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Reducing UPOPs and Mercury Releases from The Health Sector in Africa

Module 36: Introduction of Mercury Free Alternatives

UNDP

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GLOBAL ENVIRONMENT FACILITY
INVESTING IN OUR PLANET



Policy on Mercury in Health Care

Short Term: Develop and implement plans to reduce the use of mercury equipment and replace with mercury free alternatives. Address mercury clean up, waste handling and storage procedures.



World Health Organization

Medium Term: Increase efforts to reduce use of unnecessary mercury equipment

Long Term: Support a ban of mercury containing devices and promote alternatives.

www.who.int/water_sanitation_health/medicalwaste/mercury/en





Phasing-out of mercury

► No mercury, No Problems

- The UNEP Governing Council, representing all UN represented countries, made reducing methyl mercury accumulation in the global environment a major global priority.
- safe, cost-effective non-mercury alternatives for nearly all health care processes are available





Hierarchy of Controls in Mercury Waste Management

▶ Elimination and Substitution

- Develop and implement a mercury phase-out plan

▶ Engineering controls

- Construct safe mercury storage facilities

▶ Administrative control

- Evaluate causes of spills and adopt preventive measures
- Conduct awareness-raising and trainings
- Promote safe handling procedures
- Use educational posters and warning labels
- Provide mercury spill clean-up kits

▶ Personal protective equipment

- Use proper PPE during spill clean-up



About Mercury-Free Alternatives

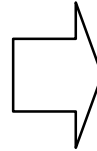
- Studies show that alternatives can be as accurate as mercury devices
 - Mercury-free alternatives must meet existing standards
 - Alternatives of unknown quality should be validated before use
 - Like mercury sphygmomanometers, aneroid blood pressure devices should be periodically maintained and calibrated



Alternatives to Mercury-containing products in healthcare

■ Product

- Mercury thermometers
- Hg-based blood pressure monitoring devices
- Esophageal devices, Cantor & Miller-Abbott tubes
- Hg dental amalgams
- Hg batteries
- Lamps & lighting devices
- Hg switches



▶ Alternatives

- Digital thermometers, alcohol, galinstan, etc.
- Aneroid, electronic, oscillometric
- Tungsten-filled dilators, products w/ tungsten tubing, Anderson AN-20
- Composite resin, porcelain
- Lithium, zinc air, alkaline
- LEDs, non-Hg lamps
- Electronic switches



Types of Non-Mercury Thermometers

▶ Thermistor-based digital thermometers
(most common)



▶ Tympanic infrared thermometers



▶ Temporal artery infrared thermometers



▶ Galinstan-in-glass thermometers (look just like mercury thermometers)



▶ Thermocouple and platinum resistance thermometers
(can be extremely accurate; used for calibration!)

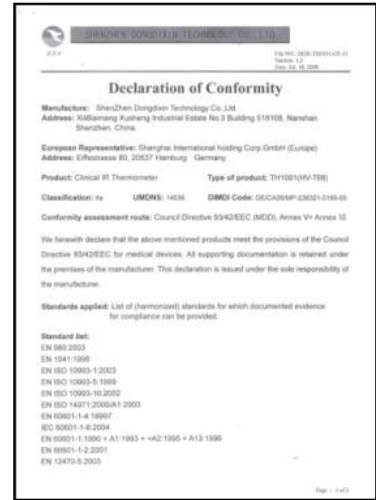




Key Specifications for Non-Mercury Digital Thermometers

- ▶ Specifications are defined by two international standards:
 - EN 12470-3:2000+A1:2009
 - ASTM E1112-00

- ▶ Certification of conformity to international standards, including EN 12470-3:2000 or ASTM E1112 and copy of the certificate from the notified body must be available





Key Specifications for Non-Mercury Digital Thermometers

Most important: Accuracy

Maximum Error	Measuring T Range
0.1°C	35.5°C – 42.0°C
0.2°C	Outside T range
Ambient temperature range: 18°C to 28°C	

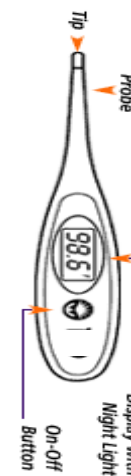
or

Maximum Error	Measuring T Range
±0.3°C	<35.8°C
±0.2°C	35.8°C to <37°C
±0.1°C	37°C to 39°C
±0.2°C	>39°C to 41°C
±0.3°C	>41°C
Ambient temperature operating range: 16°C to 40°C at a relative humidity of 15-95% (non-condensing)	



