COMPENDIUM OF TECHNOLOGIES FOR TREATMENT AND DESTRUCTION OF HEALTHCARE WASTE

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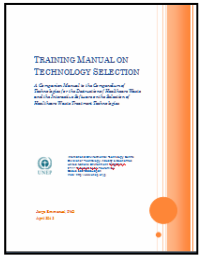
COMPONENTS OF THE PROJECT

- Compendium of Technologies for Treatment and Destruction of Healthcare Waste

- Excel-based interactive software to assist users in technology selection

- Training manual



CONTEXT FOR THE COMPENDIUM

- To promote environmentally sound technologies
- To promote the WHO Policy Paper on safe healthcare waste management (2004):
  - Prevent the health risks associated with exposure to health-care waste for both health workers and the public by promoting environmentally sound management policies for healthcare waste;
  - Support global efforts to reduce the amount of noxious emissions released into the atmosphere to reduce disease and defer the onset of global change;
  - Support the Stockholm Convention on Persistent Organic Pollutants (POPs);
  - ➢ Promote non-incineration technologies for the final disposal of healthcare waste to prevent the disease burden from: (a) unsafe healthcare waste management; and (b) exposure to dioxins and furans;

PURPOSES OF THE COMPENDIUM

- To assist developing countries in assessment and selection of appropriate technologies for treatment and destruction of healthcare waste

- To promote environmentally sound technologies

MAIN PARTS OF THE COMPENDIUM

- Executive Summary

1. Introduction
2. Basic Data on Healthcare Waste
3. Generic Technologies
4. Specific Technologies
5. Technology Assessment Methodology

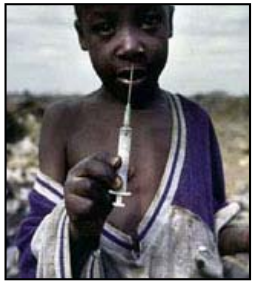
INTRODUCTION TO HEALTHCARE WASTE (HCW)

- Typical Definitions of HCW

  - All the waste generated by healthcare facilities, medical laboratories and biomedical research facilities, as well as waste from minor or scattered sources, such as home health care
    [WHO Blue Book]

  - Any waste, hazardous or not, generated during the diagnosis, treatment or immunization of humans or animals; or waste generated in research related to the aforementioned activities; or waste generated in the production or testing of biologicals
    [Bio-medical Waste Rules, India]

INTRODUCTION TO HEALTHCARE WASTE (HCW)



- Hazards of healthcare waste in developing countries
  - Waste discarded without treatment in open dumps
    - Waste pickers (scavengers)
    - Waste workers without personal protective equipment

  - Waste burned in antiquated and dysfunctional incinerators
    - Communities exposed to incinerator emissions
    - Workers and waste pickers exposed to incinerator ash

RISKS ASSOCIATED WITH HCW

- Risk of infection from a deep needle-stick injury involving fresh blood from an infected patient
  - HIV: 1 in 250
  - Hepatitis C: 1 in 10 to 1 in 30
  - Hepatitis B: 1 in 3 to 1 in 5

- WHO: In 2000, about 16,000 hepatitis C infections, 66,000 hepatitis B infections, and 1,000 HIV infections worldwide among healthcare workers due to occupational exposure to sharps injuries

