

# RecShow '08

Middle East Waste  
And Environmental Management Congress

Kempinski Ishtar Dead Sea Hotel  
Feb. 17 - 19, 2008

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# RecShow '08

Middle East Recycling, Waste & Environmental  
Management Exhibition & Congress

**Kempinski Hotel, Dead Sea - Jordan**

17-19 February 2008

## Conference Proceedings

### Table of Contents

1. Introduction - **page 3**
2. Conference Tracks - **page 4**
3. Conference Agenda - **page 53**
4. Conference Committee - **page 54**
5. RecShow '09 - **page 55**

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# RecShow '08

## Introduction

We would like to welcome our esteemed guests and speakers who have come a long way to share their knowledge and experience and to enrich and support all efforts towards a better environment and a better life for our people.

I wish to extend special appreciation and thanks to His Excellency Dr. Khalid Al Irani the Minister of Environment for supporting the conference along with his staff and scholars who spared no effort in making this event what it is now - a pure success.

The conference committee headed by Dr. Mohamed Al Khashahneh with the other colleagues Dr. Aida Hussien, Dr. Mohamed Al Shafie, Dr. Abdelatif Shafie, Eng. Hala Nobani and Eng. Hamed Tarawneh worked hard over six months to select the appropriate articles, put the agenda and moderate the event to which they deserve appreciation and recognition for their superb work.

The conference will be managed in four tracks addressing small few steps towards the conservation of our environment. While recycling has positive impact on the economy in terms of re-using scrapped material and saving earth resources, proper recycling need to be closely monitored in order to avoid any damage to the environment on the account of the economy - no environment - no economy.

Proper solid waste management is a vital issue in our quest for a better and cleaner air, cleaner water and healthier habitat. The four tracks in this conference will address various solid issues, techniques and technologies.

RecShow conference will be an annual international event to be held in the same venue at the same time every year - with each year new technologies and researches will be presented and new ideas will be exchanged.

Thank you all for your kind support and cooperation. Wish you success and prosperity.

**Walid Hikmat - Event Organizer**

# **RecShow '08**

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Management Exhibition & Congress

**Kempinski Hotel, Dead Sea - Jordan**

17-19 February 2008

## Conference Tracks

- 1. Integrated Waste Management - page 5**
- 2. Recycling - page 14**
- 3. Success Stories - Case Studies - page 28**
- 4. Sustainability in the Waste Field; Waste Recovery, Waste to Energy - page 34**
- 5. Poster Session - page 52**

# RecShow '08

Middle East Recycling, Waste & Environmental  
Management Exhibition & Congress

**Kempinski Hotel, Dead Sea - Jordan**

17-19 February 2008

## Integrated Waste Management

- The Role of Environmental Funds in Creating Economic Benefits - **page 6**
- Understanding financing and commercial delivery mechanisms available to municipal and central governments - **page 7**
- Solid Waste Management in Jordan - Current Situation and Future Challenges - **page 8**
- Municipal Solid Waste Management at Amman City - **page 9,10,11**
- Hazardous Solid Waste Management in Jordan
- The "Zero Waste" concept and the Arab World - **page 12**
- Sensitivity Analysis of Adsorption Isotherms Subject to Measurement Noise in Data - **page 13**

## **RecShow '08**

### **Middle East Recycling, Waste & Environmental Management Exhibition & Congress**

**Kempinski Hotel, Dead Sea - Jordan**

**17-19 February 2008**

#### **The Role of Environmental Funds in Creating Economic Benefits**

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Jordan recognizes that the major economic activities of the country – industry, mining, agriculture and tourism - are highly dependent on a sound environment. The sustainability of these economic activities and their continued contribution to the development of Jordan, are inextricably linked to the protection of its environment.

Jordan has shown a strong commitment to environmental protection, pollution abatement and preservation of natural resources, and this effort is demonstrated through the significant legal measures, national strategic priorities and international conventions it has ratified over the years.

Despite this, there are severe threats to Jordan's environment and they are increasingly constraining the country's economic stability. In fact, the cost of environmental degradation in Jordan was estimated at an annual rate of JD 205 million or 3.1% of GDP in a study completed by the World Bank in 2004<sup>[1]</sup>. The areas most damaging to Jordan's environment include emissions of toxic air and water pollutants; disposal practices for solid, chemical and hazardous wastes; and uncontrolled development – with non-compliance to Jordan's environmental laws heightening the challenge.

Jordan wishes to advance progress on environmental protection especially in regard to compliance to national regulations and knows that achieving improvements and full compliance will require substantial gains in institutional capacity and upgrades to infrastructure across industrial, commercial and development entities.

To support advancement, the Government of Jordan, in 2006, approved amendments to its Environment Protection Law calling for the development of a Jordan Environmental Fund (JEF). The Fund's objective is to provide financial assistance on a competitive basis to entities investing in projects that promote sustainable use of Jordan's natural resources and strengthen institutional capacity to comply to national environmental laws.

This presentation will discuss the role such financial instruments can play in maximizing economic benefits resulting from solid waste.

<sup>[1]</sup> A study conducted by the World Bank in 2004, *Cost Assessment of Environmental Degradation*

**Full Abstract**

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**Kempinski Hotel, Dead Sea - Jordan**

**17-19 February 2008**

#### **Understanding financing and commercial delivery mechanisms available to municipal and central governments**

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Given the substantial need for waste management infrastructure to improve resource and energy efficiency, manage climate change risks and improve public health, it is now of key importance to understand the financing and commercial delivery mechanisms available to municipal and central governments to deliver this challenging infrastructure investment program.

Building on the speaker's experience of advising both the public and private sectors on some of the largest and most complex waste PPP projects in the global market, this session examines the financing and commercial structures available to central government policy makers and municipal authorities, and assesses the implications associated with these in terms of cost, risk and operational freedom. Using case studies from the UK and elsewhere, the session will provide insight into the lessons learned and implications for municipal and central government in terms of:

- The commercial and financial structures that may be used in financing waste infrastructure projects;
- Banking sector and contractor concerns associated the financial deliverability of waste projects, and specifically the risks associated with technology choice and practical solutions for managing these risks to both public and private sectors in a cost effective and efficient manner;
- Critical success factors in attracting strong international competition for waste projects in the Middle East

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**17-19 February 2008**

**Solid Waste Management in Jordan - Current Situation and Future Challenges**

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**Current Situation:**

- Quantities of MSW in Jordan
- Collection & Transport
- Method of Disposal
- Landfill Disposal Sites
- Waste Constituents
- Treatment of SW IN Jordan
- Private Sector Participation in Waste Management
- Common Practices in Society
- Future Challenges
- Main Future Objective
- Specific Future Objectives
- Role of MOE IN Solid Waste Management
- Negative Aspects of SWM in Jordan
- Recommendations

**Full Abstract**



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Management Exhibition & Congress**

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**Municipal Solid Waste Management at Amman City**

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**The current management plan consists of the following processes:**

1. Sweeping and cleaning (pre – collection): This process carried out by workers through streets sweeping and pre – collection, where the produced wastes are collected and dumped in the containers to be ready for the collection vehicles. Workers and supervisors are distributed over the 27 districts of the city as well the transfer stations and the landfill. The distribution over the district depends on the area, population, and activities upon the district. Sweeping workers and supervisors are working for 3 shifts per day.

2. Waste collection: carried out by many types of collection vehicles with different capacities. These vehicles are mainly consisting of rotaries compactors and hoists. Hoists are responsible for collecting the wastes that produced by large commercial centers and markets, while the small compactors of 2 ton capacity are mainly dealing with the narrow and small roads. Trucks and loaders are also involved in waste collection and cleanliness of special places such as parks, space lands and also for dealing with bulky wastes. The collection vehicles collect the waste through a well – defined routing system.

3. Waste transferring: Three transfer stations of different capacities are used for waste transferring. Wastes are transported to these stations by various collection vehicles. These stations are allocated at the east part of the city. A new transfer station at the west part of the city will be constructed soon.

4. Landfilling: Wastes are collected and transported to Ghabawi sanitary landfill, which is located at the eastern border of Amman City (37 Km) far from the city center. The landfill site has been selected within the highest international and WHO standards.

Cont...

## **General description for the landfill:**

The site is 2000 donoms area, owned by Amman Municipality. The average prevailing wind direction is west (south-west, north-west). This helps the transfer of possible gases and smells away from the population gathering west. The nearest population to the east is Azraq city which is located 60 km from the site. It is located about 23 km east of Amman ring road, through the site selection process (1999 – 2000) the location and the surrounding areas were owned by the Jordanian military, without any residential, historical or cultural land use, the nearest residential area is sited to 8 km at the west of the location. The area also was out of Amman municipality border. In 2000 the site has been confirmed by a governmental committee that represents all the governmental bodies and ministries, as well the stakeholders including the local community. Amman municipality expanded its administrative border at 2001 to be able to control the land use in the area. Thus, an extra 1000 donoms at the west of Ghabawi site (at the western border) have been owned by the municipality, to control the land use and to save enough land space for investment in solid waste management. The site is located in the semi arid zone with low annual rainfall (100 – 200 mm), and high evaporation percentage (more than 90 %).

## **Cost recovery mechanism**

There is a cost recovery mechanism established through which municipalities cover part of the direct operating costs of collection and disposal. Other general revenues cover the rest. This mechanism involves the waste collection fee being included as an item on the monthly electricity bill. This has been achieved by agreement between the Ministry of Municipal Affairs and the Electric Power Distributing Companies. The charge is levied per household. The solid waste fee constitutes about 6% of average monthly electricity bill. This approach to fee collection has been successful securing high collection rates.

Commercial / industrial establishments are charged 20% percent of trade license fees.

Regarding disposal, there is a disposal tipping fee paid by the municipalities and waste generators who bring their own solid waste to landfills for disposal. The fee is applied per ton of waste.

## **Solid waste management is a growing concern in Jordan.**

The level of municipal solid wastes (MSW) generated in Jordan is relatively high at 0.9 kg per capita per day (average).

MSW in Jordan includes a mix of domestic garbage, plastic, glass, metals in addition to hazardous and non-hazardous medical solid wastes. In general terms, MSW in Jordan is characterized by a high organic content, with combustible matter (consisting of paper, and kitchen garbage).

