INTRODUCTION ON THE MANAGEMENT OF HAZARDOUS WASTE IN VIETNAM

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I. Waste Generation

Industrial Waste

- 2004 forecast: 3.2 million tons (0.5 million tons hazardous) in 2010
- 2008 report from 35/63 provinces: 7.5 million tons (0.7 million tons hazardous)

70% hazardous industrial waste arising from the Southern Key Economic Zone

Healthcare waste

- 2004 forecast: 75 thousand tons in 2010
- 2008 report from 35/63 provinces: 1.79 million tons

II. Legal Framework in Vietnam

1. The National Strategy on Environmental Protection (2003): covering all fields of environmental protection, including hazardous wastes management, application of environmentally friendly technologies and environmental pollution treatment and recovery.
2. The Law on Environmental Protection (amended in 2005) stipulates that:

   - Hazardous waste (HW) mean wastes containing elements that are toxic, radioactive, imflammable, explosive, abrasive, contagious, poisonous of other harmful

   - The Ministry of Natural Resources and the Environment is responsible for management of HW

   - The Ministry of Construction, in collaboration with the Ministry of Natural Resources and Environment, responsible for technical criteria and guide of designing HW landfill.

II. Legal Framework in Vietnam

3. Decree 80/2006/NĐ-CP, regulates all stages of the hazardous wastes life-cycle,.
4. Circular No 12/2011/TT-BTNMT of MONRE.

- Generators of HW must register with provincial Department of Natural Resources and Environment (DONRE) and must transfer waste to licensed transporters and treatment facility operators.
- HW collectors, transporters, and treatment facility operators (including recyclers) must apply for professional license.
  - Within one province: license issued by DONRE
  - Inter-provinces: license issued by MONRE
- No transportation permit anymore
- Incinerator with capacity under of 100 kg/h not allowed

II. Legal Framework in Vietnam

5. Vietnam National Technical Regulation on HW thresholds QCVN 07: 2009/BTNMT: used to identify whether a suspicious waste is Hazardous or not (specified in Annex 8 of Circular No 12/2011/TT-BTNMT)
6. Vietnam National Technical Regulation on emission of health care solid waste incinerators QCVN 02: 2008/BTNMT
7. Vietnam National Technical Regulation on emission of industrial waste incinerators QCVN 30: 2010/BTNMT
8. Vietnam Construction Standard on hazardous solid waste landfill design TCXDVN 320: 2004
9. Vietnam National Standard on HW warning signs TCVN 6707: 2009
10. Legal documents are being developed:

    - The Decision to be issued by the Prime Minister which requires the manufacturers and importers of Electrical and Electronic Equipment to have responsibility on collection of their products when they become e-waste.

    - National Technical Regulation on co-processing of HW in cement kiln: to be issued in December 2011.

III. Situation of HW management in Vietnam

- 96 companies of HW transport and treatment are licensed by VEA (44 combined companies, 49 transportation companies, and 3 treatment facilities).

- As of August 2011, treatment capacity of facilities that are granted by VEA is 960 thousands ton/year. Real volume of waste treated by those facilities is 130 thousand ton/year. Capacity is not enough for waste generated due to:
  - Capacity of some kinds of waste is over the need, such as waste oil, lead batteries, …
  - Treatment capacity of some kind of waste such as POP, PCB is not low.
  - Some facilities has high capacity but do not have enough waste to treat due to price offers..

IV. HW treatment technologies in Vietnam

TT	Technology	Number of applied companies	Number of systems	Capacity
1	Incineration(static incinerator with two combustion chambers)	21	26	50 - 2000 kg/h
2	Co-processing in the cement kiln	2	2	30 tons/h
3	Landfill	2	3	15.000 m3
4	Solidification	17	17	1 - 5 m3/h
5	Waste oil recycling	13	14	3-5 tons/day
6	Waste fluorescent tube treatment	8	8	0,2 tons/day
7	E-waste treatment	4	4	0,3 - 5 tons/day
8	Lead batterries reclamation	6	6	0,5 - 200 tons/day