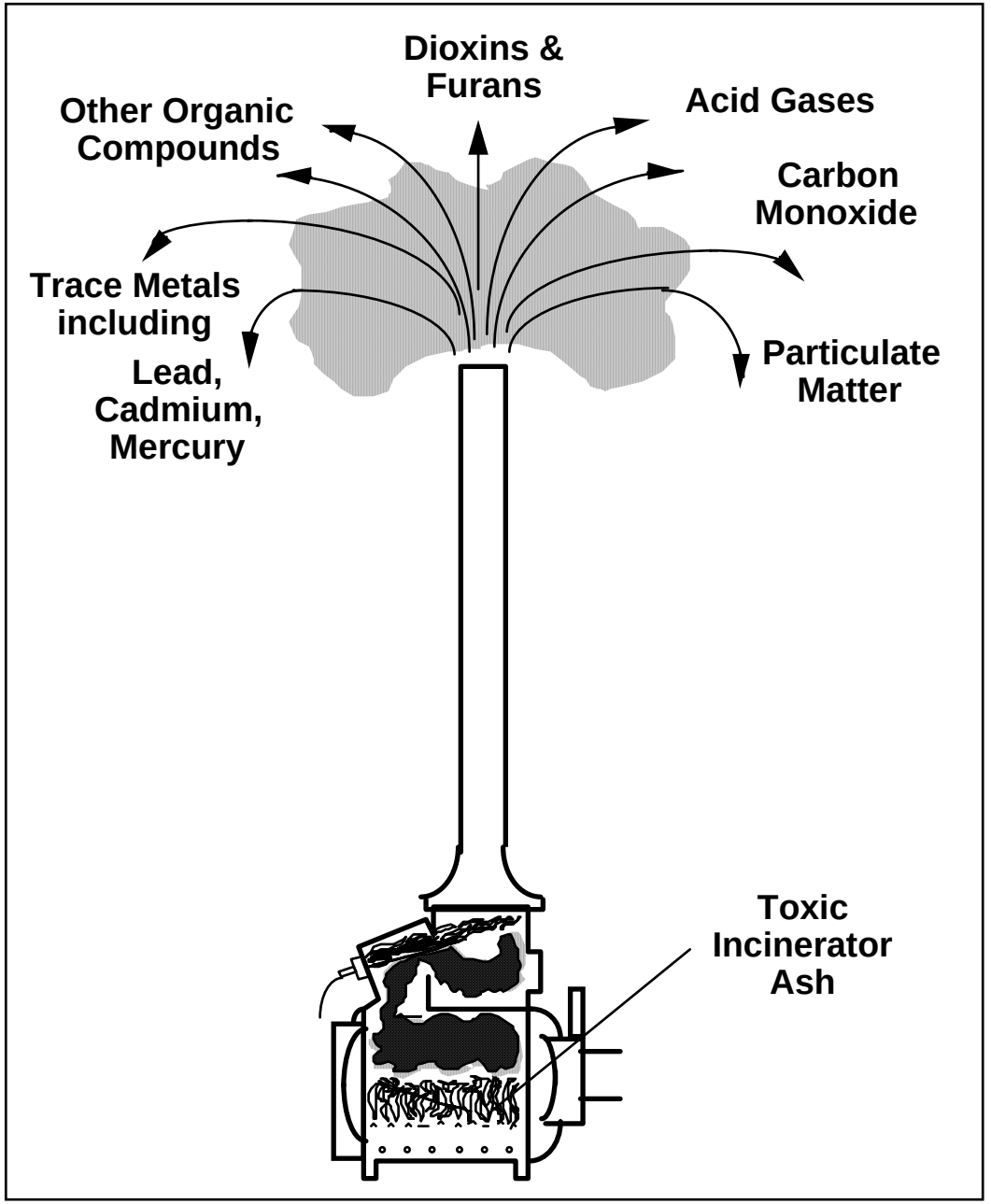
Source: ATSDR, 1990; Prüss-Ustün et al., 2005

RISKS ASSOCIATED WITH HCW

- Exposure to Blood Splashes
  - 1 to 4 out of every 10,000 workers handling biomedical waste could develop HIV due to blood splashes

Source: ATSDR, 1990

AIR EMISSIONS FROM A MEDICAL WASTE INCINERATOR



MEDICAL WASTE INCINERATION (MWI) IS A MAJOR GLOBAL SOURCE OF DIOXINS

- **Europe:** 62% of dioxin emissions due to 4 processes, including MWI
- **Belgium:** MWI accounts for 14% of dioxin emissions
- **Denmark:** MWI is 3rd or 4th largest dioxin source of 16 processes
- **Thailand:**
  - MWI - highest dioxin source by far of 7 sources tested
  - Extremely high dioxin levels in MWI ash and wastewater
- **United States:**
  - MWIs – third largest source of dioxins: 17% of total dioxins in 1995
  - Drop in dioxin emissions from MWI in part due to shift to non-incineration methods
- **Canada:**
  - MWI - largest dioxin source in Ontario province
  - Drop in dioxin emissions from MWI due to closure of MWIs

