Managing Expired and Unusable Pharmaceuticals and Medical Laboratory Liquid Waste in an Optimized Supply Chain – the GHSC-PSM Experience in Nigeria

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Context and Problem Statement

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Key Challenges:

- Risk to public health and the environment
- Inadequate coordination and improper disposal methods (e.g., open-air and low-grade temperature burning) were prevalent
- Lack of centralized and standardized waste management strategy
- Inability to track data on the volume of pharmaceutical waste generated
- Medical laboratory liquid waste management was neglected, leading to environmental contamination
- Limited awareness of best practices for managing and disposing of laboratory liquid waste.

Context and Problem Statement Contd.

Poor Waste Management Risks

- **Pharmaceutical Waste**:
  - Accumulation of expired commodities in health facilities.
  - Environmental pollution due to improper disposal practices such as open-air burning.
- **Medical Laboratory Liquid Waste**:
  - Risk of disposing of hazardous substances such as Guanidinium Thiocyanate from PCR testing.
  - Environmental and health risks, including contamination of water systems and long-term effects on aquatic life due to suboptimal disposal practices in laboratories.

GHSC-PSM Intervention (2017-2023)

GHSC-PSM Intervention (2017-2023)

- **Pharmaceutical Waste**:
  - Supports waste management in more than 10,000 health facilities and six warehouses
  - Developed a waste inventory data collection system
  - Implemented a centralized waste treatment and disposal system
  - Enhanced coordination and instituted a revamped strategy for annual retrieval and disposal drives since 2017
- **Medical Laboratory Liquid Waste**:
  - Supports waste management in three mega laboratories
  - Instituted a waste collection method at each laboratory using 1,000-liter tote tanks as reservoirs
  - Instituted centralized quarterly waste disposal drives since 2021.

Methodology & Timeline

Pharmaceutical Waste Management

Methodology and Timeline - pharmaceutical waste management

Annual Waste Drive Initiative

An annual waste drive initiative was implemented to remove waste from all supported facilities.

Collaboration with Stakeholders

Stakeholders were engaged for the seamless execution of the waste drive.

- Coordination with State Logistics Management Coordination Units for waste data collection using the developed waste data collection tool
- Coordination with regulatory bodies (NAFDAC), security and law enforcement agencies for approvals
- Engagement with third-party logistics (3PL) service providers for waste retrieval and transportation to the treatment plant.
- Collaboration with an ISO-certified third-party waste treatment service provider for safe disposal