- In some societies, solid waste is no longer considered unwanted product of our daily life activities But it is considered a raw material in wrong place which could be of essential need for other activities whether for the same generators or others within the solid waste generated communities or outside of such communities
- By far the majority of waste (more than 90%) is managed through land disposal. Recycling is very limited and undertaken by the informal sector (private individuals, scavengers). Much of the recycling is done at the recycling sites. These operations are not regulated and expose workers to hazardous conditions. Sorting of the different types of solid waste at generation sources is not yet practiced in Jordan, so considerable amounts of recyclable materials are sent to final disposal sites. Some recycling initiatives and pilot projects undertaken by NGOs were very successful, as the public was very positive but were terminated. Recycling covers paper, cardboards, metal and plastic products.
- **Recycling Projects**
  - Ministry of Environment and GAM are now in the planning phase for a joint venture recycling project.
  - The main objective for this project is to introduce to the Jordanian people the separation at source practice.

Cont ....

Alike project but in smaller scale will be held in Irbid city

- Two MRFs are going to be structured in a capacity of 100 – 200 ton daily for each. These MRFs are going to be located in Al Shaa'er transfer station in Amman, and the other one will be in Ekeeder landfill in Irbid Municipality
- The implementation of the project is expected to be on 2008 budget

### **Supporting NGOs**

Since 1995 GAM is supporting Jordan Environment Society (JES) in implementing the pilot recycling project, by sending specialized employees to help in the survey and the awareness campaign and also in depleting workers and vehicles to collect and separate the recyclables

### **Supporting private sector**

In 2005 The Mayor had signed an agreement with Al Tadweer Company. Under this agreement GAM allocated 35 dunoms near Al Ghabawi land fill to build a dirty MRF with a capacity of 600 ton daily. In 2008 the MRF is expected to start working

### **Selling Gas from the Sanitary landfill**

Through the World Bank and under the umbrella of Kyoto protocols our counselors are preparing to sell the gas generated from the first cell and convert it into electricity.

### **Biogas plant**

- Using the funds from the UNDP the plant was established by the Biogas Jordan Company (owned by GAM) and the electric generation company at a capacity of 60 ton daily of organic waste and poultry waste and diary factory wastes.
- Twelve wells were duct in the closed dump site in Al Rusaifa in order to collect the generated gases from the waste
- Now the biogas plant is generating around 3.5 Megawatt

### **Jordanian Executive Privatization Commission**

GAM has requested a feasibility study of potential for PPP in recycling from the EPC. The study helped GAM in finding answers for the following questions.

How much waste is recyclable?

How much recyclable material can be recovered (the dry recyclables)?

How can dry recyclables be collected?

How are they recovered?

Is there a local market for the recovered dry recyclables?

The amount of recyclables

41% organic materials

13% paper and boards

2% metals

14% plastics

2% glass

28% other

The study suggests that we can increase the recovered recyclables to 30% in 10 years

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**The “Zero Waste” concept and the Arab World**

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The alarmingly steep waste generation rates in the Arab world coupled with the ominous future predictions for growth, calls for us to rethink the way we are managing our waste. Developing countries lack the resources and infrastructure to dispose of their waste by traditional means whereby most villages in rural areas still rely on uncontrolled burning of their waste. On the other side of the spectrum, wealthier Arab nations have become conscious of their responsibility to the environment and have installed state-of-the-art treatment and disposal technologies. Yet, the question to be asked is how effective and sustainable are these end-of-pipe technologies when consumption patterns in these countries are competing with Western nations.

Zero Waste, a relatively recent concept based on material management principles, may hold the key to our looming waste crisis, and can be adapted to both sides of the spectrum. The focus of decision makers in some developing and developed nations is slowly but steadily shifting to this broader and more sustainable solution – that of integrated material management or ‘Zero Waste’. Policy makers are questioning the logic behind focusing on disposal as a solution to wasted materials when it is more economical and environmentally sustainable to recover all discarded materials and gradually phase out those that are not “recoverable”. Total industrial systems, from design, extraction, production and distribution are being rethought.

The speaker will investigate the “applicability” of the principles of Zero Waste to the developing and developed Arab states. The lecture will recommend material management practices to achieve sustainable solution to waste by conserving our finite resources and eliminating unsustainable and polluting end-of-pipe disposal technologies.

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**Sensitivity Analysis of Adsorption Isotherms Subject to Measurement Noise in Data**

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Reflecting the importance of adsorption as a major water purification method, the main objective of this research was to perform a sensitivity analysis on some of the common adsorption isotherms subject to measurement noise in data. Even though most of adsorption isotherms have been derived based on some theoretical assumptions about the adsorption mechanism, they involve model parameters that need to be estimated from experimental measurements of the process variables. Specifically, for the Langmuir isotherm, which can be linearized in three forms, it was sought to determine which of these three forms would give the highest accuracy of the adsorption model parameters – maximum amount of adsorbate per unit weight of the adsorbent and the constant related to the affinity between the adsorbent and adsorbate. Another objective was to estimate the adsorption parameters using the nonlinear Langmuir model, and to compare their accuracy to the ones estimated using the most accurate linear form.

Furthermore, it was desired to examine the effect of noise magnitude on the estimation accuracy for the various Langmuir forms (linear or nonlinear) by varying the noise variance and the magnitude of the adsorption parameters themselves. To achieve this aim, MATLAB programming software was used to simulate functions for the estimation of the Langmuir isotherm model parameters using its nonlinear and three linearized forms. These functions were used to determine the best form for the estimation of the model parameters from noisy measurements by adding noise to data – which were generated from a pre-defined model – and then comparing the estimated parameters with the given ones. Then, the same procedure was repeated for different levels of noise (different standard deviations) and using models with different given parameters to study the effect of noise magnitude and parameters' values on the estimation accuracy.

Finally, the results of this work could be summarized as follows: One of the linearized forms of Langmuir model showed normal distribution and provided most accurate estimation of both model parameters. In addition, it was shown that when the noise content (standard deviation) increased on the data, less accurate estimates were obtained for both adsorption parameters. Finally, the estimation accuracy was more sensitive to the magnitude of the affinity constant than to the maximum amount of adsorbate in adsorbent; larger values of affinity constant result in higher estimation accuracy of both model parameters.

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17-19 February 2008

## Recycling

- Recycling of Industrial Solid Waste to produce cement units - **page 15**
- Recycling Concrete: A Possible approach to improve the environment - **page 16**
- Tyre Recycling in the European Union - **page 17**
- Lead Acid Batteries – Environmental Hazard, challenges.. - **page 18**
- A research on using pH, conductivity and temperature at electro-coagulation process control - **page 19**
- Bioremediation, Reuse-recycling - Tertiary Treatment of Metal containing Wastewaters using Aquatic microphyte Azolla - **page 20**
- Effects of Biomass Growth on Pressure Drop in Submerged Aerated Bioreactors - WASTEWATER - The Effect Of Ultrasonic ... - **page 21**
- Mass transfer and biodegradation of polycyclic aromatic hydrocarbons from nonaqueous-phase liquid contaminated soils - **page 22**
- Natural remediation of Groundwater quality in tsunami affected Coastal areas- Sri Lanka - **page 23**
- Initial Pumping Period In Barttle, North Iraq - **page 24**
- Experience with UASB Technology for Municipal Wastewater Treatment in India - **page 25**
- Evaluate of the Efficiency of Heavy Metal Removal in Wastewater Treatment Plants of hospitals in Mosul city - **page 26**
- Hazardous Waste Characteristics in Baghdad - **page 27**

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**Recycling of Industrial Solid Waste to produce cement units**

**Dr. Daad M. Daowd**

Assistant Professor Mosul Technical College

Waste minimization approach has been seen as the only sustainable means of dealing with the waste problem. Life cycle assessment is a developing environmental management technique. At every stage of any industry there can be material, energy and labor input. At each stage there may be waste that is treated or untreated before disposal to the environment. Within the cycle, wastes and retired materials may be re-used, re-manufactured or further processed (recycled) to minimize the net output.

Sugar beet fibers is a major fraction of solid waste produced from sugar industry, it is a residue remaining after the extraction of the juice. These natural fibers could be reused in concrete industry to produce fiber reinforced cement units ; it is made primarily of hydraulic cement, lime water , and discrete reinforcing fibers. The principal reason for incorporating fibers into a cement matrix is to increase the toughness, tensile strength, and improve the cracking deformation characteristics of the resultant composite.

The target of this research is to use the sugar solid waste industry (Beet fibers) to produce fiber reinforced concrete units after removing organic materials from it. Two types of mixes were used. Mix A is (1 cement part to 1.5 part of beet sugar by weight). While Mix B lime was used with cement as 1 part cement: 0.5 part hydrated lime 1.5 parts of beet fiber by weight. Calcium chloride was added as an accelerating factor while copper sulfate was used in the mix as antibiotic growth. The compressive strength of mix A cement units was 3.1 MP. At age of 28 days the modulus of rupture was 0.79 MP at the same age. While mix B results was 7.2 MP for compressive strength at age of 28 day and modulus of rupture was 7.4 MP at the same age. Then these units were exposed to natural climate condition (cold, hot, rain) for seven months with no change in properties. The other benefit of these units is light weight which means good thermal insulation.

The dry density of mix A was 1850 Kg/m<sup>3</sup> and for mix B was 1350 Kg/m<sup>3</sup>.

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**RECYCLING CONCRETE: A POSSIBLE APPROACH TO IMPROVE THE ENVIRONMENT**

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Many structures in the GCC countries are currently either reaching the end of their design life or were not constructed according to the specifications. This results in huge amount of concrete rubbles that are routinely discarded in landfill sites.

Therefore, it makes economic and environmental sense to seek alternative means of disposal of concrete from construction and demolition operations. Hardened concrete can be reclaimed during demolition and crushed into coarse aggregate that can be used as a substitute for crushed natural rock. The objective of this study is to determine the mechanical of recycled concrete. To achieve the objective, laboratory tests are carried out on concrete specimens made from recycled concrete aggregate following the relevant ASTM standards.

The variables that are considered in the tests include the properties of the recycled aggregates, percentage of recycled aggregates in the concrete mix, source of the recycled concrete, and target concrete strength. The recycled concrete specimen tests include compressive and tensile strengths, as well as water absorption. In general, the strength of recycled concrete can be 10–25% lower than that of conventional concrete. The main reason for this decrease in strength is due to the additional amount of water needed to achieve the same slump.

The drop in strength in the recycled concrete can be avoided if chemical additives are used to increase workability instead of adding more water.