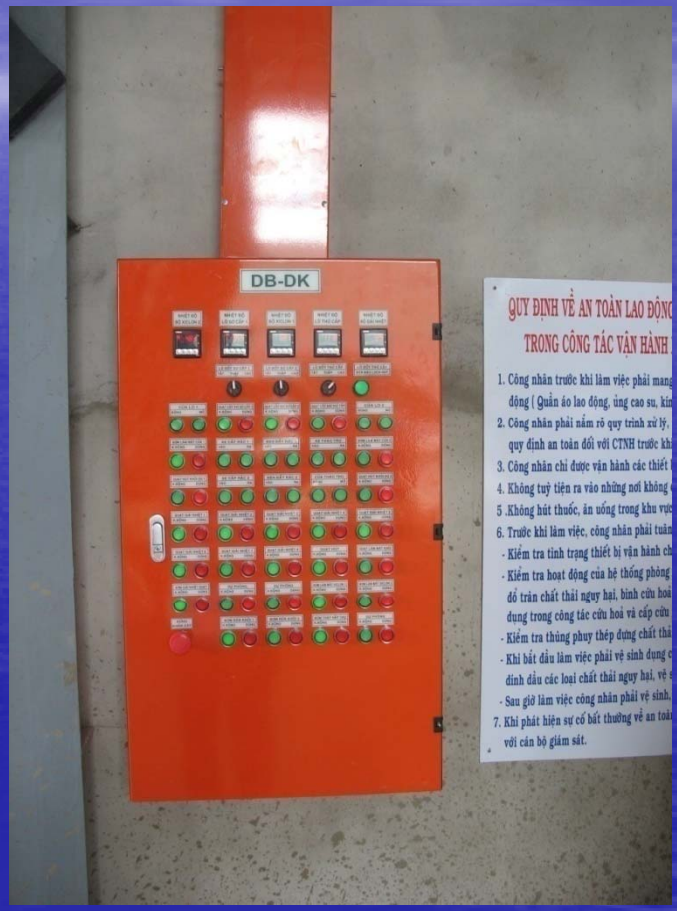
IV. HW treatment technologies in Vietnam

1. Static incinerator with two combustion chambers

- Characteristics: The primary combustion chamber (400-800^{o}C), the secondary combustion chamber (1100-1300^{o}C). Some incinerator have an additional combustion chamber after the secondary combustion chamber. The incinerators are equipped with exhaust gas treatment system and heat exchanger
- Advantages: Simple technology, available, reasonable investment cost, easy to operate, treatment many types of HW
- Disadvantages: Burning in batches so the economic efficiency is not high, need more time at startup and shutdown the incinerator, process control is manual, difficult to burn sludge and POPs
- Solution: Remove ashes. slag during combustion to prolong the operation time, install continuously automatic monitoring system, enhance the automatic waste feeding system and control system

Combustion chambers

Controlling box and cooling system



Stack and gas treatment equpment

IV. HW treatment technologies in Vietnam

2. Co-processing in the cement kiln

- Characteristics: Destruction temperature is over 1300ºC. Cylindrical furnace rotates around an axis. The rate of waste loading is about 30 tons/h. Exhaust gas treatment system includes cyclone (crude dust filtering), electrostatic precipitator/cloth bag (small sized dust filtering), then use the method of alkali absorption.
- Advantages: High capacity and destruction efficiency, treatment many types of HW such as PCB
- Disadvantages: Capacity of HW treatment depends on the production of cement and the rate of loading. The waste feeding is quite complicated.
- Solution: Equip with loading system for each group of HW and control the waste loading

Cement kiln and waste feeding system of Holcim Company

IV. HW treatment technologies in Vietnam

3. Landfill

- **Characteristics: Landfill is designed based on TCXDVN 320: 2004 (hazardous solid waste landfill design) and Landfill Technical Guidance issued by Decision No 60/2002/QD-BKHCNMT on 7th, August 2002 of the Minister of Science, Technology and Environment.**
- **Advantages: Isolate HW which is not capable of treatment with other technologies, high capacity, can be dug up for treatment if having appropriate technology in the future**
- **Disadvantages: Large areas, waste can not be treated thoroughly; need long-term monitoring after closing the landfill, ensure the strict conditions of area, distance to residential areas**
- **Solution: Need revising and editing the current technical standards relating to the actual conditions**

HW landfill of URENCO

IV. HW treatment technologies in Vietnam

4. Solidification (concretion)

- Characteristics: Cement additive is used for solidification of inorganic HW such as incinerator ashes, slags from metal refining. Two types of solidification technology: forced compression and normal solidification (poured concrete).
- Advantages: Simple technology, available, easy to operate; economic efficiency (can make production of construction materials)
- Disadvantages: Safe treatment of for inorganic HW only , need spaces to store the solidified material
- Solution: Control the type of HW which need to be solidified (ensuring to be inorganic), monitor the output product to ensure that it do not exceed the HW thresholds QCVN 07: 2009/BTNMT, use all of the output product to avoid making an another mass of solid waste should be controlled.