Methodology & Timeline Contd.
- pharmaceutical waste management

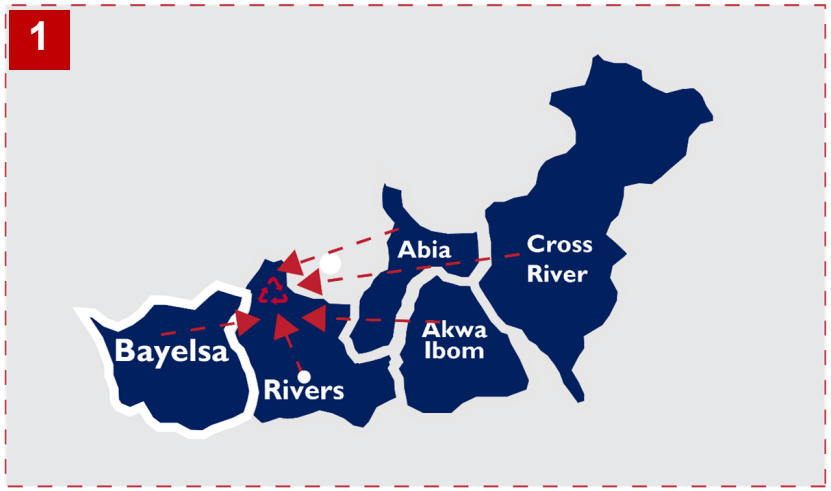
Pharmaceutical Waste Retrieval Process

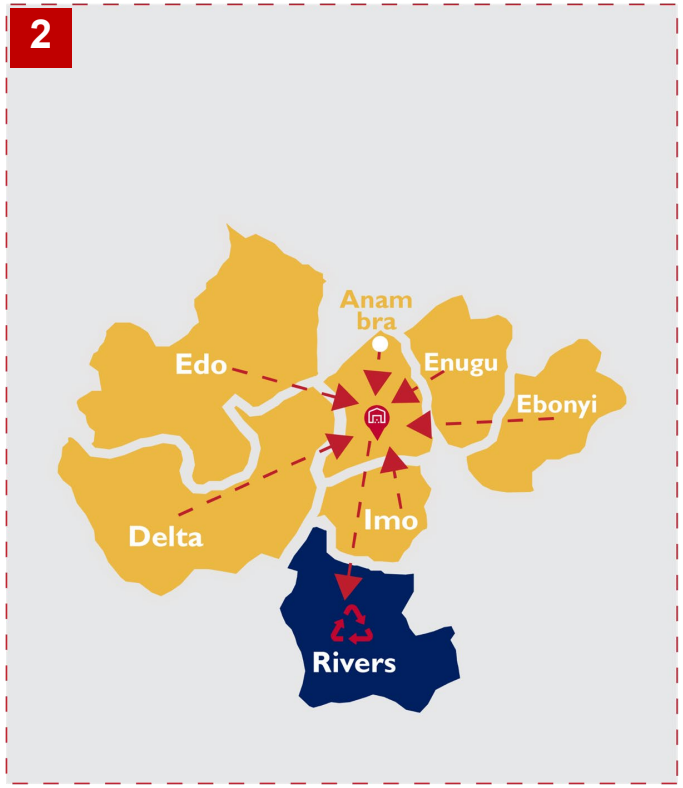
- Best practices for packaging and labeling for safe transport
- Waste consolidation in central and axial warehouses
- Stringent controls: secured locations, sealed containers, and biohazard labeling for transportation

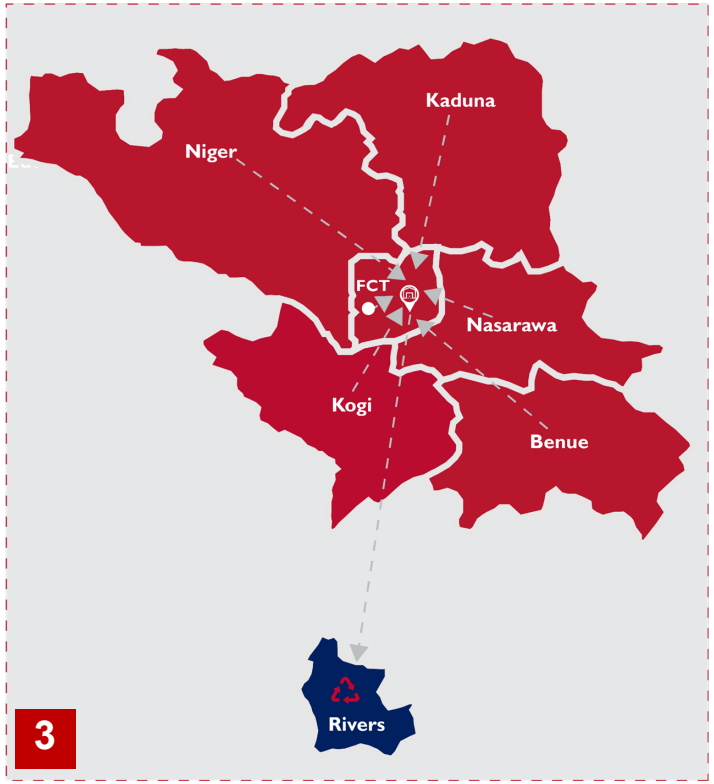
Innovative Approaches in Waste Management

- Hub and spoke model for optimized reverse logistics to reduce carbon footprint.
- Use smaller trucks at the state level and larger trucks for long-haul, optimizing transport efficiency.