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#### **Tyre (Tire) Recycling in the European Union**

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ETRA is the European Tyre Recycling Association. Founded in 1994 by European tyre recyclers, it has become a strong voice for the tyre recycling industry, ETRA maintains annual data on tyre arisings and collection systems, as well as on the treatments and the use of recycled tyre materials within the EU. An annual report is prepared with indications of current and future trend in material use.

Within the EU alone, tyre recycling has grown from 5% to almost 35% of arisings. Recycled tyre materials are seen as a valuable resource that can reduce reliance on virgin materials. They are used by over fifty different industries in both the public and private sectors for construction, roads, road furniture, environmental rehabilitation, erosion control, sports surfaces, children's play grounds, vibration mats, animal mattresses, solid wheels – among many others.

The benefits of recycled tyre materials include their high technical performance as well as their cost-effectiveness in comparison to more traditional products. The future is bright – with many new material, applications and products entering the mainstream.

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**Lead Acid Batteries – Environmental Hazard, challenges and best practices**

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**Abstract**

Millions of Lead Acid Batteries are being discarded each year, with the temptations of rising lead prices worldwide, these batteries are being collected and recycled in a primitive manner especially in third world countries, causing harm and fatalities to the workers and grave danger to the environment.

Lead is a major environmental challenge, Lead is a heavy metal -- that is, a metallic element that in pure form is heavy. Examples: lead, mercury, cadmium, tin, chromium, zinc and copper. Most heavy metals are extremely toxic because, as ions or in certain compounds, they may be taken into the body, where they tend to combine with and inhibit the functioning of particular enzymes. Minute amounts can have severe physiological or neurological effects. Improper handling, transportation, storage, disposal or recycling pose serious problems to the environment and wellbeing of people involved in such acts and the general public alike with tangible impact on the economy in health support services.

Proper recycling practices can reverse the harm into beneficial reuse of the earth's resources.

Keywords: Recycling, Batteries, Lead, Environment, Health, Technologies

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**A RESEARCH ON USING pH, CONDUCTIVITY AND TEMPERATURE AT ELECTROCOAGULATION PROCESS CONTROL**

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Electrocoagulation process (EC) is recently preferred to chemical coagulation process because of its some advantages such as the more stable and less sludge deposition, no need chemical additive, the fast and high efficient treatment. Controlling of the process with some parameters is important to get optimum efficiency and minimum energy cost. In the control of the electrochemical process, solution parameters showing ionic ingredients such as pH, conductivity and temperature which changes depending on reaction time can be used.

The study was realized for a medium age (12 years) landfill leachate sample, and followed COD removal rates while EC process at different current densities (30 and 50mA/cm<sup>2</sup>), pH (3.0 and 8.1raw) and electrode types (Fe-Fe and Al-Al). Their variations were obtained as 8.1 to 9.3 for pH, 19.7 to 18.6 for conductivity, and 21.5 to 33.2 for temperature during initial and after 30 minutes reactions respectively. Accordingly it was seen that obtained a correlation in a good fitness between COD removal data and the parameters data. This phenomenon shows that the relationship can be used in the automation of the control of this type electrochemical process.

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**Bioremediation, Reuse-recycling - Tertiary Treatment of Metal containing Wastewaters using Aquatic microphyte Azolla**

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On our planet, water is finite but renewable resource. With demographic changes and changing lifestyles, there is enhanced need for water. We use water for domestic, agricultural and industrial operations and Wastewaters originate from domestic as well as industrial sources. To have sustainable water supply it has become imperative to reuse what is termed as wastewaters. Experts predict that we can no longer have the luxury of using water once and sustainability in waters can only be achieved through wastewaters.

Safe use of treated wastewaters for irrigation purposes, gardening, landscaping and non residential purposes is being encouraged. However, the quality of wastewaters to be reused, has to be assured. Besides physical and chemical technologies for improving the quality of wastewaters, the biological processes offer much superior alternatives. The aerobic and anaerobic biological treatment processes have been efficient in bringing down the pollutant loads in wastewaters to acceptable levels. However, certain pollutants like heavy metals have to be removed during tertiary treatment. Wetland processes using natural plants and microorganisms offer most suitable alternatives for polishing of primary/secondary treated wastewaters.

Azolla, an aquatic fern has been studied extensively for its metal accumulating potential and its role in remediation of metal contaminated wastewaters. It removes heavy metals both by active and passive processes. The presentation will be made of studies on Chromium removal by aquatic fern Azolla. Chromium is toxic metal pollutant in wastewaters coming from tanneries. Potential of Azolla to remove Cr from its growth environment by active and passive processes was evaluated. Azolla was able to tolerate Cr stress and grow in presence of 10ppm Cr. It was able to remove Cr and accumulate it in its biomass in a batch process. However, under semi continuous process simulating stabilization ponds/ wetlands the removal was not as efficient. The results of studies on removal of Cr by Azolla from contaminated wastewaters will be presented and possibility of Azolla to be employed in wetlands and for tertiary treatment of wastewaters for Cr removal will be discussed.

**Full Abstract**

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**17-19 February 2008**

**Effects of Biomass Growth on Pressure Drop in Submerged Aerated Bioreactors**

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A semi-empirical model was developed to predict biomass-affected porosity, specific surface area and pressure drop as a function of the biomass concentration in two selected Submerged Aerated bioreactors (SABRs). Under similar conditions two bench-scale SABRs (1m long and 100mm diameter) were operated to treat an industrial wastewater, the first packed with porcelinaite rocks and the other with polystyrene grains at hydraulic loading rates of ( 0.1–3.2 m/h) and with BOD5 concentration of (110- 436 mg/L) .

Typical constant that can be used to estimate pressure drop for some of the most common design of SABRs were correlated. The proposed equations in porosity and specific surface area caused by biomass accumulation in SABR bed are based on macroscopic estimates of average biomass concentrations. In comparison to biofilm-based models, the macroscopic models are relatively simple to implement and are computationally more efficient.

The effects of biomass accumulation and distribution on pressure losses and removal efficiency of biological load in SABRs were experimentally studied. Localized biomass accumulation in the SBAF beds is the key factor increasing the pressure drop, which was caused by local bed clogging due to biomass growth. The highest pressure drops in the beds (porcelinaite rocks: 2,150 N/m<sup>3</sup> and polystyrene grains: 1115 N/m<sup>3</sup>) occurred where there were high biomass levels. The pressure drop varied nonlinearly with the amount of accumulated biomass and the amount of oxygen consumed. Porcelinaite rocks caused greater pressure drops, on average 2 times higher than the polystyrene grains. Compaction, as a consequence of biomass growth and porcelinaite rocks degradation increased the pressure drop in the porcelinaite rocks bed.

A comparison of the experimental and the predicted pressure drops showed that the model provided good estimates of biomass-affected porosity and pressure drop in the SABRs packed with spherical grains with even biomass distribution.

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**MASS TRANSFER AND BIODEGRADATION OF POLYCYCLIC AROMATIC HYDROCARBONS FROM NONAQUEOUS-PHASE LIQUID CONTAMINATED SOILS**

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At contaminated sites, nonaqueous phase liquids (NAPLs) such as crude oil, creosote and coal tar, often remain in contact with ground or surface water for long periods of time before or during any attempted remediation. During that time solutes such as aromatic or polycyclic aromatic hydrocarbon compounds are continuously released from the NAPL into aqueous phase causing ground and/or surface water contamination. The dissolution of individual PAHs from NAPLs into ground or surface waters could lead to aqueous concentrations exceeding environmental quality and health standards. The hazards of exposure of receptors to PAHs released from NAPLs often require the remediation of NAPL contaminated sites.

In-situ bioremediation is considered to be a promising technology because of its relatively low cost, low disruptive effects and because toxic compounds can be potentially mineralized to harmless products such as carbon dioxide and water by this technology. However the extent of clean up achieved with in-situ bioremediation is often unpredictable. The a priori prediction of bioremediation and other remediation technologies can only be improved by a better understanding of the physico-chemical and biological processes involved. The overall objective of this research is to evaluate, quantify and predict maximum achievable rates and end points of microbial degradation of PAH compounds for NAPL-contaminated solids, in column systems.

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**17-19 February 2008**

**Natural remediation of Groundwater quality in tsunami affected  
Coastal areas- Sri Lanka**

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Asian Tsunami occurred in 26th of December 2004 had big impact to the southern Sri Lankan coastal strip of groundwater. Almost all the open dug wells of the affected zone were heavily damaged and groundwater resources were heavily polluted. The previous studies conducted in the southern coastal belt after the tsunami indicates that the groundwater electrical conductivity (EC) increased from 300 to 5000 and more micro siemens/ cm. The principle objective of the present research study is to identify the variation and natural remediation of ground water quality in Tsunami affected southern coastal belt. The study was conducted during 2005 May to 2007 November in coastal belt of southern Matara district, which has been seriously affected by the tsunami waves. The research study includes monitoring network of 90 dug wells distributed over the Tsunami-affected coastal belt and location of the wells was detected with a GPS. Continuous monitoring of the water levels in the wells were conducted in monthly interval during the study period, and the water quality observed in respect to electrical conductivity (EC), total dissolved solids (TDS), pH and salinity. Groundwater quality changers and hydro geological maps prepared using the GIS packages. The results conclude that atmospheric precipitations, hydrogeological condition, geomorphology of the area are the main natural remediation factor to change the quality of groundwater. During the monsoon periods, monthly rainfall exceed 400 micro siemens/ cm and groundwater in the elevated areas from the coastal line EC values are decreased due to groundwater recharge from inland areas. In the some areas where low hydraulic gradient of the groundwater, EC values are not change considerably and remain 2000 to 3000 micro siemens/ cm.

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**Initial Pumping Period in Bartle, North Iraq.**

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**Hala Hikmat Nadhim**

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Assistant Engineer

Environment and Pollution Control Research Center

The present work aims to study the effect of alternation in providing water network on the water quality at Bartle area, north of Mousl city.

Fifteen samples were taken monthly from salamiya water plant and different popular areas in Bartle for the period started in January till the end of July. Field measurements of turbidity, Ph and residual chlorinewere carried out.

The mean value for the studied samples is achieved monthly for comparison with the effluent water from the Salamiya project and other areas using t-test analysis. Variation in water quality is drawn for the period of the study.

The study recreated high difference in turbidity and Ph values between the main project and other areas studied residual native chlorine value ranges between (0.4-2.5) mg/l with recognize difference between the Salamiya project and other studied areas. The lowest turbidity value 2.8NTU is recorded in January with Ph of 7.4, wherese; residual native chlorine has 0.4mg/l value in March. The highest value of turbidity and ph (7.2NTU and 8.5 NTU respectively) are recorded in March while the highest residual chlorine 2.5mg/l.