GENERIC TREATMENT TECHNOLOGIES FOR HEALTHCARE WASTE

TYPES OF GENERIC TREATMENT TECHNOLOGIES (BY DISINFECTION PROCESS)

- Thermal
  - Temperature
- Chemical
  - Concentration
- Irradiative
  - Radiation dose
- Biological

MICROBIAL INACTIVATION

- STAATT criteria for healthcare waste

  - Minimum requirement: Level III
    - Reduction of vegetative bacteria, fungi, lipophilic/hydrophilic viruses, parasites, mycobacteria by 6 Log or greater
    - Reduction of heat resistant spores by 4 Log or greater

  - Microbiological indicators
    - *Geobacillus stearothermophilus* or *Bacillus atrophaeus* spores
    - *Mycobacterium phlei* or *Mycobacterium bovis*

GENERIC TECHNOLOGIES

- Information in the Compendium for each Generic Technology

  - Process Description
  - Diagram or sketch
  - Types of Waste Treated
  - Range of Capacities
  - Pathogen Destruction
  - Emissions and By-Products
  - Operational Details
  - Installation Requirements
  - Maintenance Requirements

GENERIC TECHNOLOGIES COVERED IN THE COMPENDIUM

- Thermal
  - Autoclaves
  - Hybrid autoclaves
  - Continuous steam treatment systems
  - Batch microwave
  - Continuous microwave
  - Frictional heating
  - Dry heat
  - Incineration and related technologies

SPECIFIC TREATMENT TECHNOLOGIES FOR HEALTHCARE WASTE

SPECIFIC TECHNOLOGIES IN THE COMPENDIUM

- **64 specific technologies:**
  - 15 autoclave technologies
  - 11 hybrid autoclaves
  - 4 continuous steam treatment systems
  - 3 batch microwave units
  - 3 continuous microwave systems
  - 2 frictional heating treatment technologies
  - 2 dry heat units
  - 9 incinerators
  - 4 alkaline hydrolysis technologies
  - 3 chemical treatment systems
  - 8 new or emerging technologies
- **Technologies represent 22 countries:**
  - Argentina (1), Australia (3), Austria (2), Belgium (2), Canada (1), China (3), France (5), Germany (2), Hungary (1), India (2), Iran (1), Israel (2), Italy (4), Japan (1), Luxemburg (1), New Zealand (1), Philippines (1), Spain (2), Tanzania (1), Turkey (1), United Kingdom (3), and United States (24)

SPECIFIC TECHNOLOGIES IN THE COMPENDIUM

- **Data on each specific technology**
  - Type of technology
  - Process description
  - Types of waste treated
  - Range of capacities
  - Pathogen destruction
  - Emissions and by-products
  - Operation
  - Installation
  - Maintenance
  - Job Potential
  - Locations where the technology is in operation
  - Cost estimates
  - Special features
  - Parameter for specification
  - Photographs
  - Vendor information
  - Contact information

AUTOCLAVES: SPECIFIC TECHNOLOGIES

- AWS Clinical Waste
- Bondtech
- CISA
- GEF Technology
- GK Moss
- Incol
- MachinFabrik
- Mark-Costello
- Matachana / Webeco
- Medclean Technologies
- OnSite Sterilization/Variclave
- Safewaste Technologies
- San-I-Pak
- Steridium
- Tuttnauer

HYBRID AUTOCLAVES: SPECIFIC TECHNOLOGIES

- Celitron
- Ecodas
- Ecolotec
- Hydroclave
- MedFreshe/Narula Group
- Medivac Metamizer
- Metan
- RedBag Solutions
- Sazgar
- T.E.M. Steriflash and Steri2flash
- Tempico Rotoclave

