Iraqi aggression.
- Investigation of long term health impacts of the air pollution episodes resulting from the oil fires on the Kuwaiti population.
- Assessment of Toxic effect of Environmental pollutants associated with sewage sludge.
- Multi Biomarkers Response in fish from Kuwait Sea Area.

## ANNEX II

**List of some KISR'S scientificant related Publications**


Ali S. Al- Omair**,** Nisar Ahmed, Abdul Aziz Inayatullah and Al- Kandari. Performance in International Analytical Quality Assurance studies on pesticides residues in spiked food samples. Kuwait Journal of Science& Engineering" V 31 number (1) June, 2004

Bondi Gevao, Kevin C. Jones and John Hamilton-Taylor. Polycyclic aromatic hydrocarbon (PAH) deposition to and processing in a small rural lake. Sci. Tot. Environ. 1998 215, 231-242.

Bioavailability of non-extractable (bound) pesticide residues to earthworms. Bondi Gevao, Catriona Mourdaunt, Kirk T. Semple, Trevor G. Piearce and Kevin C. Jones *Environ. Sci. Technol*. 2000 35(3) 501-507.

Bondi Gevao, Peter Burauel, Kirk Semple, Andrew Craven and Kevin C. Jones Environ. 12-Non-extractable (bound) pesticide residues in soil: resolving conflicts between their definition, regulatory requirements and significance. Sci. Technol. 2003, 13: 138A-144A.

Bondi Gevao, Kirk T. Semple and Kevin C. Jones. 16-Formation, and release, of non-extractable (bound) dicamba residues under sterile and non-sterile regimes in an organic rich soil. *Environ. Pollut*. 2005, 133:17-24

Cousins, B. Gevao and K. C. Jones. Vertical distribution of PCBs and PAHs in soils and implication for air-soil exchange modelling. Chemosphere, 1999, 39(14) 2507-2518.

Catriona J. Mordaunt, Bondi Gevao, Kirk T. Semple, and Kevin C. Jones. 17-Formation of non-extractable pesticide residues: observations on compound differences, measurement and regulatory issues. *Environ. Pollut*. 2005, 133:25-34

Gevao, B., Al-Omair, A., Sweetman, A, Ali, L., Al-Bahloul M., Helaleh, M and Zafar, J. (2006). Passive Sampler-Derived Air Concentrations for Polybrominated

Diphenyl Ethers and Polycyclic Aromatic Hydrocarbons in Kuwait. Environmental Toxicology and Chemistry, v 25, No. 6, pp. 1496-1502**.**

Gevao, B., Al-Bahloul, M., Al-Ghadban, A., Ali, L., Al-Omair A., Helaleh, M., Al-Mutrouk, K. and Zafar, J. (2006). Polybrominated Diphenyl Ethers in indoor Air in Kuwait: Implications for Human Exposure. Atmospheric Environment, 40 (2006) 1419-1426.

Gevao, B., Al-Bahloul, Al-Ghadban, Al-Omair, A, Ali, L., Zafar, J.and Helaleh, M. (2006). House Dust as a Source of Human Exposure to Polybrominated Diphenyl Ethers. In Kuwait. Chemosphere, 64 (2006) 603-608.

Kinetics and potential significance of polycyclic aromatic hydrocarbon (PAH) desorption from creosote-treated wood. Bondi Gevao and Kevin C. Jones *Environ. Sci. Technol*.; 1998, 32, 640-646

M.I.Helaleh, A. Al-Omair. N. Ahmed. B. Gevao. Quantitative determination of organ chlorine pesticides in sewage sledges using soxtec, soxhlet and pressurized liquid extractions and ion trap mass-spectrometric detection, Anal Bioanal Chem (2005) **382**: 1127-1134

Sources of pesticides on farms and the behaviour and fate in soil. Bondi Gevao and Kevin C. Jones. In: Agriculture, Hydrology and Water Quality; P. Haygarth and S. Jarvis CABI publishing, Oxon, UK pp83-106, ch. 4