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**17-19 February 2008**

**Experience with UASB Technology for Municipal Wastewater Treatment in India**

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India has taken an edge over the other developing countries having similar climatic and economic conditions in the use of UASB (Upflow Anaerobic Sludge Blanket) technology for municipal wastewater (sewage) treatment. Study revealed that low investment cost, simple & low operation and maintenance cost, resource recovery in the form of biogas, better efficiency without any energy input are some of the appealing factors that led to wide implementation in the use of this technology in India. At present, about 23 full-scale UASB plants are in operation at various places in India with total installed capacity of about 9,85,000  $m^3/day$  (985 mld) and about 12 number are in pipeline which are likely to be commissioned within next 3-4 years. With financial assistance from JBIC (Japan Bank for International Corporation), the centralized nodal agency National River Conservation Directorate (NRCD) under the Ministry of Environment & Forests (MoEF), Government of India (GoI), formulated and launched a comprehensive action plan project for conservation of the river Yamuna under which 16 UASB sewage treatment plants (STPs) were commissioned in the period of 1999-2002. Experience shows that the present UASB reactor design and construction is quite different from the very first module of 5 mld treatment capacity that was constructed as a demonstration plant at Kanpur, India under the Ganga Action Plan (GAP) in late 80's. Except for plants under GAP, modular approach has been adopted for UASB reactors, which offers flexibility in operation. The discrepancies in the initial UASB plants were recorded and now a new breed of UASB reactor is available with respect to the design, operation and maintenance, and materials of construction. Initially, most of the UASB plants were provided with final polishing ponds as post-treatment unit, but now other options for the same are being explored. With stringent regulations that have come up, the post-treatment issue is yet to be addressed in these and upcoming plants. New alternatives like combination of UASB and constructed wetlands, membrane bioreactor etc. are being investigated to improve the water quality for organic pollution, solids and newly introduced coliforms parameter. This paper reviews the overall experience and implications of UASB technology in India. Institutional framework, technical aspects, design considerations, performance, operation and maintenance with special reference to the Yamuna Action Plan are discussed in this paper.

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**Evaluate of the Efficiency of Heavy Metal Removal in Wastewater Treatment Plants  
of hospitals in Mosul city**

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Hospital effluents are considered as one of the most important sources of river pollution due to its contents of heavy metals such as Cd, Ni, Pb, etc which arises from different processes inside hospitals and discharged to the river through the treatment plant.

The research focuses on the measurement of concentrations of some heavy metals that are likely to be found in effluents of three hospitals plants in Mosul city namely Al-Salam; hospitals groups, and Al-Khansaa. in order to assess the removal efficiency of the process and to estimate and compare the concentration of heavy metal from each plant with the Iraqi permissible levels.

Besides measuring concentration of heavy metals (Cu, Zn, Fe, Cd, Pb and Ni), laboratory tests to assess the wastewater quality were also conducted to measure (pH, E.C, COD, BOD, PO<sub>4</sub>, NO<sub>3</sub>, SO<sub>4</sub>, Cl<sup>-</sup>).

Results revealed that there was an increase in chemical oxygen demand (COD) as compared to biological oxygen demand (BOD) in the effluent water of the three hospitals; that may be attributed to high content of chemicals and toxic materials.

The efficiency of heavy metal removal was different among the three plants. Concentrations of (Cd, Pb, Ni and Fe) passes the maximum acceptable level of environmental specific effluents while (Cu, and Zn) concentrations were within environmental specific effluents. Phosphate concentration was found to increase due to the excessive use of detergents in the hospitals.

The efficiency of heavy metal removal in AL-Khansaa treatment plant showed a decrease as compared to plants of other hospitals because of the short retention time in the aeration stage.

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**Hazardous Waste Characteristics in Baghdad**

**Pilot Study: Hospital Waste**

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Infectious waste in hospital is generated during the diagnosis, treatment, or immunization of human beings or animals or in research activities in these fields or in the production or testing of biological. It may include wastes like sharps, soiled waste, disposables, anatomical waste, cultures, discarded medicines, chemical wastes, etc. These are in the form of disposable syringes, swabs, bandages, body fluids, human excreta, etc.

This waste is highly infectious and can be a serious threat to human health if not managed in a scientific and discriminate manner. It has been meanly determined that of the 100 kg of waste generated in a hospitals in Baghdad at range 16-28 kg would be infected.

During 2002 and 2006, six governmental hospitals in Baghdad were covered, included Baghdad teaching, Al-Shaheid Adnan, Al-Mansor, Al-Qadsiya, Al-Amam Ali and Ibn Al-baldi hospital. Not only the annual medical waste generation rate and its composition but also generation of some indicators correlating waste generation and hospital capacity were the objectives of the study. Therefore, the security situation, number of beds, occupancy rate of the beds, number of employees and staff, amount of medical waste and household waste generated per day, fuel consumption for heating, collection, deposition, transportation, and disposal of wastes, recycling applied, incineration plant capacity if available were questioned during the survey. In the composition research, amount and type of wastes generated were quantified together with number of patients per day, number of surgeries per day, number of births, number of x-ray photography and number of laboratory tests.

The main conclusion from this study is infection diseases and illnesses have already increased by 48% due to terrorisms and violent accidents and an accumulation of health issues, no system of hospital waste management in Baghdad, a lack of knowledge among health staffs, a lack of necessary supplies and facilities and a lack of connections among different ministries.

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17-19 February 2008

## Success Stories - Case Studies

- Recycling of Municipal Solid Waste in a Medium Size Indian Town: Practice, Market and Economics - **page 29**
- Solid Waste Management Issues for Northern Sindh (Pakistan) Cities - **page 30**
- Italian Cooperation - Lebanon Case Study - **page 31**
- Greenhouse Gases: The UAE Experience - **page 32**
- Environment, You, & Me: Responsibility lies within the spirit of the manufacture - **page 33**

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Kempinski Hotel, Dead Sea - Jordan

17-19 February 2008

#### Recycling of Municipal Solid Waste in a Medium Size Indian Town: Practice, Market and Economics

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This paper discusses the outcome of the study that was carried out with an objective to investigate the municipal solid waste management system of a medium size Indian town with special focus on recycling and reuse practices, which is presented here. For this work, Aligarh city, which has a population of about 0.7 million, situated 120 km southeast to the capital of India, Delhi was selected. The work covered extensive study on waste management system and its trade.

Field surveys, interviews and existing data helped in investigating the waste trade of this city and in evaluating the market mechanism and economics of this informal sector. Based on the study, it has been found that about 30% of total solid waste being generated goes to the recycling units in the city. Recycling is being done mainly for glass, metal, paper and plastic. Aligarh has about 78 different recycling units, which recycle 500 to 650 *tones per day*. Of that amount, 70 to 80 *tones per day* of recovered materials come from Aligarh while the rest from adjoining cities.

The informal sector plays a very important role in the recycling of municipal solid waste management. Most of the recyclable materials are segregated from other waste by the rag pickers and sold to middlemen or informal agencies. About 10800 people are employed in different recycling units. Study further revealed that about 700 rag pickers (children, men and women) are active in the area of Aligarh Municipal Corporation. These rag pickers, nowadays commonly called 'recyclists', picks up about 35 to 40 *kg* of waste on daily basis and earn Rs. 75 to Rs. 90 a day which is almost half the salary of the daily wagger employee and just sufficient for their livelihood. The value addition of each product from waste is done at every step of its processing. Metal waste is converted into bars and rods, which then are used for small construction works.

Kraft paper produced from waste paper is used for packaging etc. Similarly other materials are utilized for beneficial market. It could be concluded that informal recycling industry not only has good market and associated economy but contributing to waste volume reduction, collection, and daily living of recyclists. It is possible to organize the sector, but this may leave to unemployment and daily living to recyclists who belong to the poorest strata of the society.

The work also probes some other important aspects of recyclists such as their health, social issues, education etc.

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Management Exhibition & Congress**

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**17-19 February 2008**

**Solid Waste Management Issues for Northern Sindh (Pakistan) Cities**

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**Introduction**

This paper discusses the situation in Northern Sindh (Pakistan) cities where climate is relatively hot and municipalities do not have sufficient resources to handle solid waste.

**Abstract**

This study included cities of Sukkur, Larkana, Shikarpur, & Khairpur from the Northern Sindh (Pakistan). Current population of these cities is about 1.2 million which is projected to be doubled in 20 years. Similarly the produced waste is also foreseen to rise from existing 700 tonnes/day to 1500 tonnes/day. All these cities do not have enough human or financial resources to manage the solid waste system efficiently.

There are many models being suggested for improvement of the existing situation. However it should never be forgotten that any solution should be in accordance with local climate, socio-economic and culture constraints. The region is relatively hot with average temperature within 30 degrees Celsius for whole year. People are quite poor and there exists a strong feudal system in the region. Culture is mainly of extreme nature with extreme friendship and extreme enmity.

This hot climate provides various advantages for the solid waste management as compared to areas in cold regions. The high temperatures allow quick evaporation of the water content from the waste and thus reducing the smell problems and leachate flow. Recyclables present no more than 20% of the total waste under existing conditions. Almost 50% of this is sorted and sold at source and remaining is handled by local buyers.

All of these cities have un-even terrain with lot of ponds and shallow lands in the area. A very widespread practice for waste dumping is to dump the waste in shallow lands to get them available for construction. A small colony in Sukkur has been developed above the abandoned waste dump without any remediation or rehabilitation and situation is also similar for other cities of the region. A common belief that waste packed in a plastic bag when dumped becomes more stable than brick makes people to pay to the municipality drivers to dump waste at the selected site. However this practice is also destroying the marsh lands along the river banks.

Municipalities in the area are trying hard to cope with increased waste problem and some have chosen the privatization as an option. However the complex power and responsibility sharing system in the area is hindering the quick solutions. Unfortunately major players in solid waste in the country are not very interested in getting involved mainly due to issues like, less volume of waste produced, less recyclables, poor neighborhood and municipalities unable to pay for services. However there are some advantages also and most important of them is hot climate, allowing the development of dry landfill system which is more economical and easy to rehabilitate than conventional system.

