FACS
ANEC

NECTAR

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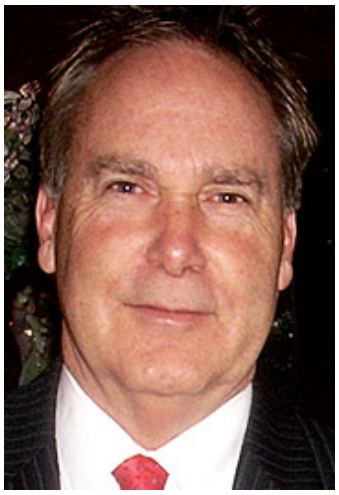
Network
for Environmental Chemistry and
Toxicology in the Asia-Pacific
Region

NECTAR is the official web newsletter for the Asian Network for Environmental Chemistry, a working group of the Federation of Asian Chemical Societies.

Contributions for NECTAR, which will appear approximately quarterly are welcome and should be sent to the page editor, Dr. Ross Sadler at ross.sadler@griffith.edu.au.

From the FACS President

FACS President Professor David Winkler describes activities aimed at charting a new structure and course for FACS in the 21st century.



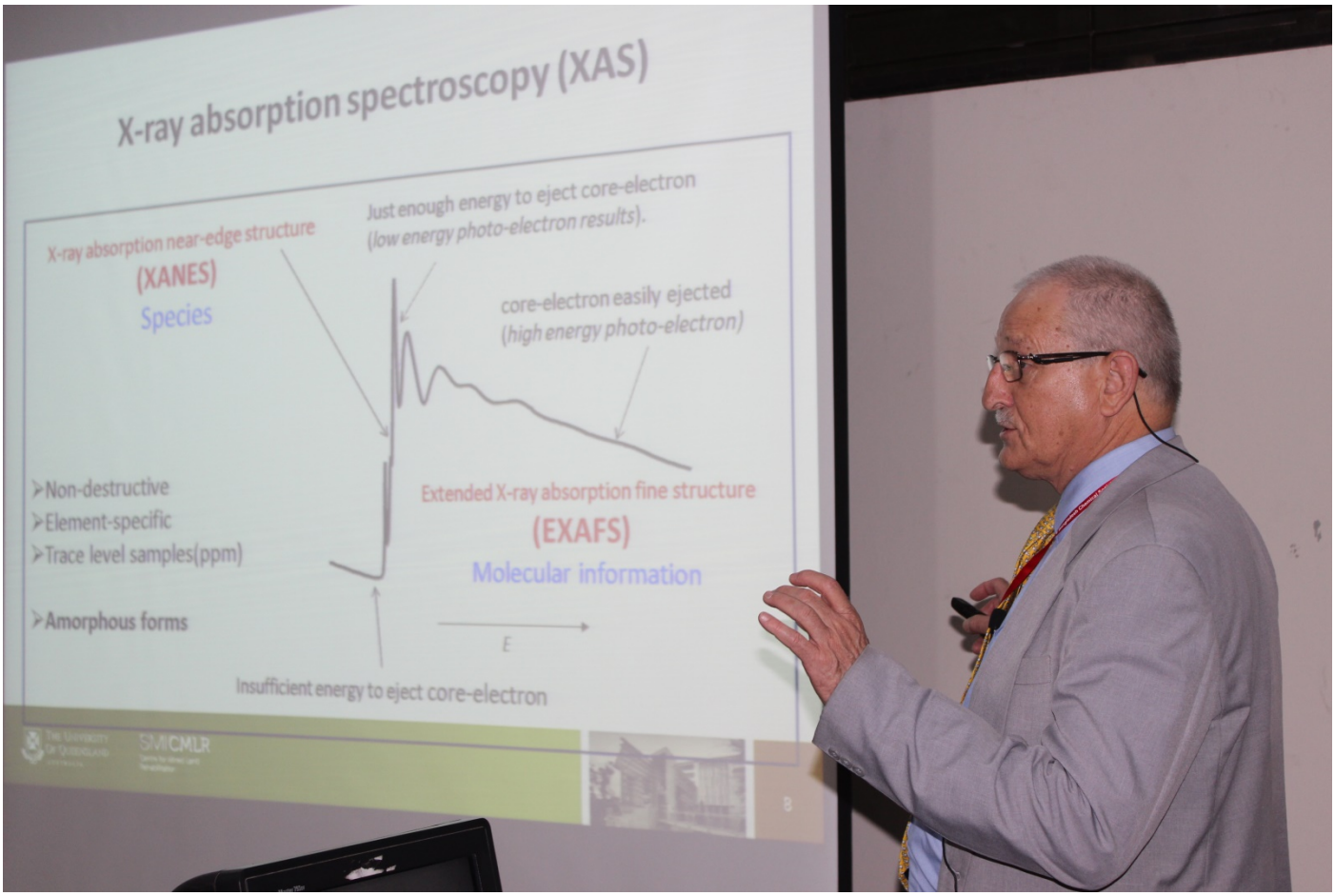
The operational components of FACS have performed a valuable function since the formation of the Federation almost 40 years ago. In the early days there was a relatively low level of development in many member countries, but clearly much has changed in the Asia-Pacific region. Today the region is the dominant scientific and economic centre of the world. Communications have improved in ways that could not have been imagined 40 years ago and all member societies are very capable of running strong scientific conferences with excellent content. There are also new opportunities for FACS and its member societies to take advantage of our important position in the world and to improve our financial position (allowing more to be done), communication within the region and with kindred organisations internationally, and for developing a new internal structure that better serves the needs of chemists from the Asia-Pacific region.