Pharma Waste Movement

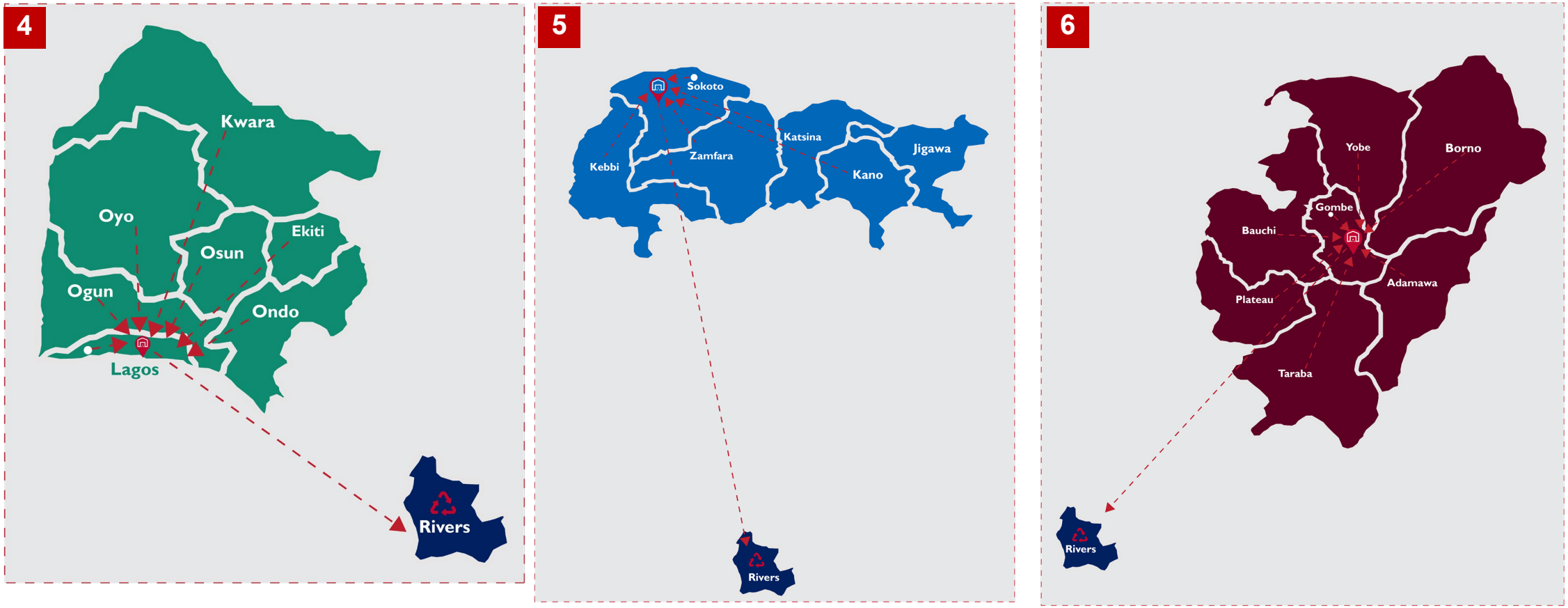






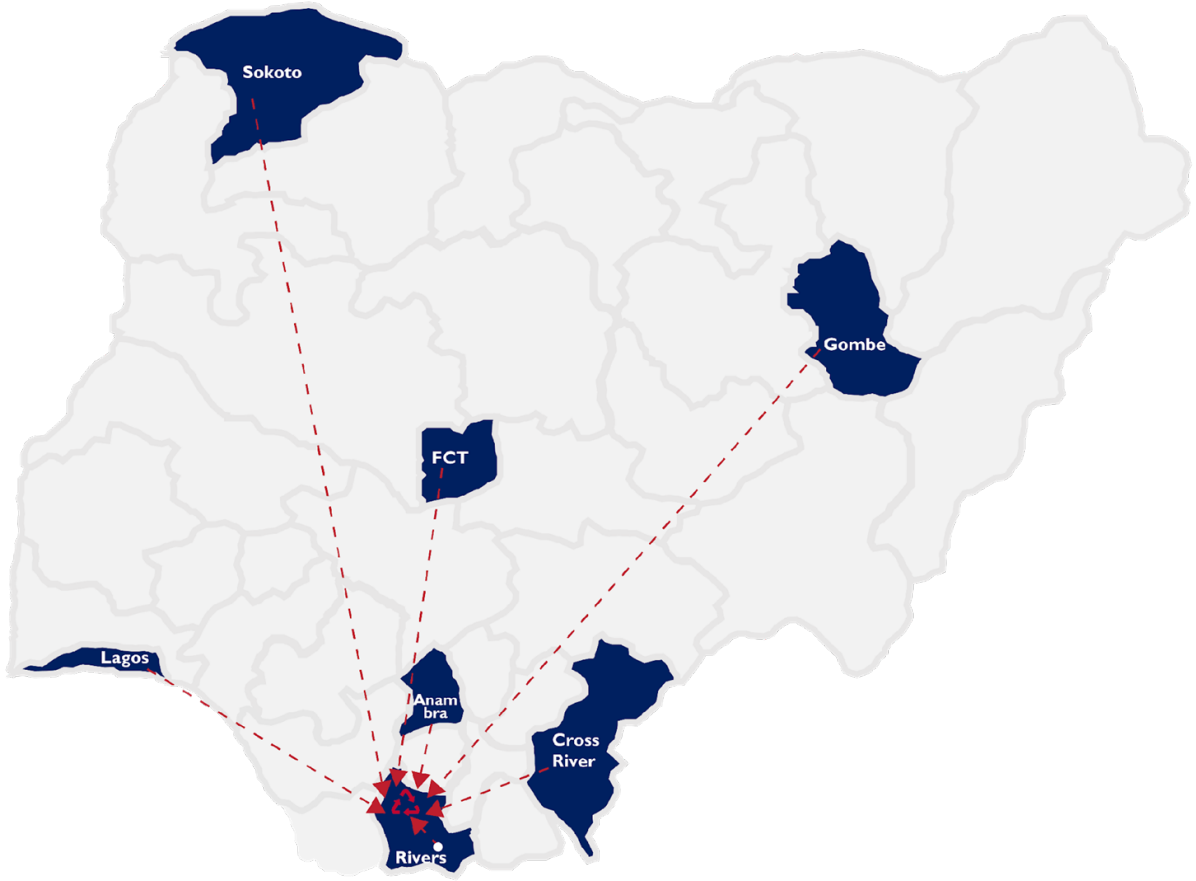
1. South-South Region
2. South-East Region
3. North-Central Region

Pharma Waste Movement



4. South-West Region
5. North-West Region
6. North-East Region

Summary of Pharma Waste Movement



Methodology and Timeline Contd. - pharmaceutical waste management

Safe Disposal

- Use of dual chamber high-temperature rotary kiln incinerator for treatment (800-1100C).
- Stringent controls: Flue gas emission controls and measuring emissions against national and international allowable standards.

Advanced Recycling Initiatives

- Conversion of plastics into oils
- Use of incineration ash in brick production to stabilize waste
- Prevent leakage due to lack of hazardous landfill

Methodology and Timeline Contd.
- pharmaceutical waste management

Advanced Technology

High-temperature rotary kiln incinerator

Photo Source: Boskel Nig. Ltd

- Dual Chamber
- High temperature 800C – 1200C
- Flue gas emission controls

Liquid Waste Management

Methodology and Timeline Contd. - liquid waste management

Proof of Concept – Medical Laboratory Liquid Waste Disposal

Three Mega Laboratory Facilities Supported:

- Nigerian Institute of Medical Research (NIMR), Lagos.
- University of Uyo Teaching Hospital (UUTH), Akwa Ibom state.
- Chukwuemeka Odumegwu Ojukwu University Teaching Hospital (COOUTH), Anambra.
- Federal Medical Centre Jalingo PCR Lab

Tote Tanks for Collection: Two to three 1,000-liter capacity tanks installed for temporary storage.