**Full Abstract**

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#### Italian Cooperation - Lebanon Case Study

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In Lebanon, responsibility for waste management is assigned to municipalities. However, lack of funds, weak technical know-how, total absence of sanitary landfills and a weak tax system have caused most municipalities to pay only minimal attention to this issue, leading to a widespread environmental problem that will only worsen with time. The ROSS Program of the Italian Cooperation (Italian Embassy) decided to invest in the development of a sound solid waste management strategy in Lebanon and started several initiatives aimed at addressing the SW issue from production to disposal, in collaboration with Italian NGOs COSV, CISP and UCODEP.

The rehabilitation and strengthening of existing Selection-Sorting-Disposal (SSD) Units through provision of specialized equipment will be coupled with a wide "sorting-at-the-source" awareness campaign for the local populations and used as pilot in order to demonstrate that SW has to be sorted and managed as a resource. The thus-sorted waste will then be channeled into the rehabilitated SSD units where the non-organic waste will be further separated in plastic, glass, metal, fabric and batteries, whereas organic waste will be transformed into compost that will be constantly analyzed, monitored and certified.

A key aspect of the strategy is the search for profitability and reduction in management costs so that this improved system may last in time and the municipality will have a genuine interest in maintaining it. Therefore, part of the compost will be used locally while the remaining compost and the recyclables will be sold (through a bidding procedure) to various users and recyclers in Lebanon. Alongside these activities, the Environment Team of the ROSS program conducted a study of the SWM sector in Lebanon. Municipalities had been interviewed and a full market analysis of recyclable had been done. The results are encouraging and confirm the viability of the strategy described above.

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**17-19 February 2008**

**Greenhouse Gases: The UAE Experience**

**Noor Othman Alshaigy - Amal Rashed Alhassany**

Applied Ecology, Biology department  
United Arab Emirates University

Greenhouse gases present a threat to the environment all over the globe, including the United Arab Emirates (UAE). Especially because of the dependency of its economy on fossil fuel. Additionally, the economic boost of the region has caused a surge in fuel consumption for vehicles. Traffic congestion in Abu Dhabi, the UAE capital, for instance has caused nitrogen dioxide levels to exceed air quality in the outskirts and center of the city and surrounding the industrial areas. Furthermore, and in other parts of the UAE, pollution levels is either close to or exceed the air pollution guidelines where SO<sub>2</sub> levels are of a particular concern. The main pollution sources are the region's oil and gas and related heavy industries both on and offshore.

Substantial effort is being supported by the UAE government to reduce such pollutants. From 1995 to 2004, for instance, the UAE successfully reduced flaring of hydrocarbon gas that comes out from burning of waste gas or oil during testing or production processes from 7.5 down to 2.5 million cubic meters per day. Moreover, in 2003 the UAE introduced unleaded petrol on the local market as part of its program which involved 500 filling stations. Also the government introduced compressed natural gas vehicles into the transportation fleet, which will convert 20% of the most polluting fleet in Abu Dhabi to CNG by 2012. Additionally the government is switching to diesel fuel supply to only ultra low sulphur diesel by 2015.

In short, the UAE government is trying to minimize the negative impacts of its environmental challenges, while continuing its economic development.

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17-19 February 2008

#### Environment, You, & Me: Responsibility lies within the spirit of the manufacture

##### Laurie Adams

E'Terra Inn, Niagara Escarpment  
Bruce Peninsula, Canada

Laurie Adams speaks with knowledge from a pragmatic, 'hands on' perspective as a Project Manager, Builder and Researcher implementing the requirements and procedures set forth by the scientific academia, as well as the engineering and architectural industries. Through thought provocation, she engages co-workers, students and audiences to understand the impacts of the balancing-point in our changing world from environmental survival, economical outreach and ethics of the human spirit.

Governmental Institutions as well as governmentally subsidized industries located worldwide may feel pressured to adopt the "sustainable cause" seeking changes to human impact within their unique geographical regions thereby using techniques implemented in dissimilar regions without considering cultural and political differences. By considering geography, geology and history, the utilization of a building philosophy entitled 'Balance within the 3 E's of ecology, economics and ethics' creates a new working platform for the future.

Laurie Adams built E'Terra Inn, a prototype using the 3E's wherein the balance of lifecycles and everyday decisions are considered regarding site disturbance and sanitation issues; "tested" waste management using new technologies; water treatment with wells or community water systems also addressing the "pharmaceutical soup"; construction with responsibility and common-sense assessments; foundations of good energy efficiency – looking at efficient technologies that work in application not theories; spend research time wisely; use existing programs as guidelines from cohesive architectural design and engineering practices; human consumption and learning to live within the change of 'living green' on a planet where the climate continues to change and challenge us.

Ask yourself where does this responsibility of balance begin?

- A sense of place – our home

- Dynamics of you and me

- Environment, economics and ethics

- Elementals – earth (geography), air to breathe, water (sanitation, drinking) and fire (energy)

- Basic needs – adequate housing, sanitation, health care (proper food and medicines) education, and jobs

- Directions for our built environment to engage the six senses.

E'Terra is an award winning, self-sustaining 8,400 square foot multi - level facility located in the core area of the Niagara Escarpment World Biosphere Reserve on the Bruce Peninsula, Canada. This environmentally sensitive getaway is crafted of stone and timbers, nestled amongst the cedars on 100 acres of private forest, overlooking Georgian Bay.

E'Terra Inn provides exclusive year round first class services and is dedicated to the conservation of the Bruce Peninsula's rich natural diversity. Interestingly, E'Terra lies in a unique geographical region that requires systems that consider extremely cold temperatures whereas Jordan lies in a unique geographical region that requires systems that consider extremely hot temperatures. Despite the differences of geographical locations of both regions, both locations require similar operating systems.

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**Kempinski Hotel, Dead Sea - Jordan**

17-19 February 2008

## Sustainability in the Waste Field; Waste Recovery & Waste to Energy

- Environmental Reform in Jordan: a Trigger for Sustainable Change - **page 35, 36**
- Practicality and Preliminary Procedures for Pollution Prevention - **page 37**
- Solid waste to energy conversion by thermal-chemical process - **page 38**
- Toxic compounds emission from fossil fuels in compression with alternative energies - **page 39**
- The environmental awareness for better management - the urban .. **Page 40**
- Sustainability Science: Research opportunities and the emergence of a new meta-disciplines - **page 41**
- Infusing Environmental Themes into Existing In-Service Teacher Education Programme in Science - **page 42**
- Sustainable Land Management: Policy Implication and Sectoral Achievement - Sustainability - **page 43**
- Environmental Education - Short Courses on Environmental Pollution Control - **page 44**
- Study of capturing emitted CO<sub>2</sub> in the form of hydrates in tubular .. **page 45**
- Health Risks from Microbial Growth and Biofilms in Drinking Water Distribution Systems in Palestine - **page 46**
- The Simulation Geological & Environmental for water Shortage from Jifara Plain Basin Northwest of Libya - **page 47**
- Monitoring Hydrocarbons Levels in Al-Riqqa Urban Area (Kuwait) Using Modern Environmental Techniques: Investigating the Effect of Petroleum Downstream Industries on the Outdoor Air Quality - **page 48**
- Air quality and potential health hazards of gamma-emitting radionuclides and heavy metals associated with contaminated dusts in Amman, Jordan - **page 49**
- Application of the Laser at measurement of particle size distribution in Tehran atmosphere (Iran) - **page 50**
- The effect of different hardwood and conifer tree species, physiographic features and land use in decreasing the noise pollution - **page 51**

## **RecShow '08**

### **Middle East Recycling, Waste & Environmental Management Exhibition & Congress**

**Kempinski Hotel, Dead Sea - Jordan**

**17-19 February 2008**

#### **Environmental Reform in Jordan: a Trigger for Sustainable Change**

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#### **Home-made Reform Agenda**

Jordan is a semi arid country that lies between three continents namely Europe, Asia, and Africa which gave the country diversity in habitats with an enormous biodiversity. Jordan is facing a number of challenges including those associated with water and wastewater, energy, land degradation, unplanned urbanization, waste management ..etc. In addition to a dedicated chapter for environment in the National Agenda – our national strategic roadmap whose ultimate purpose is to achieve sustainable development through a transformation program that puts Jordan on a trajectory path toward fast economic growth and greater social inclusion, several legislative acts have been adopted to address environmental challenges; namely, the new Environment Protection Law (No. 52 for 2006) and the amended Agricultural Law (No. 44 for 2002).

In his opening remarks at the World Economic Forum (May 2007), His Majesty King Abdullah II highlighted three key challenges that our Region needs to tackle among which are environment and sustainability of natural resources. A couple of days before that and in the Petra III Noble Laureates Meeting, His Majesty stressed the need to prepare initiatives in areas of core concern – education, economic progress, health, the environment; and to think out of the box to ignite tremendous innovation.

In Jordan, the leadership and the Government believe it is about time to become proactive rather than reactive and support innovative ideas and technologies to ensure a sustainable pattern of development. It is about time for people and civil society organizations to have a say and action in protecting their surrounding environments. It is undoubtedly the time to reform the whole environment management system.

Jordan has embarked on a multifaceted agenda of social, economic, and political reforms, with the aim of building a modern state based on economic vitality with substantial potential for growth and prosperity, political inclusion, and social stability. Jordan's reform agenda includes legislative, administrative, and judicial reforms to enhance the efficiency of the public sector, enhance investment environment, and ensure the strict and transparent implementation of the rule of law. Legislative reforms included amending and enacting numerous laws and regulations, as well as streamlining of investment related laws. As for monetary and fiscal reforms, efforts have been undertaken by the Government of Jordan in order to strengthen fiscal discipline, reform tax system, maintain stable exchange rate, and sustain high levels of foreign currency reserves. In the area of good governance, political and social inclusion, Jordan is moving ahead with a wide range of reforms aimed at increased transparency, broadening public participation

Cont ...

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**17-19 February 2008**

#### **Environmental Reform in Jordan: a Trigger for Sustainable Change - continued**

in the decision making process, promoting judicial independence, promoting greater accountability of the government, and combating corruption.