Tom Harner, Robert G. M. Lee, Bondi Gevao, Wendy A. Ockenden, Gareth Thomas, Grant Northcott and Kevin C. Jones. 15-Polychlorinated naphthalene's in the United Kingdom - past and present. *Organohalogen Compd*., 1999, 43, 97-100

Talat Saeed, Wajih N. Sawaya, Nisar Ahmad, Sangeetha Rajagopal, and Ali Al-Omair. Organ phosphorus Pesticide Residues in the total diet of Kuwait .The Arabian Journal for Science and Engineering, volume 1A (2005).

Talat Saeed, Waji N. Sawaya**,** Nisar Ahmad, Sangeetha Rajagopal, Ali Al-Omair, Fawzia Al-Awadhi. Chlorinated pesticide residues in the total diet of Kuwait. Food Control 12 (2001) 91-98.

Talat Saeed, Waji N. Sawaya**,** Nisar Ahmad, Sangeetha Rajagopal, Basma Dashti and Samira Al-Awadhi. Assessment of the levels of chlorinated pesticides in breast milk in Kuwait. Food Additive and Contaminants, 2000, vol, **17**.No.12, 1013-1018.

Waji N. Sawaya. Fawzia Al-Awadhi, Talat Saeed, Ali Al-Omair, Adnan Hussain, Nissar Ahmad, Husam Al-Omirah, Sameer Al-Zenki, Sherif Khalafawi, Jamal Al-Otaibi, Hanan Al-Amiri. Dietary intake of Organophosphate Pesticides in Kuwait." Food Chemistry 69 (2000) 331-338".

W.N.Sawaya, F. A. Al-Awadhi, T. Saeed, A. Al-Omair, N. Ahmad, A. Hussain, S. Khalafawi, S. Al-Zenki, H. Al-Amiri, J. Al-Otaibi and J. Al-Saqer. Dietary intake of Pesticides: State of Kuwait Total Diet Study"._"Food Additive & Contaminants." 1999,Vol.**16**.No 11.473-480,

Waji N. Sawaya. Fawzia Al-Awadhi, Talat Saeed, Ali Al-Omair, Nissar Ahmad, Adnan Hussain, Sherif Khalafawi, Husam Al-Omirah, Basma Dashti, Hanan Al- Amiri and Jameela Al-Saqer. Kuwait's Total Diet Study: Dietary Intake of Organ chlorine, Carbamate, Benzimidazole and Phenyl urea Pesticides residues". "Journal of AOAC International Vol. 82, No.6.1999".

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## ANNEX III

**List of selected related training courses conducted by KISR**

- Gas chromatography
- High performance liquid chromatography
- Quality control and quality assurance in analytical laboratory
- Analytical Chemistry of Persistent Organic Pollutant
- Instrumentation on Theories & Applications in the Field of Environmental Studies
- Fish cytochrome P450 1A-A Biomarker of marine oil pollution Environmental Analyses
- Marine pollution, data handling and interpretation
- Persistent chemicals, toxicity and management
- Pollution prevention and waste minimization
- Marine Pollution Assessment
- Environmental planning for industrial area
- Analysis of Organic Pollutants in Sewage Sludge
- Pollution prevention and waste minimization
- Effective wastewater treatment
- Environmental impact for marine and water related projects
- GIS applications in environmental sciences
- Monitoring of marine environment pollution and its effects on exposed biosystem
- Ist Technical Workshop on Sources and Environmental Levels of Persistent Toxic Substances, organized jointly between KISR and UNEP, March 10-13 2002, KISR-Kuwait
- Environmental Analysis
- Instrumentation on Theories & Applications in the Field of Environmental Studies
- Instrumentation Theories & Application
- Analysis in Waste Management
- Marine Pollution Assessment (T & NI)
- Analyze of Organic Pollutants in Sewage Sludge