Different solidification equipments

IV. HW treatment technologies in Vietnam

5. Waste oil recycling

- Characteristics: Different technologies
  - Oil distillation (fractional distillation and simple distillation),
  - Oil water separation by mechanical method (centrifugation) and heat. Fractional distillation used commonly.
- Advantages:
  - Simple distillation technology: Simple equipment, easy to manufacture, install and operate, low investment
  - Fractional distillation technology: good quality of recycled oil, saving resources, thorough treatment of waste oil.
- Disadvantages:
  - Simple distillation technology: Product quality not high
  - Fractional distillation technology: High investment cost, complex operation
- Solution: Simple distillation technology need to be installed additional temperature control system, ensuring temperature control, minimizing the risk of fire/explosion.

Fractional distillation system of waste oil recycling

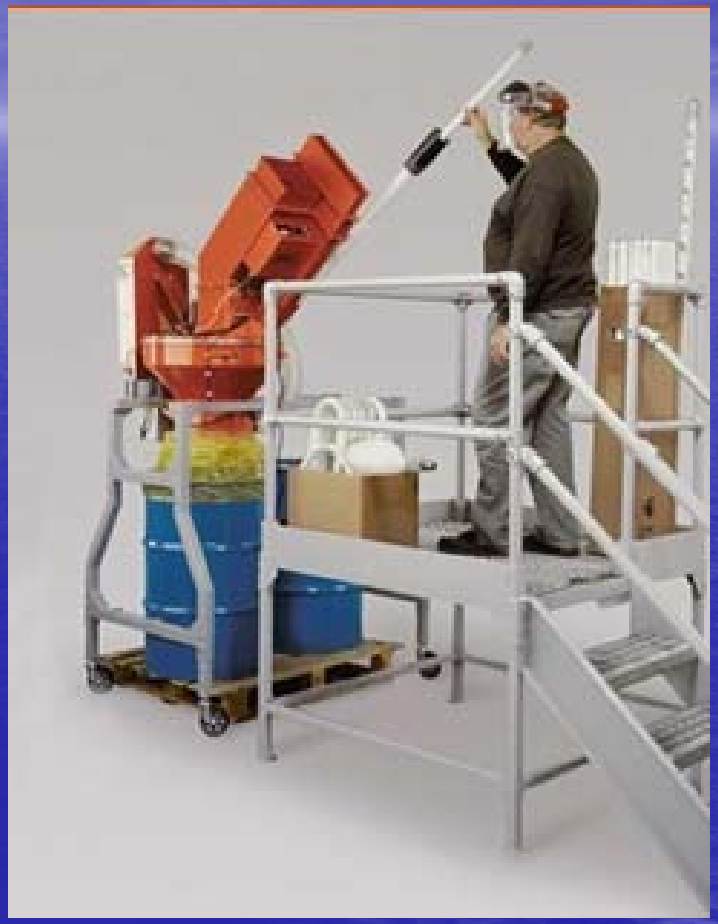
Cooling equipment of simple distillation system

IV. HW treatment technologies in Vietnam

6. Waste fluorescent tube treatment

- Characteristics: Treatment system consists of grinding device, cloth bag filter (fluorescent powder recovering), device of mercury vapor absorbability and exhaust fan
- Advantages: Reasonable investment cost, easy to operate. Fluorescent powder and glass can be used as raw material in cement production or recycle clean glass
- Disadvantages: Absorption of mercury vapor in the tube will create new waste (mercury salt) and need to be treated
- Solution: Desorption of the saturated absorbent to recover mercury and reuse the absorbent

System of Waste fluorescent tube treatment



IV. HW treatment technologies in Vietnam

7. E-Waste treatment

- Characteristics: Combine manual demolition (separating each type of electronic components) and mechanization. Depending on the type of components will have the corresponding treatment technologies such as grinding, sorting machine, ...)
- Advantages: Recovery of metals like gold, tin, copper, aluminum, ... simple technology, easy to operate
- Disadvantages: Low economic efficiency (manual demolition), affect the health of workers due to contact with waste
- Solution: Mechanize all stages of process.