As part of its overall environmental reform process, the Hashemite Kingdom of Jordan is developing and reforming the legal and institutional frameworks for environmental management and compliance. This is of particular significance to Jordan as a signatory to most of the Multilateral Environmental Agreements and to a considerable number of free trade and association agreements including those with the United States and the European Union. In a marked step towards enhancing environmental enforcement, Jordan launched its Environmental Rangers Directorate in June 2006 aiming at gathering all enforcement-related efforts under one qualified agency. In addition, the establishment of Jordan Environment Fund is underway. The fund shall contribute to harnessing the impact of technological innovation and capital investment to promote energy and water resources utilization and means of production that are cleaner, more efficient, cheaper, and more sustainable, and will be open on a competitive basis and within pre-specified criteria to a variety of interested sectors. In addition, the Ministry is developing policies and mechanisms to enhance public participation in environmental decision-making as well as private sector involvement in environmental management. The 'young' Ministry of Environment – established in 2003 – is leading the process in cooperation with various concerned stakeholders and with the support of several international donors. Undoubtedly, strong – yet upgradeable - institutional and regulatory frameworks are a key enabling base for sustainable environmental management systems including waste. This brief paper summarizes the Jordanian Ministry of Environment's institutional and legal strengthening efforts that made us a successful model across the region, as well as some of the strategic directions necessary to sustain and improve the process.

#### **Highlights on Reform Aspects:**

1. Legal Upgrading
2. Policy and Planning
3. Institutional Capacity Development and Decentralization
4. Permitting and Guidance
5. Inspection and Enforcement
6. Economic and Soft Instruments
7. Role of Non-governmental Organizations
8. Role of Private Sector
9. Research and Innovation

**Full Abstract**

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#### Environmental Requirements for Pollution Prevention using Recycling Processes

##### **Eng. Hamed Trawneh**

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##### Introduction:

Refining is considered one of the most important industries in the world but any industry has a certain impact on the environment. The level of pollution resulted from refineries depends on the quality of crude oil processed and the precautions for pollution prevention taken. The main aim of refineries is to produce a wide range of distillate products which have many uses. This is accomplished through the following:

1. Distillation: atmospheric and vacuum.
2. Cracking: using heat or catalysts.
3. Treating: intermediate and final products.
4. Blending.

##### Refineries has an impact on the following :

- Air
- Water
- Ground

##### 1. Environmental impact of air resources:

###### 1.1 Air: Fixed source (able to be measured and treated):

- Carbon monoxide
- Sulfur dioxide
- Nitrogen oxides
- Ammonia
- Hydrogen Sulfide
- Metals
- Volatile organic materials
- Particulate matter PM<sub>1</sub>

###### 1.2 Air: Fugitive emissions:

..... abstract

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**17-19 February 2008**

**Solid waste to energy conversion by thermal-chemical process**

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the paper presents an analysis on thermal treatment for municipal solid waste neutralization with energy recovery together with an original thermal-chemical characterization installation and procedure. The experimental research focused on disintegration mechanisms of MSW treated samples under pyrolysis and vapour-gasification conditions both at laboratory and pilot scale with respect to operating parameters, final products and pollutants emission.

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**17-19 February 2008**

**Toxic compounds emission from fossil fuels in compression with alternative energies**

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Transportation sources are one of the leading contributors to hazardous air pollutants. The internal combustion engine emits a large percentage of pollutants, but gasoline and diesel in the liquid form also contribute chemical pollution in the form of vaporization of the fuel as it heats and cools within the gas tank. Polycyclic aromatic hydrocarbons (PAHs) are a group of organic compounds made up of two or more fused benzene rings in linear, angular or cluster arrangements. PAHs are considered highly toxic for human beings and several of these compounds are carcinogenic, mutagenic or teratogenic. A major source of PAH in Tehran related to traffic and the number of gasoline and diesel vehicles.

During nearly a 1-year period (throughout 2005) a comprehensive study has done in Tehran area in 21 stations. Sixteen PAHs were detected in all the samples for 2-6 rings PAHs. Concentration of individual compounds was found in the range of 0.76 - 10997.2 ng/m<sup>3</sup>.

Of the total analyzed PAHs (8089.35 ng/m<sup>3</sup>), the low molecular weight PAHs were the dominant species, corresponding to 87 % (7038.35 ng/m<sup>3</sup>), while high molecular weight PAHs representing 13 % (1051.00 ng/m<sup>3</sup>) of the total detected PAHs.

Results of PAHs analysis indicated that existence of several of low molecular weights, like Fluoranthene, Fluorene and Phenanthrene confirm role of diesel oil emissions in Tehran's atmosphere.

Biodiesel, a renewable energy source is the name for a variety of ester-basted oxygenated fuels (11% oxygen by weight) made from vegetable oils: sunflower, safflower, soybean, palm, cottonseed, rapeseed or peanut. The lifecycle production and use of biodiesel produces approximately 80% less carbon dioxide emissions, and almost 100% less sulphur dioxide. Combustion of biodiesel alone provide over a 90% reduction in total unburned hydrocarbons, and a 75-90% reduction in aromatic hydrocarbons. Biodiesel further provides significant reductions in particulates and carbon monoxide than petroleum diesel fuel. Based on mutagenicity tests, biodiesel provides a 90% reduction in cancer risks.

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**THE ENVIRONMENTAL AWARENESS FOR BETTER MANAGEMENT  
THE URBAN ENVIRONMENT**

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The environment, composed of elements having complex relations and composing a setting of life for the human being. The city constitutes his material support containing his interactive agents.

The interest of environmental problems takes his source of a spectacular cities development , that is at a time consumers of resources and emitters of harmful pollutant, which interrogates processes of urban areas production. facing challenges of the environmental quality, urban growth puts in reason two essential factors, on the first hand a regimentation that is not adapted to economic, social and spatial changes, and on the other hand behavior of urban actor towards this environment.

The balance recommended between the economic and social development and the environment can make himself in charge without an efficient hold of environmental composite in the harnessing of a way permitting an urban development in a sustainable development perspective. This fact, the environment, must be an essential composite in all urban operation either are geographical or temporal context, passing the instantaneous preoccupations concerning decontamination of the urban perimeter to his protection and his enhancement.

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**SUSTAINABILITY SCIENCE: RESEARCH OPPORTUNITIES AND THE EMERGENCE OF A  
NEW METADISCIPLINES**

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Changes in the discipline of environmental science and engineering (ESE) are reviewed and a case is made for continued growth of a new metadiscipline of Sustainability Science. This new field embraces economics, social processes, environmental processes, and industrial ecology.

Research opportunities and examples of previous successes are discussed in the areas of: (1) sustainability metrics, (2) coupling of industrial ecology, economics and environmental impacts, and (3) decision support for individual, organizational and societal choices. Multiple skills and capabilities required to support the new metadiscipline of Sustainability Science are summarized.

It is clear that pollution prevention and industrial ecology alone are not sufficient to achieve sustainability, because even systems with efficient material and energy use can overwhelm the carrying capacity of a region, or lead to other socially unacceptable outcomes. A critical aspect of Sustainable Science will be to understand the flow of information that supports and motivates the decisions which control material and energy flows. This will consequently affect system sustainability, and it is this integration that will motivate many of the advances in our field.

**Full Abstract**

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#### **Infusing Environmental Themes into Existing In-Service Teacher Education Program in Science**

##### **Dr. Shahid Hussain Mughal**

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Environmental education has become an important and growing area of educational research. An environmental perspective allows students to understand the importance of science for the society and the environment, to develop a sense of inquiry, and to think creatively about the solutions to environmental problems. Teachers have a vital role in ensuring that environmental education is implemented effectively.

One of the purposes of my research study was to explore the opportunities for environmental infusion in the existing Science teacher education program, and to understand the perceptions of a science teacher educator, of how he experienced the possibilities and challenges of environmental infusion in his teaching of science topics.

My research was designed in a qualitative paradigm; within this paradigm, I employed action research. My primary sources of data were interviews, and classroom observations, together with secondary sources such as document analysis and unstructured conversations. Major findings from the study revealed that the science curriculum of in-service teachers' training program contains a fair amount of environmental content in it.

This include information on the relationship between living and non-living things (Simple Food Chains), Factors determining weather, rate of evaporation, Exploring ways in which living things adapt themselves to their natural environment( migration, hibernation, camouflage), Erosion, and forms of energy as a sources of electricity.

These concepts are loaded with the basic information rather than the skills needed by the learners to enable them to have a positive approach towards the environment, for the purpose of resolving, or helping to resolve, environmental issues. The study further indicated that infusing environmental content in science was very challenging because environmental issues are complex. Building a sufficient knowledge base of science teacher educators is very essential while discussing and handling environmental issues.

In the light of the findings, the study recommended the infusion of environmental concepts in all subjects of teacher education. The study also recommended the training of teacher educators in environmental education, on a massive scale. Science-based environmental education is required at every level of education to take informed, effective, and on the spot decisions. The study recommended the incorporation of skills in science textbooks that would help learners to take initiatives about the solution of environmental problems.

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**17-19 February 2008**

**Sustainable Land Management: Policy Implication and Sectoral Achievement - Sustainability**

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Present investigation deals with the "Sustainable Land Management: Policy Implication and Sectoral Achievement". It was conducted from the period of three years (July'2003 to June'2006) in plain-land and wetland. The investigation was designed with land management system and degradation due to inadequate existing policies and improper implementation of existing laws.

The present study has observed that there are many laws and government policies to manage the land but most of these laws were not implementing.

The land use pattern has been changed and increased land-using. The excessive land-use and improper land-use change are causing land degradation. The socio-economic problems are also rising due to improper land management.

The population is much more than the affording capacity of the area. The people need foods, shelter and others from the limited land. The farmers are trying to produce much food from the limited land resource. They are using chemical fertilizer, insecticides, HYV seeds and other harmful things in agricultural land without considering its consequences and future. But there are not laws and policies to stop or to reduce of these harmful activities. Impact of these laws and policies on agriculture environment and other environmental sectors examined and found that due to these laws agriculture production increased significantly but there are some adverse effects such as wetland degradation and deforestation due to conversion of these lands into agriculture. There are no enough provisions in existing laws and policies to mitigate these problems. It is also found that the existing laws and policies are inadequate to cope with the environmental problems such as decreasing fertility.

The proper laws, acts, regulations, government policies are not being implemented properly which is a reality. So we must prepare a proper and sustainable land management policy that causes into effect for our better future.

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**17-19 February 2008**

**Environmental Education - Short Courses on Environmental Pollution Control**

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Worldwide concerns over issues such as waste management, climate change, water supply, and food contamination make Pollution Control a topic that is foremost in many countries, and especially in the fast-growing nations of the Middle East.