Laboratory Liquid Waste Movement

Methodology and Timeline Contd. - liquid waste management

Evacuation

- Quarterly waste disposal drives implemented.
- Licensed third-party facility engaged for quarterly waste retrieval.

Safe Disposal

- Use of dual chamber high-temperature rotary kiln incinerator for treatment (800-1100C).
- Stringent controls: Flue gas emission controls and measuring emissions against national and international allowable standards.

Liquid Waste Management

: Boskel Nig. LtdPhoto Source

Results & Impact

Results and Impact

Pharmaceutical Waste Disposal: 821 tons safely disposed of from 2017-2023

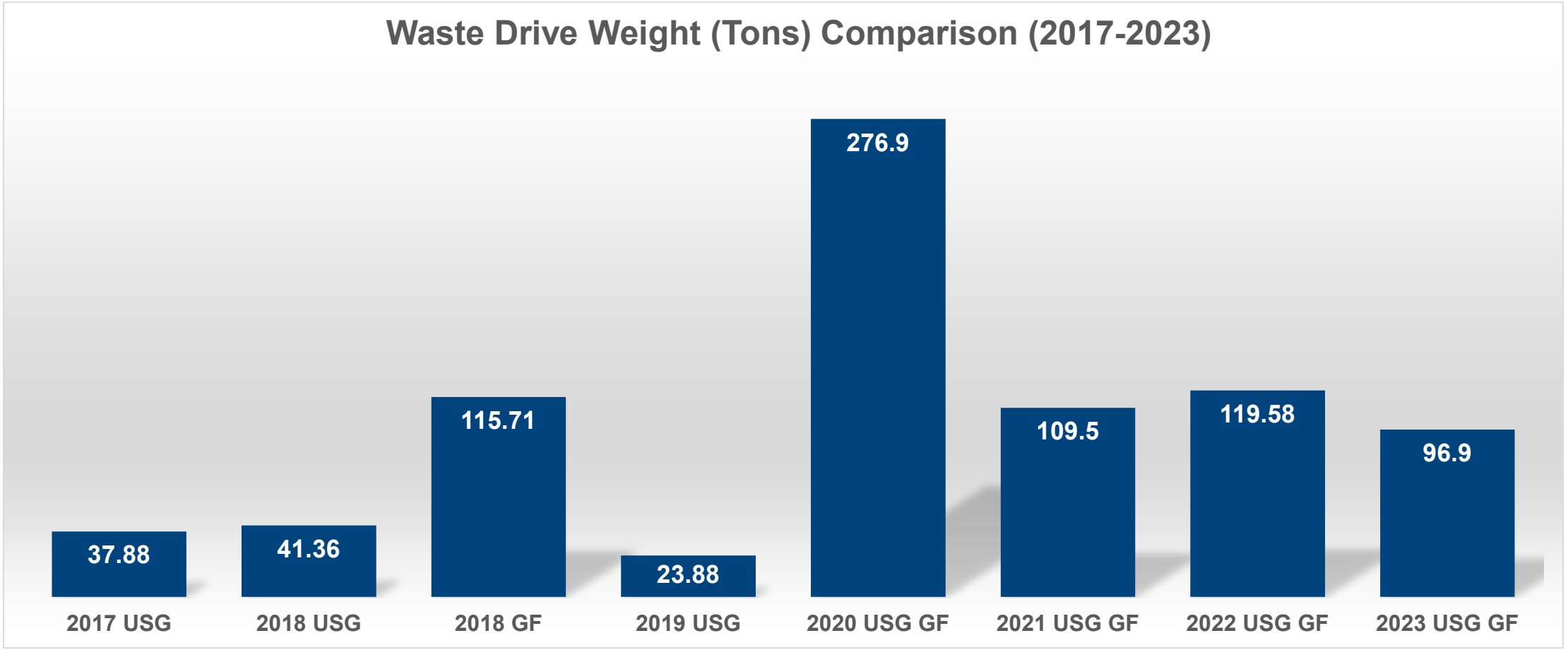
Medical Lab Liquid Waste Disposal: 36,430 liters were safely evacuated from 2021 to 2023