The Executive Committee (EXCO) of FACS has been discussing several White Papers developed by the President that map out a better path for these vital components of FACS. Projects needs to evolve along with the region, both to better serve the aims of the FACS, and to take advantage of the enormous opportunities that the changes in the region now provide. We have been discussing making Projects better aligned with major questions chemists are tackling (particularly local issue like, food, environment, natural products etc.), more dynamic (being created and dissolved according to where the science is moving), making them more inclusive, and improving their resources. Similarly, the financial model is now not optimal as it does not take advantage of opportunities in the region. FACS can increase income so it can achieve much more in the region. The President has been addressing communications in two ways: by restructuring the roles of the EXCO members especially communication that will now include social media, LinkedIn pages and a refreshed web site; and by visiting members societies and major international kindred societies

such as the ACS, RSC, Royal Society and our African and Middle Eastern counterpart Federations. We aim to finalise the new structure and financial model after extensive consultation with FACS members societies so that the changes can be voted on and implemented at the next major FACS meeting in Taipei in December 2019.

Safe drinking water supply in arsenic affected rural Bangladesh

Associate Professor Barry Noller reports on a 2016 symposium which dealt with the provision of Safe drinking water supply in arsenic affected rural Bangladesh.



On 19 March 2016 a one day symposium organised by the Asian Network of Environmental Chemistry (ANEC) on groundwater contaminants and public health was held to draw together current issues. The meeting was held in Dhaka as part of the 2016 Asian Chemical Congress. Presentations were given by 7 speakers, there being a total of 10 presentations with a general discussion at the end. The speakers from Bangladesh and Australia covered a wide range of issues and disciplines encompassing hydrogeology geology, chemistry, toxicology, environmental engineering and social issues. There was a packed room of lively delegates and the discussion was intensive, drawing out key significant issues that are elaborated on below. The key speakers were Associate Professor Barry Noller, Professor Jack Ng and Dr. Ross Sadler (Australia); Professor Kazi Matin Ahmed, Dr. Mohammad Shoeb and Professor Bilqis Amin Hoque (Bangladesh).

Background.

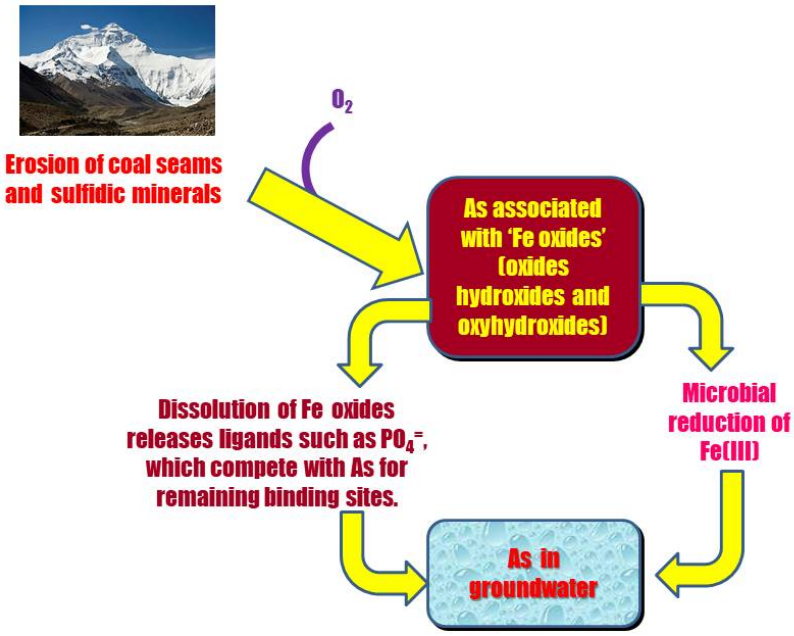
An introduction on groundwater contaminants in the Asia-Pacific overviewed the range identifying arsenic as the key of particular relevance to Bangladesh. Others that should not be put aside include: nitrate,

fluoride, insecticides and herbicides, landfill leachates as well as the significance of interactions of mixtures. However, arsenic was the dominant issue of the workshop.