The Open University, in the United Kingdom, a leader in distance-teaching, offers a Diploma in Pollution Control which equips practitioners with the technical know-how they need to address issues related to control of pollution due to water, wastes, noise and air. The Diploma comprises two Courses, each taken over one calendar year. Practitioners in industry often do not have the time for such extended study. Taking this into account, the subject specialists who produced the material for the Diploma in Pollution Control are able to offer short, one-week Courses, at client's premises, to cover pollution control in each of the four fields (i.e. water, wastes, noise and air) of importance in the world today. Up to 15 trainees can be taught at one time, making this a cost-effective way of developing staff. The wide-ranging subject matter available in these Short Courses will be outlined in this Paper. The Short Courses comprise face-to-face lectures, and Workshops. Attendees will be presented with the relevant Open University course texts, which are written in a very clear, readable format, ready for independent study. They will also receive an Attendance Certificate.

Society of America Meeting at Salt Lake City, USA, in June 2007.

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**17-19 February 2008**

**STUDY OF CAPTURING EMMITTED CO<sub>2</sub> IN THE FORM OF HYDRATES IN A TUBULAR REACTOR**

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Stabilizing atmospheric CO<sub>2</sub> concentration needs the development of the novel methods for capturing it in the form of permanent reservoirs. Amongst the proposed methods is the CO<sub>2</sub> storage in the form of hydrate. In this study a method is established for CO<sub>2</sub> conversion to hydrate. This method can be applied to bioethanol plants which produce CO<sub>2</sub> as a byproduct of ethanol fermentation. In this regard, a tubular recirculating flow reactor is developed for the study of CO<sub>2</sub> hydrate formation. The experiments are carried out at 279 (K) and 3.5-4 MPa to determine the rate of CO<sub>2</sub> hydrate formation. Further, a model was developed for prediction of the rate of hydrate formation based on the mass transfer, crystallization and thermodynamic concepts. The predicted hydrae formation rate was compared to the experimental data to validate the model prediction. The comparisons have been carried out at different operating conditions which good agreements are noticed.

Keywords: CO<sub>2</sub> hydrate; Tubular reactor; Gas storage; Sequestration; Air pollution

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**17-19 February 2008**

**Health Risks from Microbial Growth and Biofilms in Drinking Water Distribution Systems in Palestine**

**Khalid Swaileh, PhD1, , Rashed Al-Sa'ed, PhD2,  
Rateb Hussein, MSc1 and Rasmi AbuHelu, PhD3**

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Water distribution systems play a major role in determining the final quality of potable drinking water. Pathogenic and toxigenic microbiological agents in drinking water can cause diseases and death to consumers. The health risks associated with these pathogens range from viral and bacterial gastroenteric diseases to infections such as hepatitis A and giardiasis.

Drinking water samples (n=24) with a volume of 1000 ml were collected in sterile bottles from the distribution systems at different regions in Ramallah District in Palestine. Moreover, swabs from the inside of the water distribution system of the same regions were taken. Sample were filtered through 0.45µm membrane, and various tests were conducted on each sample including total coliform, fecal coliform, heterotrophic plate count, *Pseudomonas auroginosa* count, fecal streptococci, sulfite reducing anaerobes, residual chlorine, turbidity, ammonium and nitrate. For protozoa, microscopic examination was done for the swabs transported in saline from the biofilms within the same day of sampling.

Four samples out of 12 (33%) were containing too many to count for HPC. The remaining 8 samples were containing an average of 26 CFU/100 ml. Five samples out of 12 (42%) were found to contain total coliform. The number ranged between 0 and 80 CFU/100 ml. The average number of total coliform was 14 CFU/100 ml. Summer samples were found to have more total coliforms than winter ones. Neither winter nor summer samples were found to contain fecal coliforms. Residual chlorine ranged between 0.08-0.55 mg/L (average 0.24mg/L) and nitrate concentrations in drinking water samples ranged between 4.79-16.26 mg/L (average 9 mg/L). PCR results of the DNA extracted from a total of 25 samples of different origins (pipes water, tanks water and biofilm swabs) revealed that 23 samples were not containing the microbes (bacteria and protozoa) considered in this study.

Our results show that the drinking water quality in the distribution system of Ramallah District is of good quality and water intermittent supply should be avoided when possible, as this was associated with an increase in total coliform and turbidity.

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**17-19 February 2008**

#### **The Simulation Geological & Environmental for water Shortage from Jifara Plain Basin Northwest of Libya**

##### **Mr. Fathi Elost**

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Libya is among the countries suffering surface water supply shortage Due to scarcity of rain and snow era, and the formation mature, the vast Libyan lands (1.700.000km) of which 95% arid lands, in this study our focus will mainly be on Jifara blain basin with such a complicated geological formation higher to the south and lower to the north with extreme slop towards the sea, this area was exposed to cleave movement resulted in two fractures, the first fractures heading north-east toward Tunisia borders as for as Jabal Abu-kirsh , 100 to 200 meters , the second fracture is heading west and called , the greater Azizia elevate , such movement led to fold and slop towards the sea forming three rock units :

1 -Mountain front sequence extending from homes to missiles to the west where it includes garish formation constituting sand lime sediments, such sediments formed water reservoirs of great subterranean water reserves.

2 - Mountain front sequence extending east and west to Tunisian borders, this line of sequence includes Abu-gailan and Abu-shaiba being covered by sand and limestone soil sedimentary containing underneath lime sediments it is around 700 meters over sea level, this formation also contains deep and wide gulfs including Mjineen and Essirt valleys being the main feeder to most north west area.

3 -Hadba surface sequences include the 4th era formations scattered in most edges and centre of the area with rock masses in which much low water exists. It is believed that such rock units moved back to its present place by reason of different erosion factors, the basin is believed to be covered by lime and sand rock that led to the birth of lime water accumulations reaching 2.4x1610cubic km. Also the occurrence of low level water reservoirs scattered in the centre of the basin which was exposed to up and down and fracture movement contributed to the lowering of the north part of the basin most parts of this basin have been flooded by sea water during the Miocene and Oligocene resulted in the formation of rock Hollows consisting large quantities of water most of which are accumulated in the sea it is also believed that there is a large water basin branching from Jifara plain, it is also believed that the low level in the underground reservoirs is attributed to the low level of the north part of the basin where water flows from the south part towards the lower north part to flow into the sea water forming fresh water reservoirs inside the sea if we examine the way taken by water during the water cycle we find the movement indicates that it originates from sea to land , then land to sea again , once again it is believed that most countries will produce fresh water from sea in future as a result of water cycle of water returning to its original source.

The 4th era sediments are considered to have contributed to the basin surface and underground features formation during Holocene containing water carrying sediments such as Quaser El-haj formation consisting of lime and grain rocks where reservoirs of Al-Azizia Abushaibs and Abu-Ghailan are located where water is being pumped from Miocene layer as well as gargarish

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**17-19 February 2008**

**Monitoring Hydrocarbons Levels in Al-Riqā Urban Area (Kuwait) Using Modern Environmental Techniques: Investigating the Effect of Petroleum Downstream Industries on the Outdoor Air Quality**

**S. M. Al-Salem, A. A. Al-Fadhlee' A. A. Al-Haddad**

**Abstract**

Al-Riqā urban area is one of the major residential estates in Al-Ahmadi governorate (Kuwait) which is known for its adjacent petroleum facilities. The main objective of this communication is to assess the outdoor air quality of the investigated area in terms of Hydrocarbon levels in the ambient. The data analyzed was gathered from a continuous monitoring station situated in Al-Riqā area.

A series of concentration roses were established in order to study the behavior of Total Hydrocarbons, non-Methane Hydrocarbons and Methane gases in the ambient.

45° spans were used to execute the roses coupled with wind roses to study the predominant winds affecting the area.

The Southern downstream facilities (i.e. Three refineries belt, Petrochemical complexes, Cottage and small industries etc ....) were identified as main contributors to the total ambient load of Al-Riqā.

**Keywords:** Al-Riqā urban area, Kuwait, outdoor air quality, Petrochemical, Total Hydrocarbons.

**Full Abstract**



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17-19 February 2008

#### **Air quality and potential health hazards of gamma-emitting radionuclides and heavy metals associated with contaminated dusts in Amman, Jordan.**

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#### **Introduction**

This paper discusses the air quality and pollutant in Amman, Jordan during 2001-2002, and the potential health hazards associated with those pollutant.

About 400 dust samples, collected from the air, all year around in 6 locations in Amman and Al Rusaifa in Jordan. In addition of 110 Street dust samples have been collected twice, in winter and summer 2001, from the city of Amman, Jordan. These samples have been subjected to heavy metals analysis and the activities of gamma-emitting radionuclides have been measured in order to measure and assess their health hazards and relationship with published trigger or action levels. The street samples show higher normal radioactivity values than the limit of 0.3 mSV/yr of the ECRP 135, 2003 standard for all Amman areas. No difference could be found between winter samples and summer samples which suggest that seasonality has no impact on the activities and that their sources are continuously present. The dust collector measurements for one whole year of dust gathering from different wind directions show no values of the radioactivity effective dose lower than the 0.3 mSv/yr level recommended by the ECRP 135, (2003) standard, and 24% of them are higher than the 1 mSv/yr in the ECNSE, (2000) standard. This could be due to the local radioactivity in potential source materials, but the possibility of wind transporting radioactive dusts from surrounding countries cannot be ignored.

Heavy metals analysis results for the street samples show that only east Amman area has high concentrations of heavy metals. The Pb mean value was above the trigger value of the ICRCL 1990 and Dutch guidelines 1994/5 but below the threshold values of DEFRA and EA 2002 in winter and Ni and Cr above the ICRCL 1987 trigger levels, but lower than the other standards in summer which may suggest a local source.

In the dust collector samples; 90% of the heavy metals mean values were above the trigger values of the ICRCL 1987. Almost 26% of the heavy metals mean values were above the trigger and threshold values of the above standards. Around 35% of the heavy metals maximum values and 8% of the minimum values were above the trigger and threshold values of all the above standards. The dust collector samples were different from the streets sample groups regarding their heavy metals concentrations. They show much higher values and a wider distribution. This may suggest anthropogenic sources, seasonal effects and particle size related concentration effects for almost all the heavy metals.

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#### Application of the Laser at measurement of particle size distribution in Tehran atmosphere (Iran)

##### F.Halek, A.Kavousi

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Tehran is located in a valley at the foot of the Alborz Mountains in northern Iran (35 degrees latitude north). Urban expansion in Tehran resulted from a high rate of population growth and rural-urban migration combined with a strong tradition of centralization in the capital. Much attention has been focused on particulate phase components of exhaust fumes due to possible acute and chronic respiratory effects. Tehran urban areas with poor ventilation, unfavorable geographical and meteorological conditions, and a high number of emission sources including motor vehicles experience air pollution problems especially suspended particles.