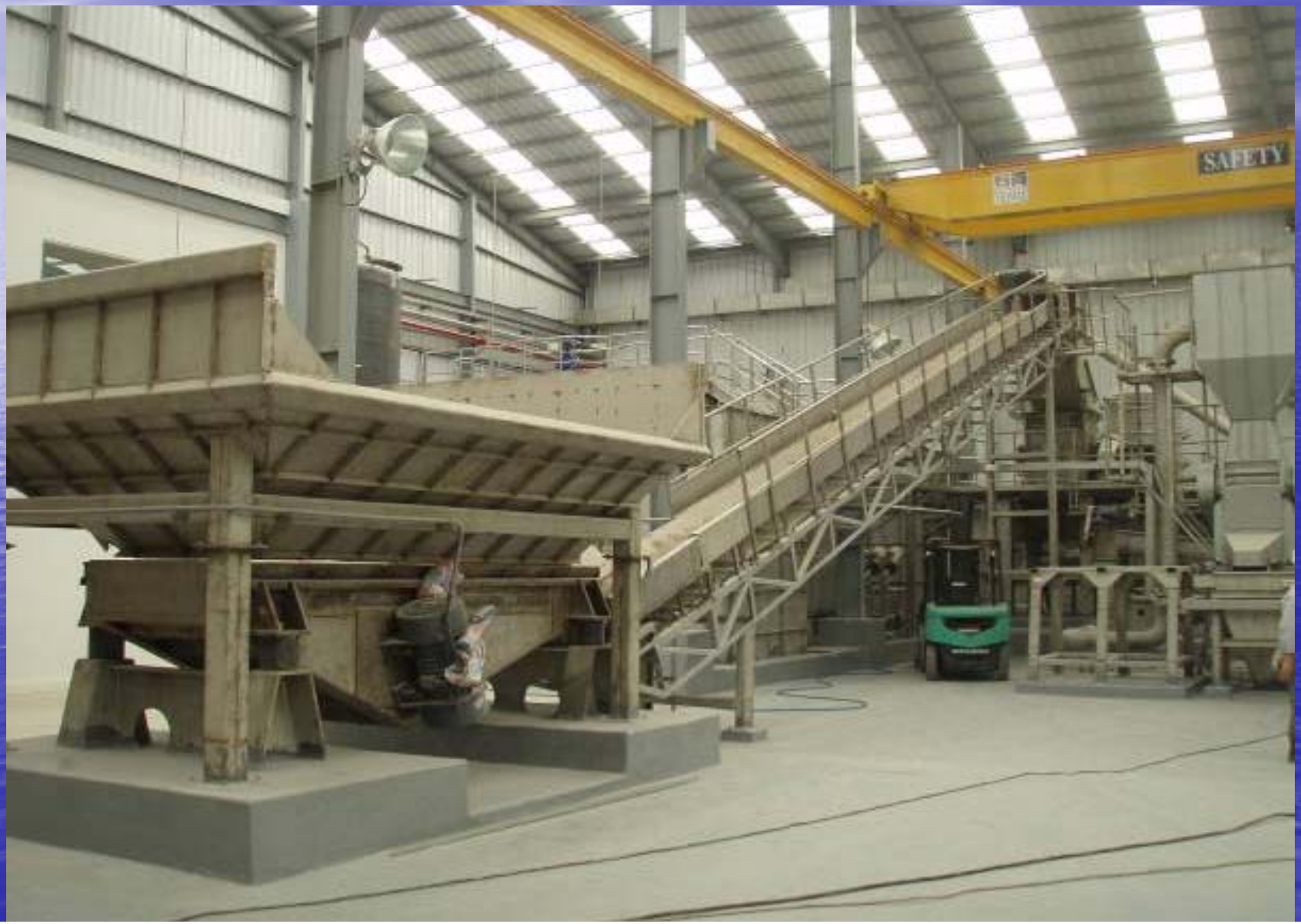
E-waste treatment system

IV. HW treatment technologies in Vietnam

8. Lead batterries reclamation

- Characteristics: Battery with acidic solution is put into the mill and add base (soda) to neutralize. Then the mixture is taken to separate system to separate lead and plastic
- Advantages: Easy operation, high economic efficiency, save resources
- Disadvantages: The process of battery dismantling generates acid vapor and emissions from lead refining can cause environmental pollution
- Solution: install the treatment system of acid vapor and gases from the lead refining, and auto environmental monitoring equipment for exhaust gas treatment system

System of Lead batterries reclamation



V. Conclusion

- Waste generated increasing rapidly;
- Some licensed transporters still discard HW to environment without treatment. MONRE stop issuing licenses to transporters hopefully will improve the situation;
- The current technologies in Vietnam are not really advanced and at moderate size:
  - Not meet the demand of HW treatment in Vietnam.
  - Do not focus on treatment efficiency, but only to meet customer demand.
- Lack of appropriate treatment technology and lack of regulation and guidance on treatment and recycling technologies (including national technical regulations)