Arsenic health issues

Human arsenic toxicology and intervention strategies have been studied in great detail during the last 30 years. When arsenic concentration in the water source is high, it is a chronic poison resulting in skin keratosis and leading to cancer. Arsenic and diabetes interact and result in their own complications. The toxicological mechanism of arsenic in humans was not demonstrated easily in animals until observed in mice. Several key documents summarise the extensive work undertaken. The detailed records in the *Arsenic in the Environment* conferences are recognised. Human epidemiological studies pertaining to arsenic induced lung cancer, the most aggressive form of cancer, have been carried out in Taiwan. In this country, drinking water intake may be >2L/ adult/day. Ways to control arsenic exposure in people from drinking water have been sought. Intervention strategies have undergone considerable development and reversion to the historical practice of using dug out wells has emerged. Removal of arsenic out from soil using phytomining with Chinese brake fern has been undertaken successfully.

Arsenic distribution.



Arsenic contamination in groundwater has been assessed intensively with focus on drinking water supply in Bangladesh and West Bengal. A workshop delegate Prof MNGA Khan first measured arsenic in groundwater in Bangladesh in 1988. The accepted mechanism of arsenic release based on geology of arsenic distribution is pyrite oxidation followed by oxyhydroxide reduction of arsenic and the basin model with Himalaya erosion is the main model widely accepted with incorporation of organic matter. Deep tube wells have become effective and arsenic mitigation use is going down. However Bangladesh is still using the earlier (out-dated) WHO drinking water guideline of 50 µg/L. The 1998-99 vs 2012-13 survey of contamination in the Southern part of Bangladesh

showed that 22 million people are at risk at 50 µg/L but a much higher number applies if a criterion of 10 µg/L is employed. Advances in well safety categorisation have been made with a variety of approaches:

- Use field test kits to scan,
- Colour codes,
- Correlation of sediment colour with arsenic concentration, etc.

But it should also be noted that many wells remain untested.

Deep tube wells are the better option. Nevertheless, *in 2009 many people were still being exposed to arsenic in water*.

Water supply issues

In rural areas of Bangladesh there exists a need to provide safe drinking water supply in arsenic affected areas. Research and Development issues are related to trends in water supply and provision of improved water supply for the 28% of population who are exposed to harmful levels of arsenic. Unfortunately, many people do not want to use the intervention strategies.

The importance of arsenic removal technologies need to be understood, especially at a village level. There also needs to be proper supervision of the operation of arsenic removal procedures to ensure that these are being carried out correctly. Alternative technology costs for maintenance are a serious problem with distribution of arsenic removal facilities. Hardly any arsenic health records exist in Bangladesh (as opposed to diabetes records which are extensive). Thus arsenic-related water quality problems persist and it is noteworthy that there seems to be very little involvement of women in the water purification technology. Sourcing of alternative safe water supplies remains an extremely important initiative, in view of the fact that chemical removal of arsenic from all the affected wells in Bangladesh would result in major waste generation throughout the country.

Drinking Water and Diet

In assessing overall health risk due to arsenic, it must be remembered that drinking water constitutes only one possible means of exposure and all dietary sources need to be taken into account. A diet study in Brazil for instance showed the importance of diet beans and rice alongside drinking water. Put simply, all such key intake foods need to be identified.

Arsenic in Bangladesh rice 120 ng/g in the ballpark of the world data (mean 194 ng/g). Thus cooked food needs to be assessed for arsenic together with drinking water intake. In Bangladesh, as elsewhere, more data are needed on exposure to arsenic through foodstuffs. The assessment of rice and other foods as

arsenic contributors is difficult in places such as Bangladesh, where there is high exposure through drinking water.

The Issues today

Knowledge of arsenic in foods and drinking water is now quite extensive and covers:

(i) Arsenic levels, speciation (as inorganic and organic) and toxicology;
(ii) Arsenic distribution and source.

However there remain significant areas for improvement as regards confronting the problems of arsenic in drinking water.