Other Specifications for Digital Thermometers

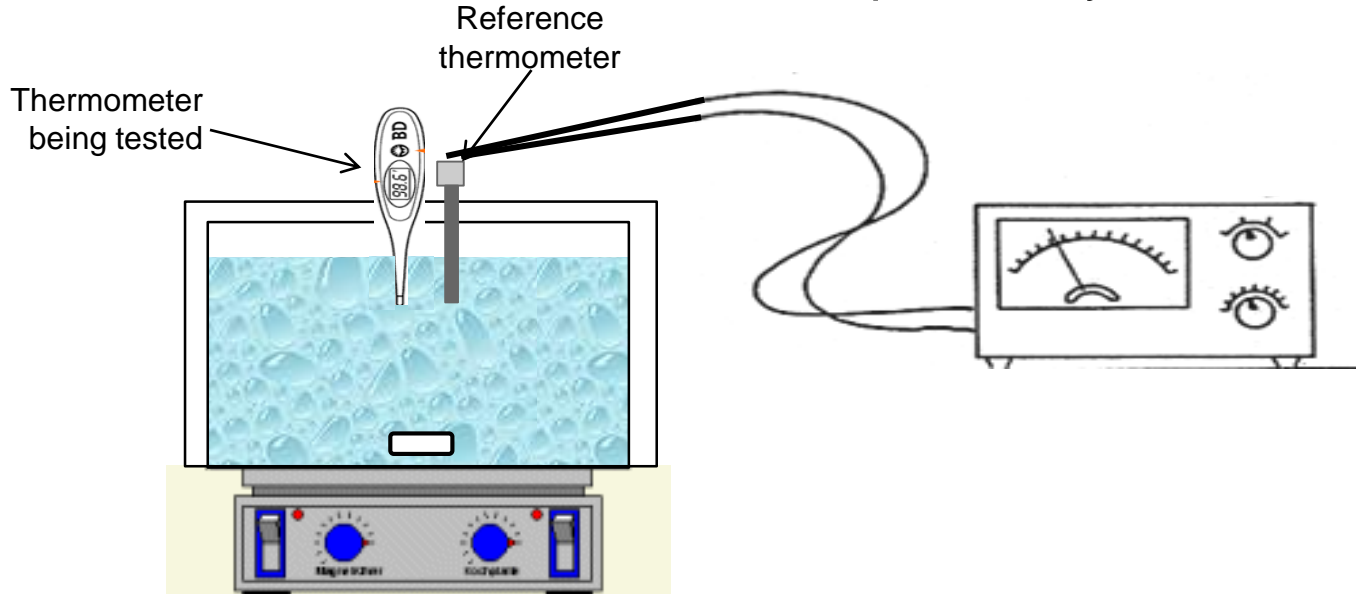
- Meets accuracy requirement after storage at different temperatures, exposure to a range of humidity, and some degree of mechanical shock
- Readability
- Electrical safety
- Availability of instructions
- Options:
 - Rapid response time: 10 seconds or less
 - Extra large display
 - Audible alarm when peak temperature is reached
 - Display of self-check results during start-up
 - Automatic shut-off
 - Memory functions
 - Mercury-free or “no added mercury” battery
 - Easily replaceable battery or rechargeable battery
 - Long battery life: e.g., 4000 temperature readings
 - If solar-powered, up to 72 hours per solar charge





Validation Testing of Thermometer Accuracy

- Constant temperature bath with reference thermometer
 - Large glass flask (>100 times the volume of the thermometer) with insulation (5-7 cm), top cover, and continuous magnetic stirring
 - Distilled water with reference and test thermometers near each other
 - Measure two or more points between the working range
 - Conduct test three times to check repeatability





Validation Testing of Thermometer Accuracy

- What reference thermometer to use?
 - Reference thermometer traceable through an unbroken chain of comparisons to a national or international standard body
 - Common reference used:
Platinum resistance thermometer
- But... are mercury thermometers not more reliable...?
 - Results of Leick-Rude & Bloom study:
25% of the mercury thermometers tested were off by $>0.2^{\circ}\text{C}$