The ability of fast measurement of particulate materials including aerosols has consequences and impact on the environmental sciences, on human health, and on industrial process control. The first objective of this study was to measurement of PM in twenty sites in central areas in Tehran. Other objectives were to obtain detailed measurements of aerosol size distribution in Tehran's atmosphere during the 2006.

One of the most widely used methods in sizing particulate materials is the laser diffraction (L.D). The Portable Aerosol Spectrometer model 1.108 GRIMM is capable of simultaneous measurement of inhalable, thoracic and respirable dust in different size ranges from 0.3 up to 20  $\mu\text{m}$ .

The model 1.108 uses a light scattering technology for single-particle counts, whereby a semiconductor-laser serves as the light-source. This spectrometer measures in real-time the particle size and mass distribution, generated through a scattering laser light, than permitting a validation/correlation by weighing the sampled dust collected on the integrated filter. It is capable to read EPA Environmental PM<sub>10</sub>, PM<sub>2.5</sub> and PM<sub>1.0</sub> values of 15 channels in real time and particle size distributions in count modes of 15 channels at same time simultaneously. To obtain the role of motor vehicles in particulate emissions, Hourly samplings were done for 10-12 hours (8:00 am to 18:00 – 20:00 pm).

In all samples the mean of PM<sub>10</sub> and PM<sub>2.5</sub> are high (77.53  $\mu\text{g}/\text{m}^3$  and 19.32  $\mu\text{g}/\text{m}^3$  respectively). The highest value of PM<sub>10</sub> -average in sampling period- was found in Vali-Asre Square station 159.62  $\mu\text{g}/\text{m}^3$  and the highest PM<sub>2.5</sub> concentration is found 37.93  $\mu\text{g}/\text{m}^3$  at the Enghelab Square station. Air pollution in Tehran atmosphere are higher than the U.S. National Ambient Air Quality Standards (NAAQS) for particulate matter less than 10 and 2.5  $\mu\text{m}$  (PM<sub>10</sub> and PM<sub>2.5</sub>). In most stations mean of PM values were more than standards (annual standard 50  $\mu\text{g}/\text{m}^3$  for PM<sub>10</sub> and 15  $\mu\text{g}/\text{m}^3$  for PM<sub>2.5</sub>).

The average of PM<sub>1.0</sub> concentration was 11.72  $\mu\text{g}/\text{m}^3$  and the highest PM<sub>1.0</sub> were found 20.32  $\mu\text{g}/\text{m}^3$  at the Enghelab Square.

**Full Abstract**

**RecShow '08**

**Middle East Recycling, Waste & Environmental  
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**Kempinski Hotel, Dead Sea - Jordan**

**17-19 February 2008**

**The effect of different hardwood and conifer tree species, physiographic features and land use in decreasing the noise pollution**

**Dr. S. M. Hosseini (Associate Professor)**

Vice- president for Academic Affairs

Faculty of Natural Resources

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One of the most important roles of green space is decreasing the noise pollution. The noise pollution is affecting the human life due to its increase result of urban areas development.

This research was conducted in order to study the effect of different hardwood and conifer tree species, green space, physiographic features and land use in decreasing the noise pollution in Northern Iran. The measurement was performed in summer season with an amplifier and a sound meter of HD9019 model in different types including 8 stations in 25, 50 and 100 meters distance between noise sources and sound meter with 5 replications.

The results were analyzed using one way ANOVA and Duncan multiple range test. The results showed that the slope has a significant effect on decreasing noise pollution. The trees density showed a significant relationship with decreasing noise pollution. The most decreasing in noise pollution was finding in hardwood stand with 47.2 db decrease.

**Full Abstract**

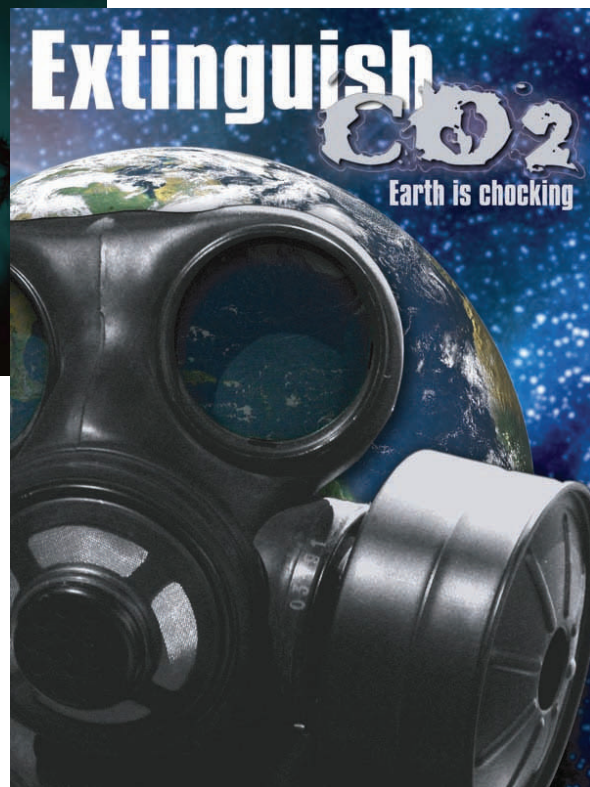
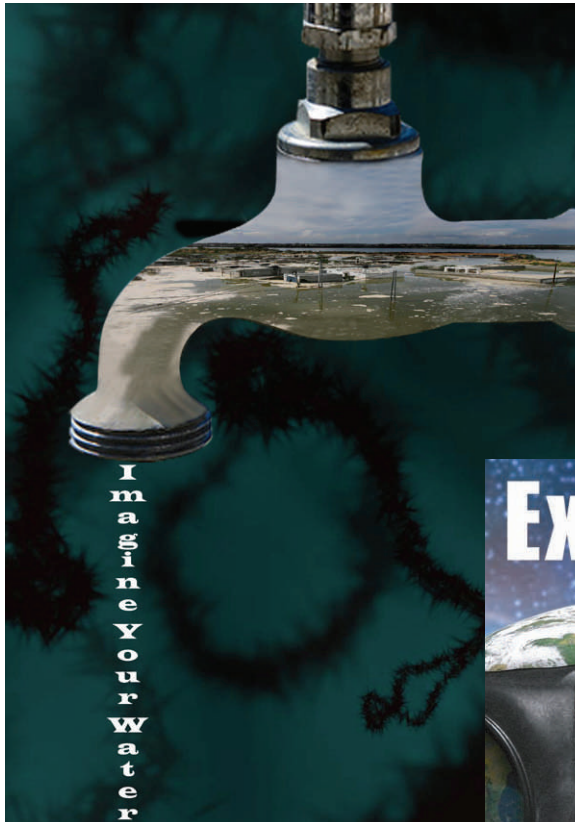
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**Poster Session**



## **RecShow '08**

### **Middle East Recycling, Waste & Environmental Management Exhibition & Congress**

**Kempinski Hotel, Dead Sea - Jordan**

**17-19 February 2008**

#### **Agenda**

##### **Sunday Feb. 17 at 09:00 - 12:00 Hrs:**

- Room A - Training sessions on Integrated Solid Waste Management
- Room B - Training sessions on Recycling

##### **Sunday Feb 17 at 12:00 Hrs**

- Keynote speech by H.E Dr. Khalid Al Irani - Minister of Environment
- Presentation by Dr. Mohamed Al Khashashneh  
Director of Hazardous Substances & Waste Management Directorate  
Head of the conference committee
- Presentation by EMAAR
- Lunch

##### **Sunday Feb 17 at 14:00 - 18:00 Hrs:**

- Room A - Training sessions on Case Studies - Success Stories
- Room B - Training sessions on Sustainability in the Waste Field

##### **Monday Feb 18 at 09:00 - 13:00**

- Main Room: Presentation on integrated waste management

##### **Monday Feb 18 at 14:00 - 18:00**

- Main Room: Presentations on Recycling

##### **Tuesday Feb 19 at 09:00 - 13:00 Hrs**

- Main Room : Presentation on Case Studies - Success Stories

##### **Tuesday Feb 19 at 14:00 - 18:00**

- Main Room : Presentations on Sustainability in the Waste Field

##### **NB1:**

FREE shuttle buss will be available at the Holiday in Hotel, Amman daily at 07:00 on Feb. 17, 18, 19 morning, will return Kempinski Ishtar to the Holiday In at 18:30

##### **NB2:**

Daily lunch at 13:00 at the Main Room level  
Breaks twice daily at the Main Room Foyer

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**Conference Committee**

**Dr. Mohammed Khashashneh - Conference Chairman**

Director of Hazardous Waste & Waste Management Directorates  
Jordan Ministry of Environment.

**Eng. Hala M. Al Nobani**

Under Secretary for Health and Environment Affairs Assistant office  
Greater Amman Municipality

**Dr. Mohammed Alshafie**

Department of Infrastructure and Environment  
DAR AL-OMRAN Planners. Architects. Engineers

**Dr . Aida H. Jokhosha**

College of Architecture and Art - Digital Photography  
**University of Petra**

**Eng. Hamed Tarawneh**

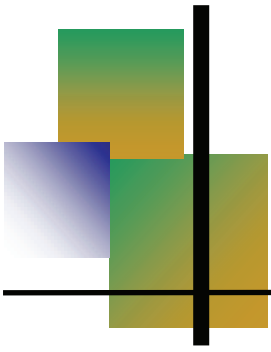
Head of Environmental Department  
Jordan Petroleum Refinery Co.,

**Dr. Abdellatif Alshafie**

PhD Waste Management, Head of Hazardous Waste Management Department,  
AL-NASSER GROUP

**Mr. Walid Hikmat - Conference Organizer**

Middle East Economic Engineering Forum - MEEF



## **RecShow '09**

**Middle East Recycling, Waste & Environmental  
Management Exhibition & Congress**

**Kempinski Hotel, Dead Sea - Jordan**

**17-19 February 2009**

**Following the unprecedented success of the first Middle East Recycling, Waste and Environmental Management Congress expressed in tangible participation of national, regional and international researchers, scholars, educators, consultants, business entrepreneurs and officials from various governments and authorities, RecShow '09 the Second Middle East Waste and Environmental Management Congress is to take place in the same venue and dates in 2009.**

**Please check the conference website for updates.**

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