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## **The 4<sup>th</sup> National Sludge Treatment, Disposal and Reuse Technologies and Market Development Conference**

26 – 27 May, 2010  
Nanjing, P.R.China

### **1. Background and Purpose**

The Chinese delegates who attended the ACEDP Lake Tai Wastewater Treatment & Recycling (WWTR) Study Tour to Australia expressed their great interests to a new Australian sludge disposal technology – Hydro Thermal Upgrading (HTU) during their tour in December 2009. The HTU technology was jointly developed by Earth Systems and Commonwealth Scientific and Industrial Research Organisation. Mr. John Sanderson, Senior Environmental Engineer of Earth Systems made a specific presentation on HTU to the Chinese delegates in the study tour.

Based upon the outcomes from the former WWTR Australian study tour and the WWTR review being conducted in Suzhou and Huzhou last October, it has been identified that sludge treatment is currently one of the main issues and a big challenge to the ongoing sewage treatment plants (STP) and wastewater treatment plants (WWTP) in the Lake Tai basin. In hence, the Lake Tai project is drafting a follow up activity to conduct a sludge reuse trial on the basis of HTU technology to determine if its technical feasibility and basically cost-effectiveness to be applied into the STPs and WWTPs in Suzhou and Huzhou.

The 4<sup>th</sup> National Sludge Treatment, Disposal and Reuse Technologies and Market Development Conference (NSC) is a designated annual sludge conference supported by the Ministry of Environmental Protection and the Jiangsu Provincial Government, aiming to communicate & provide those new technologies & solutions to the sludge treatment and disposal, as well as discuss the current challenges and technical bottleneck being faced by the research institutes and the WWTPs. Earth Systems representing Aus Lake Tai Cluster was invited to participate in the 2 days conference and it did act as a good platform for the Lake Tai team to introduce and popularize HTU technology. Meanwhile, the ACEDP Lake Tai project, and the HTU trial were also be introduced to the participants on the NSC.

### **2. Participants and Important Presentations**

The NSC was organized by the National Energy and Environment Association who invited Earth Systems China staffs Mr. Henry Wang and Mr. Samuel Liang to attend. Also, the organizers welcomed Earth Systems to present some new sludge treatment or disposal technologies based upon its experiences in Australia. More than 100 participants from government authorities, universities and research institutes, WWTPs, and environmental engineering firms attended the conference in Nanjing Yishiyuan Hotel. On behalf of Aus Lake Tai Cluster, Mr. Henry Wang was honored to make a presentation of “*Hydro Thermal Upgrading (HTU) – a New Australian Sludge Disposal Technology*” on the NSC on May 27<sup>th</sup>.



There were totally 16 diverse presentations focusing on sludge treatment and disposal. The contents of the presentations included government policies and regulations, outcomes from scientific research and new technologies or technical improvements. The details of the speakers and their speeches are listed in the following table.

Presentation Title	Speaker/Position	Agency/Organization
Opening Speech	Mr. Wang Yuqing Vice Director	The Committee of Population, Resources and Environment CPPCC
The Chinese Legal Framework and Guidelines in Supporting Sludge Treatment and Disposal	Mr. Lv Ben Vice Division Director	Department of Science, Technology and Standards Ministry of Environmental Protection
Sludge Treatment and Disposal Conditions and its Management Policies in Jiangsu Province	Ms. Huang Wenping Senior Engineer	The Solid Waste and Hazardous Materials Registration & Management Center Jiangsu Environmental Protection Department
An Overview of the Characteristics of Activated Sludge Particle	Mr. Wang Dongsheng, Professor	Research Centre of Eco-Environmental Sciences, Chinese Academy of Sciences
The Sludge Incineration Research and Application by Zhejiang University	Ms. Zhang Liyan Vice President	Energy Engineering Design Institute Zhejiang University
Case Studies of Veolia's Sludge Incineration	Mr. Chen Xiaohua Technical director	Veolia Water (Beijing) Co.

Presentation Title	Speaker/Position	Agency/Organization
Technology		
Research and Case Studies of Sludge Drying and Dewatering Technologies	Mr. Zhao Youcai Professor	Environmental Science and Engineering College Tongji University
WWTP Sludge Disposal and Utilization Technologies	Mr. Chi Xianglei Vice Manager	Beijing BMEI Co.
An Introduction of a New Wet Air Oxidation Sludge Disposal System	Mr. Gu Weidong President	Jiangsu Academy of Macroeconomic Research
An Introduction of a New Sludge Drying System	Mr. Ma Xueming Director	Suzhou Zili Chemical Industrial Co.
An Introduction of Sludge EDR Dewatering Technology	Mr. Cai Liang Chief Engineer	Korean Renewable Resources Co.
An Introduction of Fluidized Bed Incinerator developed by SouthEast University	Mr. Chen Xiaoping Professor	Energy and Environment College SouthEast University
Sludge Minimization Principle and Application	Mr. Feng Quan Vice Dean	Department of Chemistry Tsinghua University
An Introduction of SACT Sludge Fertilization Technology	Mr. Zhang Yong Director	Beijing Machinery Technology Development Co.
An Introduction of a New Sludge Dewatering Agent	Mr. Liu Weihai Senior Engineer	Hunan Research Institute of Chemical Industry
Hydro Thermal Upgrading (HTU) – a New Australian Sludge Disposal Technology	Mr. Henry Wang Senior Environmental Engineer	Earth Systems China