Types of Non-Mercury Sphygmomanometers

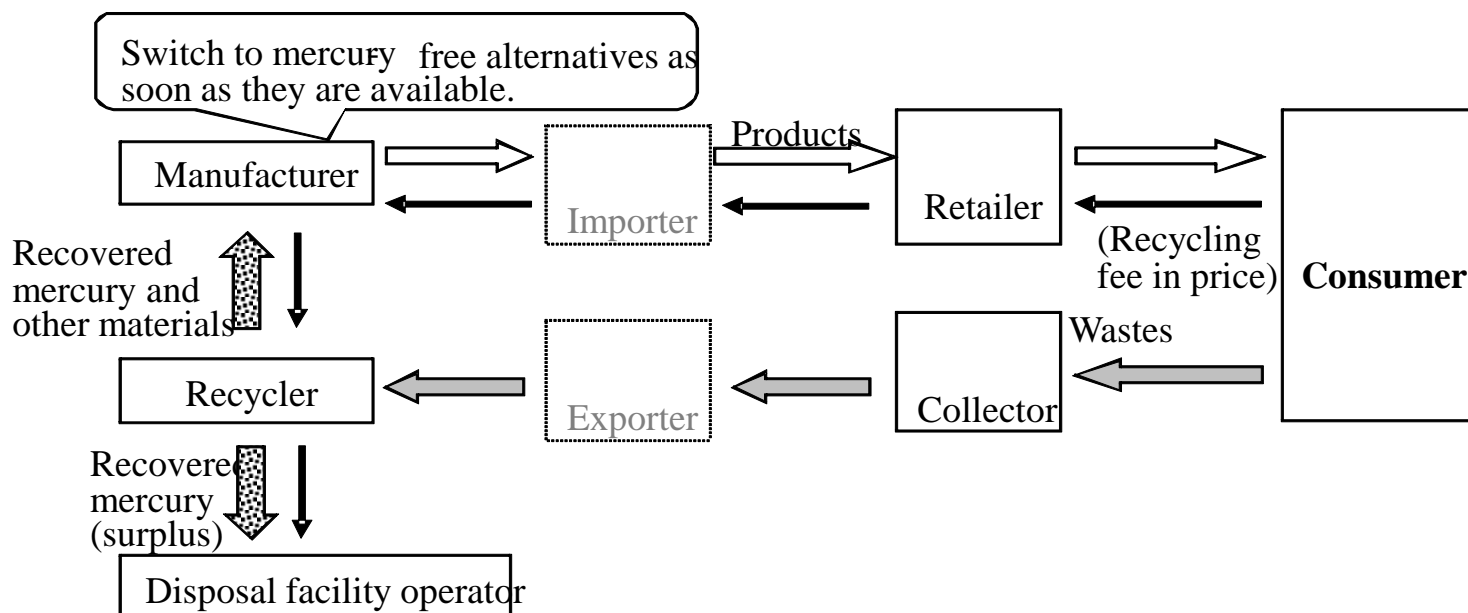
- Mechanical dial aneroid sphygmomanometer (most common)
- Digital display aneroid sphygmomanometer (common)
- Electronic oscillometric sphygmomanometer
- Doppler-based plethysmographic blood pressure monitor
- Photocell-based blood pressure monitor
- Strain gauge-based blood pressure monitor





Extended producer responsibility

- ▶ Extended producer responsibility (EPR) should be used as an instrument to encourage the production of mercury-free or less mercury-added products and collection of end-of-life products.





Collection Strategies

- ▶ There are different options for collecting waste mercury-added products such as fluorescent lamps, batteries, thermometers and electronic devices containing mercury from households (mercury batteries may be collected together with other types of batteries) for further processing
 - Waste collection stations or drop-off depots
 - Collection at public places or shops
 - Collection at households by collectors
 - Take-back collection programme



Waste collection stations or drop-off depots

- ▶ Boxes or containers are available for public use at existing waste collection stations:
 - Different containers should be used for tube bulbs and CFLs. For CFLs,
 - minimize the “free fall” of the lamp by installing soft, cascading baffles or flaps
 - Coloured, marked waste containers should be used exclusively for waste containing mercury such as fluorescent lamps and mercury-added thermometers and batteries
 - Designated containers should all be the same colour and/or bear the same logo to facilitate public education and increased participation.
- ▶ Breakage of fluorescent lamps and thermometers should be avoided, *inter alia*, through appropriate box design and by providing written information on collection procedures.
- ▶ Waste containing mercury should be collected exclusively by collectors authorised by local governments or appropriate authorities