CONTINUOUS STEAM TREATMENT SYSTEMS: SPECIFIC TECHNOLOGIES

- BioSafe Engineering
- Erdwich
- LogMed
- Miclo

BATCH MICROWAVE UNITS: SPECIFIC TECHNOLOGIES

- Meteka
- Sintion
- Sterifant-Sterival

CONTINUOUS MICROWAVE SYSTEMS: SPECIFIC TECHNOLOGIES

- AMB Ecosteryl
- Micro-Waste
- Sanitec

FRICTIONAL HEATING SYSTEMS: SPECIFIC TECHNOLOGIES

- Newster
- OMPeco

DRY HEAT UNITS: SPECIFIC TECHNOLOGIES

- Demolizer
- Sterigerms

MEDICAL WASTE INCINERATORS: SPECIFIC TECHNOLOGIES

- Advanced Combustion Systems
- ATI Incinerateurs Muller
- BIC systems
- Consutech
- Hafner
- Incinco
- Kureha
- Pennram
- Techtrol/Incol
- Plantec

ALKALINE DIGESTERS: SPECIFIC TECHNOLOGIES

- BioResponse
- BioSafe Engineering
- Peerless Waste Solutions
- PRI

CHEMICAL TREATMENT SYSTEMS: SPECIFIC TECHNOLOGIES

- PIWS
- Sterimed
- Trinova

METHODOLOGY FOR SUSTAINABILITY ASSESSMENT OF TECHNOLOGIES

- **SAT Methodology …**

… Integrates Environmental, Social and Economic Considerations

… Focuses on environment and development together and puts them at the centre of the economic and political decision making process

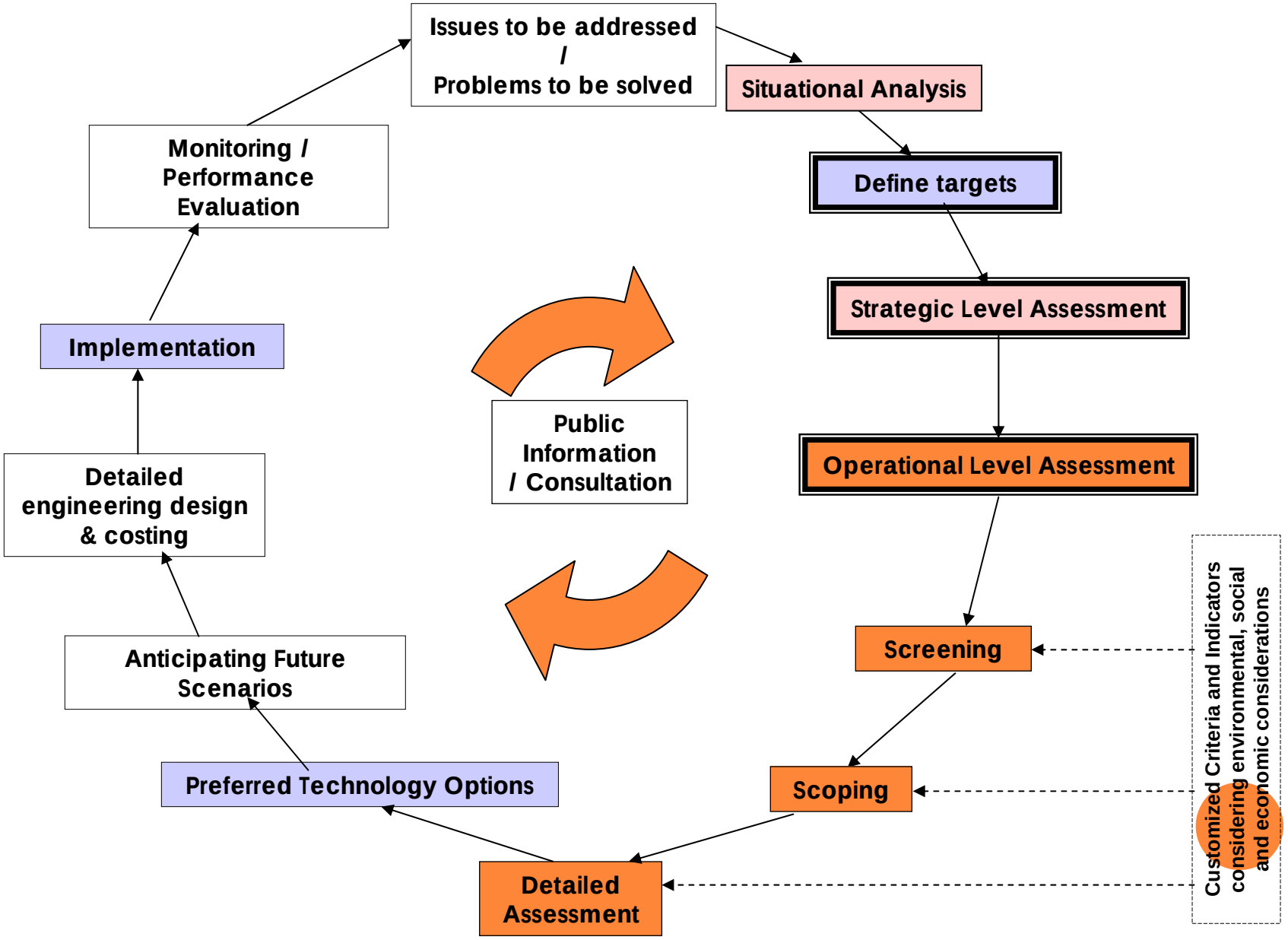
… Can be adapted to country specific parameters and constraints