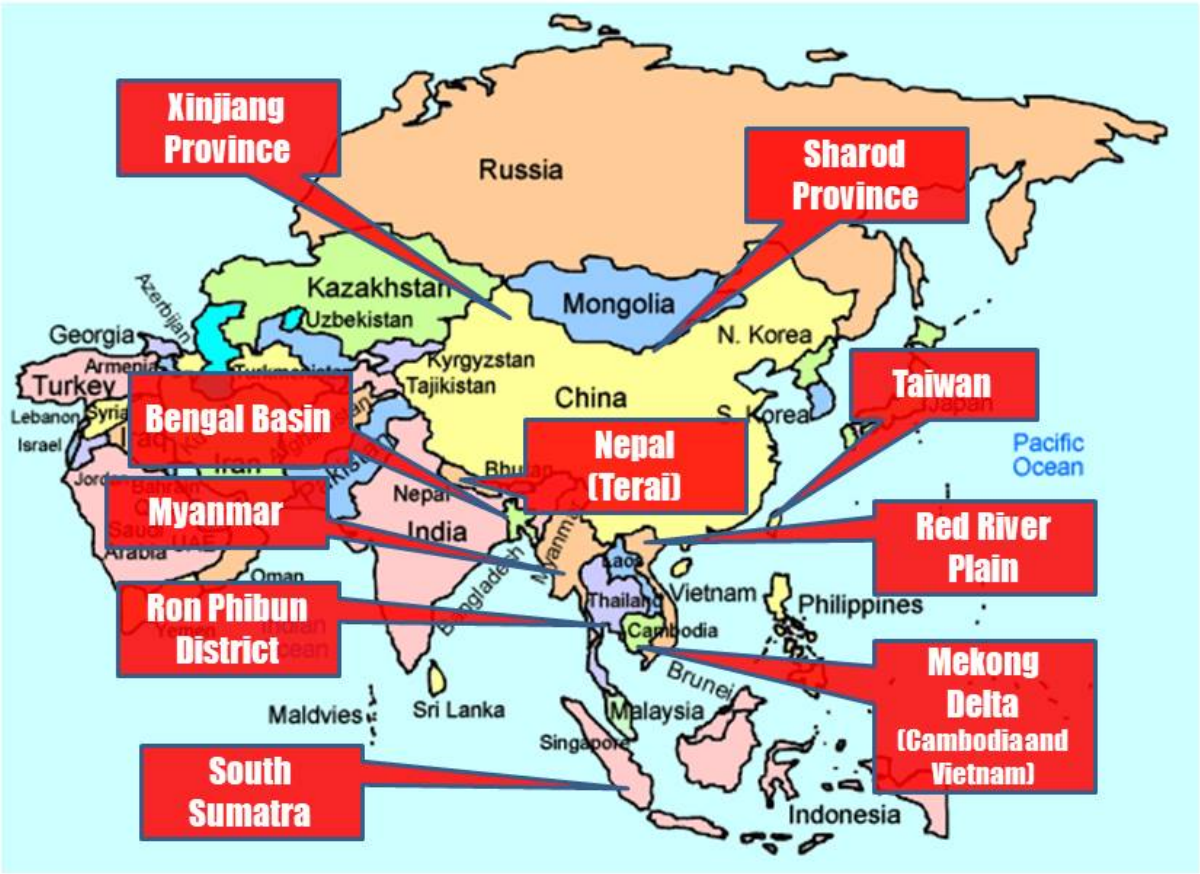
Firstly, guidelines for arsenic and foods and drinking water, prescribed in all countries (including Bangladesh) need to be consistent with those devised by the World Health Organization. For example, in Bangladesh, a safe drinking water level for arsenic of 50 µg/L is still used, whereas the World Health Organization currently prescribes a limit of 10 µg/L.

It must also be recognized that we have relatively little information as regards how well the arsenic removal schemes implemented at village levels have actually worked. There is an urgent need for a major health promotion initiative, to encourage proper application of arsenic removal technologies and for ongoing monitoring of the effectiveness of these procedures. In addition, other constituents of food and drinking water are also recognized as having equally important implications as regards public health.

Sourcing of alternative water supplies remains a far preferable option to treatment. There has so far been little attention paid to this initiative.

Finally, arsenic is not the only contaminant of drinking water and foods that presents a concern for public health. And moreover, the possibility of toxicity interactions with arsenic exists and has so far attracted almost no attention.

In conclusion, it should be noted that Bangladesh is not the only Asian country with elevated levels of arsenic in drinking water. The accompanying map gives an indication of the extent of the problem in Asian countries.


Xinjiang Province
Sharod Province
Taiwan
Bengal Basin
Nepal (Terai)
Myanmar
Red River Plain
Ron Phibun District
Mekong Delta (Cambodia and Vietnam)
South Sumatra
Russia
Kazakhstan
Uzbekistan
Mongolia
N. Korea
Georgia
Turkey
Kyrgyzstan
Tajikistan
China
S. Korea
Lebanon
Israel
Pacific Ocean
India
Nepal
Vietnam
Philippines
Thailand
Cambodia
Brunei
Malaysia
Maldives
Sri Lanka
Singapore
Indonesia