Example: USA

- ▶ Bring any expired, unbroken CFLs,
- ▶ Package in a plastic bag and deposit them both into one of the bright orange collection units in any Home Depot store in the U.S
- ▶ bags next to the bin people can put their bulbs in - prevent the mercury from escaping in case the fluorescents break
- ▶ Storage in the back, and every two weeks we ship them to a recycling plant





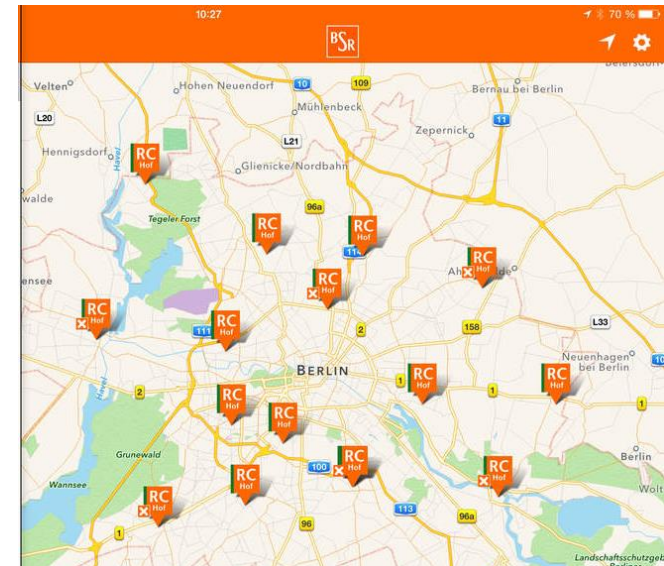
Collection by collection vehicles or public places or shops

- ▶ Collection by specially designed collection vehicles or at public places or shops such as town halls, libraries, other public buildings, electronics stores, shopping malls and other retail outlets, provided that appropriate collection containers are available.
- ▶ Consumers should be able to take used fluorescent lamps, mercury batteries, thermostats, and mercury thermometers to those places free of charge
- ▶ Collection boxes or containers:
 - designed to accommodate their characteristics and to minimize breakage
 - should be monitored to avoid any other waste being deposited in them
 - should also be labelled and placed inside buildings such as public buildings, schools and shops, where they can be monitored in a well ventilated area, or, for example, outside the building in a covered and protected area.
- ▶ Authorized collectors, such as municipal collectors or private sector collectors (e.g., collectors trusted by producers of those products), should collect the wastes in the waste collection boxes or containers



Example: Germany

- ▶ Recycling and special waste collection centre for households in Berlin, Germany
 - Taking of construction material, paints, chemicals, batteries, fluorescence lamps, etc.
 - Operated by the municipal waste management company (BSR)
 - Open every day – except Sundays and public holidays
 - Available in each district of the town
 - Some waste is taken for free other need to be paid:
 - Price for mercury containing devices: 6,40 Euro / kg





Collection at households by collectors

- ▶ Collection at households by authorized collectors may be applied for certain wastes such as e waste.
- ▶ In order to ensure efficient collection of waste containing mercury by local collectors, an initiative or legal mechanism will be required;
 - for example, governments, producers of mercury-added products or other agencies will need to provide arrangements for the collection of waste containing mercury by local collectors



Take-back collection programme

- ▶ Take-back programmes are often voluntary initiatives delivered by the private sector (e.g., manufacturers and in some cases retailers) which provide the opportunity to consumers to return used products at the point of purchase or some other specified facility.
- ▶ Some take-back programmes offer financial incentives to consumers, others can be mandated or operated by governments (e.g., bottle deposits), and others can also partly finance disposal or recycling activities.
- ▶ Take-back collection programmes generally focus on consumer products that are widely used (Honda 2005), such as batteries, switches, thermostats, fluorescent lamps and other mercury-added products.



Example: Japan

- ▶ Fluorescent lamps are not "sold" but are leased by service agents designated by the manufacturers
- ▶ Used fluorescent lamps are collected by the agents and are properly recycled via intermediate treaters while new replacement lamps are supplied to customers
- ▶ This service is enjoyed not only by business establishments but also by plants, theme parks and other premises