Reduction in Carbon Footprint:

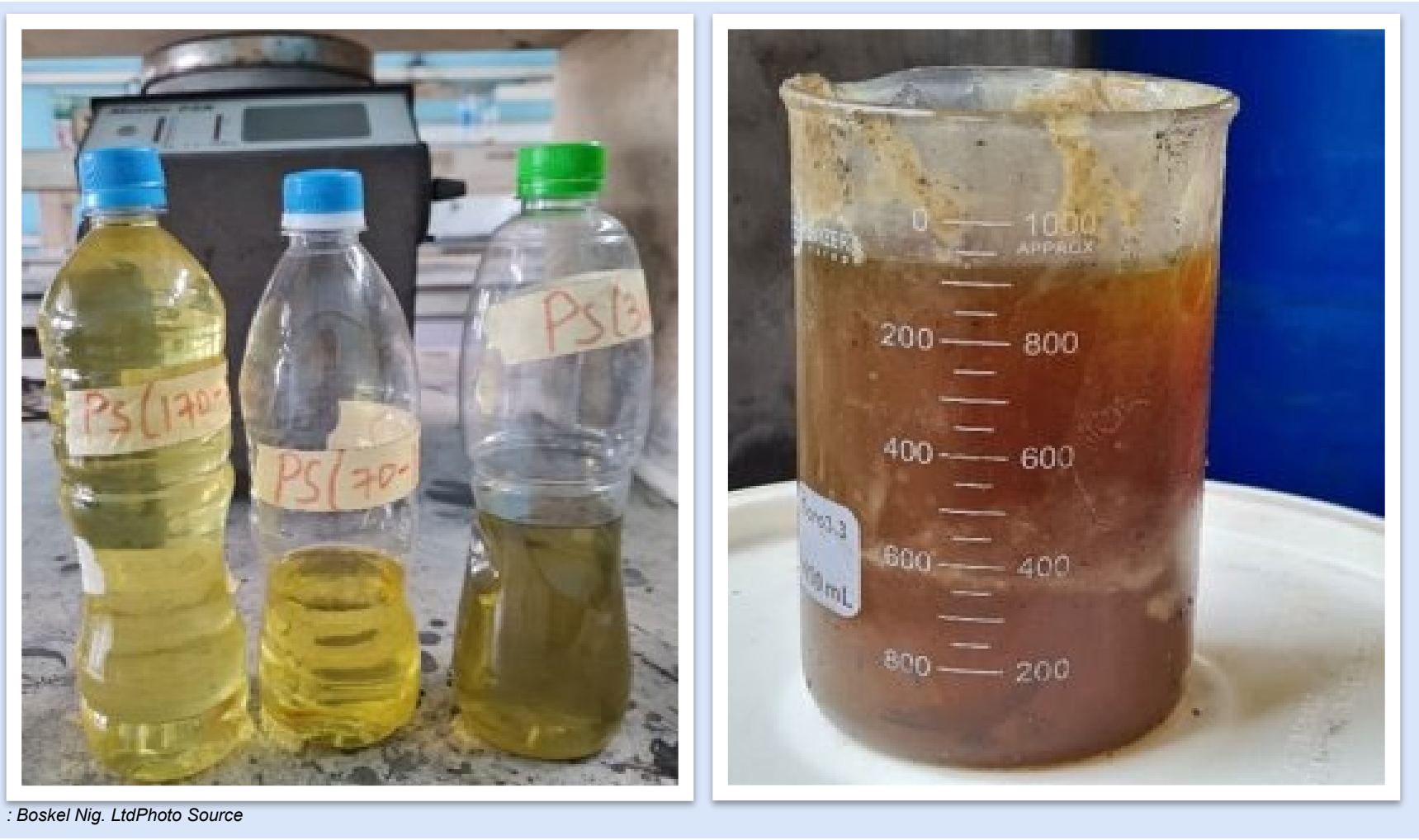
- The hub-and-spoke model shortened the waste retrieval period from 20 days to 10-15 days
- Reduced vehicles on the road for the long haul to the treatment facility