### 3. Notes of Key Presentations

#### 3.1 Opening Speech

*Mr. Wang Yuqing, Vice Director of the Committee of Population, Resources and Environment, Chinese People's Political Consultative Conference*

Currently, China has reached the capacity of annually treating more than 100 million tones of wastewater which had met the objectives of the 11<sup>th</sup> National Five-year Plan. However, it is now a heavy pressure to treat and dispose the sludge with the annual amount of more than 30 million tonnes. Compared with wastewater treatment, sludge treatment and disposal technologies are relatively lagging. Some key issues to the ongoing STPs and WWTPs in sludge disposal are as follows.

- ◆ The WWTPs that had constructed on-site sludge treatment & disposal facilities are still in a low percentage;
- ◆ Short of funds in sludge treatment and disposal;
- ◆ Cost of landfill disposal is continuously rising;
- ◆ Composting method is unstable; and
- ◆ Up to 70% of sludge is not well treated.

As such, the Chinese government is attaching more importance to the sludge and will add its investment in the 12<sup>th</sup> National Five-year Plan. It is noted that the total investment during the next Five-year Plan in environmental protection industries will reach to RMB 3.1 trillion, and new technologies development and application in sludge treatment and disposal will definitely be a priority area. China is developing technical innovations in sludge disposal by itself, as well as seeking overseas advanced technologies and solutions.

### **3.2 The Chinese Legal Framework and Guidelines in Supporting Sludge Treatment and Disposal**

*Mr. Lv Ben, Vice Division Director of Department of Science, Technology and Standards, Ministry of Environmental Protection*

Mr. Lv briefly introduced the Chinese legal framework, guidelines and standards that being used in sludge treatment and disposal. He noted that the environmental technologies approaches have become an important aspect of protecting and monitoring environmental compliance in China. He also introduced several newly issued standards and guidelines including *Technical Guideline of Sludge Treatment and Disposal for Municipal Wastewater Treatment Plant (on trial)*, *Guideline on Best Available Technologies of Pollution Prevention and Control for Treatment and Disposal from Municipal Wastewater Treatment Plant (on trial)*, and *Technical Policies for Sludge Treatment and Disposal and Pollution Prevention in Town Sewage Treatment Plants (on trial)*.

### **3.3 Sludge Treatment and Disposal Conditions and its Management Policies in Jiangsu Province**

*Ms. Huang Wenping, Senior Engineer of the Solid Waste and Hazardous Materials Registration & Management Center, Jiangsu Environmental Protection Department*

Above all, Ms. Huang summarized the current status, experiences and challenges in sludge disposal in Jiangsu Province. The percentage of the sludge disinfection has exceeded 85% in Jiangsu, which covered almost all the cities and counties. She emphasized that the provincial government had already set severe and strict regulations and procedures to the WWTP sludge composting because of the obvious drawbacks such as vacant land occupation, heavy metal, and odor. She noted that incineration and other innovative approaches could be promising ways to dispose the sludge in the future, which were also encouraged by the Jiangsu Government. On the basis of the situations, the Jiangsu Government has issued the *Rule of Jiangsu Province on Prevention of Environmental Pollution Caused by Solid Waste*, which stipulated the collection of sludge disposal fee in Jiangsu.

It is strictly prohibited to transfer the sludge cross-region in Jiangsu, as it is regarded as one of the hazardous wastes and need to comply with the hazardous wastes disposal procedures. In hence, a registration system is periodically conducted on a three-month basis. The STPs and WWTPs are obliged to manage their commissioned disposal companies. If any improper and/or

illegal sludge disposal approaches occurs, the local government authorities and environmental protection bureau should take effective measures to cease the disposal or treatment.

### **3.4 The Sludge Incineration Research and Application by Zhejiang University**

*Ms. Zhang Liyan, Vice President of the Energy Engineering Design Institute Zhejiang University*

The Energy Engineering Design Institute Zhejiang University is developing a new sludge technology based upon the fluidized bed incinerator. The temperature of the incineration is at about 850°C and the process realizes desulphurizing and denitrification in the fluidized bed which will not generate air pollutants, like dioxin and furan. It is demonstrated that the new “3T Rule” (temperature, turbidity and time) is well undertaken to control the generation of dioxin. The running cost for incinerating the sludge is about 140 RMB per tonne.