METHODOLOGY FOR SUSTAINABILITY ASSESSMENT OF TECHNOLOGIES

SOME KEY CHARACTERISTICS

- It Undergoes progressive assessment (Tiered) procedure (screening, scoping and detail assessment) thereby optimizing information requirements.
- It operates on strategic as well as operational level
- It is a quantitative procedure allowing objective assessment, sensitivity analyses and incorporation of scenarios
- It incorporates Continuous improvement through Plan-Do-Check-Act (PDCA) cycle
- It is not an automated process thereby making country specific adaptation possible

METHODOLOGY FOR SUSTAINABILITY ASSESSMENT OF TECHNOLOGIES



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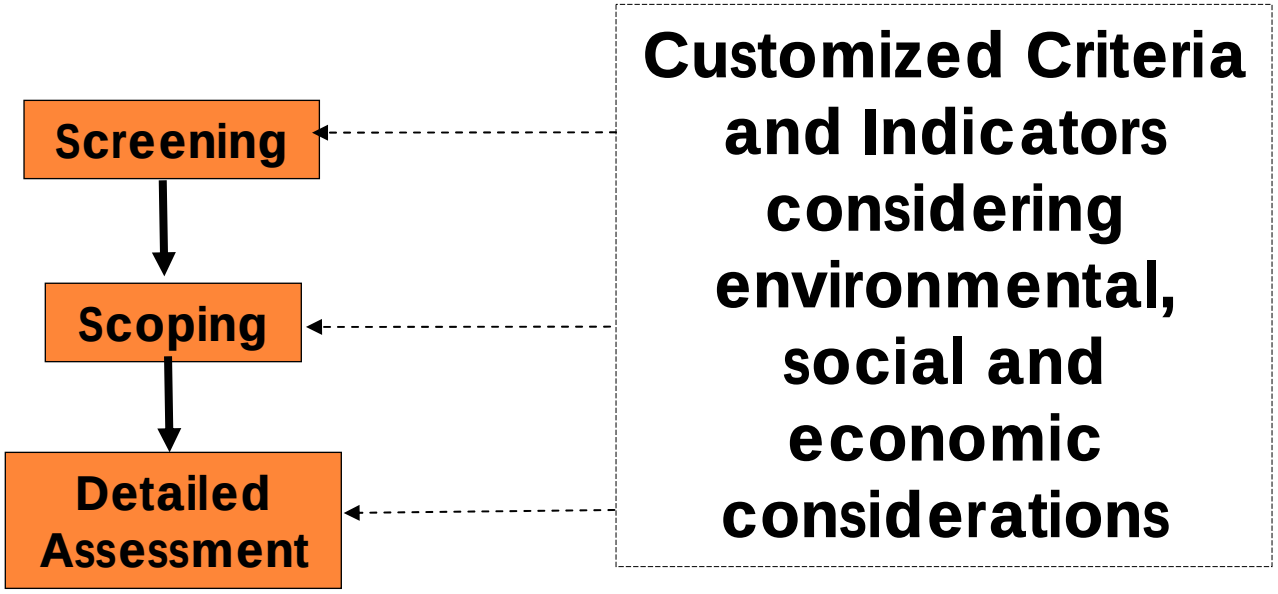
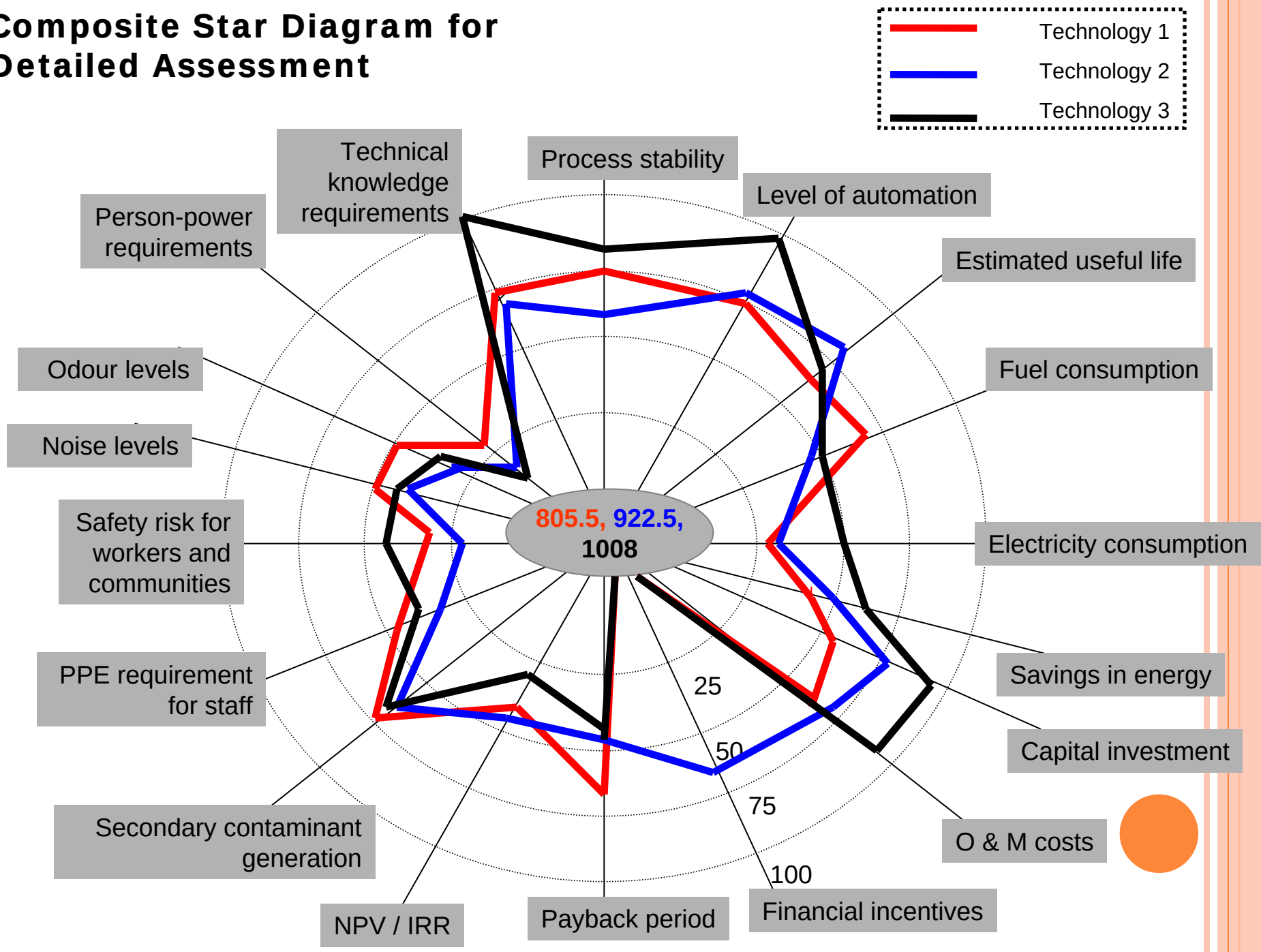


Composite Star Diagram for Detailed Assessment



WE INVITE YOUR COMMENTS AND SUGGESTIONS TO MAKE THE COMPENDIUM AS USEFUL AS POSSIBLE.

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THANK YOU

For further information:
http://www.unep.org/ietc/