Promoting Circular Economy: Converting waste plastics to valuable oils and resultant waste ash to bricks (1kg of plastics producing about 700mls of oils)

Trend in Annual Quantity of Safely Disposed Pharmaceutical Wastes

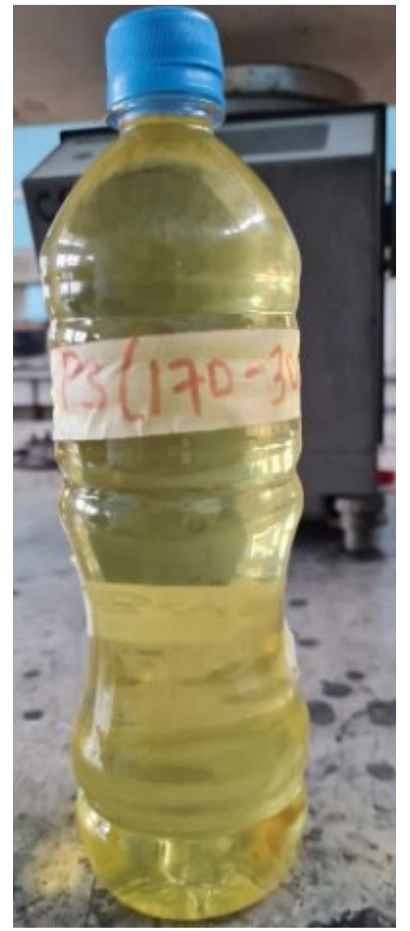


Oils from Plastic Pyrolysis



: Boskel Nig. LtdPhoto Source

Distillation of the Oils to Kerosene



: Boskel Nig. LtdPhoto Source

Incineration Ash Converted to Bricks

: Boskel Nig. LtdPhoto Source

Lessons, Recommendations, and Conclusion

Lessons for the Global Health Supply Chain

Innovative Waste Management Models:

Hub-and-spoke reverse logistics model optimizes waste disposal, cuts costs, and reduces environmental impact

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Collaborative Efforts:

Effective waste management requires strong coordination between public/private sectors, regulators, and 3PLs

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Advanced Technologies:

Using tech like waste plastic-to-oil conversion and ash-to-brick production promotes resource recovery, fosters sustainability and reduces carbon impact

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Lessons for the Global Health Supply Chain Contd.

Public Health and Environmental Benefits:

Safe disposal, like high-temperature incineration with emission controls, safeguards public health and the environment.

Data-Driven Decisions:

Metrics-driven waste management (tracking and analyzing waste data) improves forecasting and sourcing while enhancing strategy effectiveness.

Efficient Storage Practices:

Stringent controls ensure expired items are removed, freeing up storage space, optimizing inventory turnover and ensuring regulatory compliance.

Recommendations

Adoption of Best Practices

Expand GHSC-PSM methodologies across Nigeria.

Centralized Coordination

Establish a national pharmaceutical waste management system.

Training and Awareness

Capacity building for health facility staff and public engagement.

Expansion of Treatment facilities

Establishment of Regional treatment hubs.

Policy and Regulation Enhancement

Advocate for enhancing existing policies and regulations governing pharmaceutical and medical waste management.

Conclusion

Sustainable Impact

GHSC-PSM's approach mitigated the negative effects of pharmaceutical and medical laboratory wastes on public health and the environment, emphasizing sustainable practices.

Optimized Waste Management

By employing advanced technologies and innovative models, the project tackled suboptimal disposal methods, reduced environmental impacts, and promoted resource recovery.

Global Applicability

GHSC-PSM's model offers a scalable solution for effective waste management, blending innovation, collaboration, and data-driven strategies to optimize resources and enhance sustainability.

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