### **3.5 Case Studies of Veolia’s Sludge Incineration Technology**

*Mr. Chen Xiaohua, Technical Director of Veolia Water (Beijing) Co.*

Mr. Chen’s presentation was focused on the general information of sludge treatment and disposal technologies, and Veolia’s capacities and experiences in sludge incineration. Special case of Chinese sludge is high water content (75%) and low volatile solid (55%). Veolia’s experiences identified that pre-drying process combining with incineration was the most reasonable incineration approach for Chinese sludge disposal via case studies in Qingdao and Shenzhen. However, he also noted that the cost was expensive, the running cost was 200 – 220 RMB/per tonne of dry sludge. If considering the cost of disposal of byproducts ash (hazardous materials), and the cost will increase to 300 – 400 RMB/per tonne of dry sludge. Veolia has mutual dryers applying into pre-drying process, including thin layer turbo layer, rotadisc dryer, paddle dryer and horizontal thin film dryer.

Furthermore, Mr. Chen Xiaoping, a professor from SouthEast University delivered a similar speech on sludge incineration. The SouthEast University is one of the major institutes that doing incineration studies in Jiangsu Province.

### **3.6 Research and Case Studies of Sludge Drying and Dewatering Technologies**

*Mr. Zhao Youcai, Professor of Environmental Science and Engineering College Tongji University*

Prof. Zhao made a comparison between landfill and other disposal solutions, and analyzed the advantages and disadvantages respectively, including fertilization, landfill, incineration, and fermentation. He stood at the point that landfill approach was the best and most feasible measure to dispose sludge in China.

A new dewatering agent developed by Tongji University that can significantly reduce the water concentration in excessive sludge were also introduced.

### **3.7 An Introduction of SACT Sludge Fertilization Technology**

*Mr. Zhang Yong, Director of Beijing Machinery Technology Development Co.*

Beijing Machinery Technology Development Co. has the capacities in sludge fertilization technology. Mr. Zhang noted that the SACT system they developed can help to convert the sludge into useful and environmental-friendly fertilizer without generating odor pollution. SACT system has been successfully applied in many cities and some northern provinces in China. The deodorization equipments are also included in SACT system.

### 3.8 Hydro Thermal Upgrading (HTU) – a New Australian Sludge Disposal Technology

*Mr. Henry Wang, Senior Environmental Engineer of Earth Systems China*

The HTU Technology was jointly developed by Earth Systems and Commonwealth Scientific and Industrial Research Organisation. It is generated from the energy reuse strategy and to some extent meets the expectations of future development of sludge disposal. Thermochemical solutions provide a potential approach to realize the energy reuse from sludge or other biomass. The thermochemical solutions include supercritical water gasification (SCWG) and HTU, with different reaction temperatures, pressures and products. A series of lab-based trials is planning to be conducted in Australia, demonstrating the technical feasibility from both SCWG and HTU processes. It is reported that outputs from HTU process include crude bio-oil, condensable gas, water, and ash.

Mr. Henry Wang made some examples in his presentation and summarized the advantages of this technology as follows.

- ◆ No pre-drying process;
- ◆ Carbon dioxide captured as a near-pure liquid;
- ◆ Completely remove of pathogen or pathogenic bacteria;
- ◆ Generate clean water;
- ◆ Compared with landfill, it saves land resources;
- ◆ Generate crude bio-oil which can be further refined into bio-diesel;
- ◆ Unlike traditional incineration, the reaction does not generate air pollutants; and
- ◆ The reactor is smaller in space than the incinerator.

Henry also introduced the planning HTU trial on the basis of ACEDP Lake Tai Water Pollution Treatment Project, as well as the basic information of AusAID funded Australia China Environment Development Partnership (ACEDP) during his presentation.



Based upon the presentation, a strong discussion was followed among the participants and noted that the HTU technology did attract them a lot.

#### **4. Conclusions**

The purposes of participating the NSC are almost met including introduce our ACEDP Lake Tai Project, present the HTU technology and know some update sludge treatment and disposal information. It has been confirmed that HTU technology was welcomed and understood by the participants and it can be done some trials and studies in China. Some potential cooperation could be relied on the outcomes from such trials and studies.

According to the outcomes from the NSC, the Aus Lake Tai Cluster enhances its confidence in successfully conducting the HTU trial, accumulate knowledge in sludge treatment and disposal, and will work actively to get involved into the Chinese sludge market in the future.