Report on Concordia Humana Assessment of Waste Management at Public Health Facilities in Douala, Cameroon

Feb. 19-23, 2018

Executive Summary:

Concordia Humana volunteers Danny Sexton and Peter Beaucage visited a variety of district, national, and private healthcare facilities in and around the Deido district and Littoral region of Cameroon to assess the facilities' practices and equipment in the area of WASH broadly and more specifically in the area of waste management. While the situation for WASH in general was much improved from previous studies, serious deficiencies existed in waste management at all district facilities assessed. Other than easily correctable issues, the chief problem was a lack of any facilities in the Deido district facility network for waste incineration and disintegrating equipment at Nylon, the only other district hospital visited. This lack of facilities has contributed to unacceptable waste accumulation particularly at Deido, where the poorly-contained and unsegregated pile of waste constitutes an emergent public health hazard. The remediation of this hazard is within the scope of Concordia Humana's mission. After a careful assessment of a variety of options, we propose two intervention pathways by which the Deido site will be remediated and new capabilities for waste disposal installed. In the first, Deido will partner with Laquintinie, the national reference hospital, which has modern incineration equipment with well-trained operators and excess capacity. After demonstration of a successful partnership in which Deido pays disposal fees to Laquintinie, Concordia Humana will provide a package to enhance and expand the capabilities of Laquintinie, including preventive maintenance visits for the current incinerators and a vehicle for waste transport. In the second, after HD Deido has the current incinerator site professionally cleared and commits to providing a budget for operating costs, Concordia Humana will arrange for the construction of a brick incinerator on the current site and training for operators.

I. Introduction

Public healthcare facilities in Cameroon are segregated into organizational tiers based on the level of government supporting the hospital, i.e. national, regional, and district. Concordia Humana representatives, acting on information from our subject matter expert at the Centers for Disease Control and Prevention (CDC) in the United States as well as follow-up visits by the Veolia Foundation in Cameroon, conducted an assessment of the facilities and practices in particularly the area of waste management at a variety of district-tier facilities, including both district hospitals (HD) and community medical facilities (CMA), typically small clinics providing basic healthcare facilities. For benchmarking and comparison purposes, we also visited a national hospital (Laquintinie), and a private Catholic hospital (San Padre Pio). We have summarized our findings by facility, followed by a study of the various options to remediate the serious waste handling deficiencies noted at district facilities during out visits.

II. Deido District Hospital

HD Deido is a is a 60-bed regional hospital serving a catchment area of 600,000 people of predominantly low income (< 40,000 CFA = $75 / month). Their staff of 29 doctors provides services in a wide range of areas including cardiology, maternity services, outpatient clinic, full laboratory, but patients primarily come to the hospital for infectious disease (typhoid, malaria, cholera) and management of chronic conditions. The hospital performs 1,839 new consultations each month, and is always at 100% occupancy for inpatient cases. The facility is located in a dense urban area with a directly adjacent school, orphanage, police station, and main road.

Ivan Same, the Surveillant General (chief administrator) of the hospital readily identified the primary problems at the facility as water, hygiene, and disposal of medical waste. Currently, there is a nonfunctional, 20-year old incinerator in an advanced state of disrepair located in a small site at the rear of the hospital compound.

Water is sourced from both the municipal supply and an onsite borehole (manner of pump is unknown). The issue of water supply was not discussed further, possibly due to our focus on waste management issues.

On the issue of waste, Dr. Same confirmed that waste is segregated at point of generation throughout the facility. We were given a tour of the laboratory facilities, which are the primary producer of infectious waste. The laboratories were generally in good condition; equipment was modern (including an electronic records system) and the facilities seemed well staffed. Staff were using some personal protective equipment (PPE), including gloves and lab coats, correctly, though a number had open toed shoes and few wore protective eyewear. Waste segregation throughout the facility was good and pipet tips were collected separately.

Some issues were identified during the tour, which we expect could be remediated if funding were appropriated:

- A number of unlined mesh trash cans used for infectious waste, though some cans were properly lined and labeled.
- Waste bags for infectious and noninfectious waste were the same color, which could contribute to mis-sorting.

The incinerator is sited at the rear of the hospital compound in a ca. 6 m x 6 m dirt area between the facility wall and three buildings, one of which was in the final stages of construction at time of visit. There was laundry being dried on a building opposite and fruit (banana) trees immediately outside the facility wall, as well as what appeared to be papaya trees growing from the waste pile itself. The incinerator itself is constructed of brick, has a ca. 2 m chimney, and is covered by a partly collapsed awning. The incinerator appeared to be crumbling, with the top and part of a wall collapsed inside. The incinerator was full of partially burnt waste/ash with distinguishable needles, vials, and glass fragments. The area surrounding the

incinerator was strewn with uncovered and uncontained infectious waste including swabs, needles, and test tubes. There were glass fragments and needle caps (presumed needles as well) in the dirt surrounding the incinerator pad. The ash pit was ca. 3 m from the incinerator and contained a large amount of recognizable debris e.g. test tubes, presumably comparable to the ash in the incinerator.

The area separating the incinerator and ash pit was strewn with a mix of infectious waste and construction debris such as a refrigerator, plaster buckets, a bed frame, etc. There seemed to be no effort made to segregate this debris from the poorly-contained infectious waste. The poor segregation effectively undoes the extensive effort put in to waste segregation earlier in the process.

The waste volume produced at the facility was estimated by Janet Ayuk, the chief hygienist at the hospital, to be 15 sharps boxes and about 14-50L trash bags weighing appoximately 5 kg each for a total waste production of ca. 80 kg/day, an easily achievable quantity for a small incineration system.

Three days after our initial visit, we returned to HD Deido to collect further site measurements, study the area again, and speak to Ivan Same. The incinerator site was marginally worse than at the last visit two days earlier with a number of additional sharps boxes and bags of unmarked waste (possibly infectious). We noted that the new building is approx. 50 ft. The boxes and debris were strewn around the incinerator without any system of organization or waste segregation. Detailed site measurements/diagrams and photos were taken from the top floor of the building.

We spoke briefly with SG Ivan Same and discussed the possibilities of a partnership with Laquinitine and incinerator construction at Deido. He expressed concern about transport to Laquintinie but seemed optimistic when we said that transport could be addressed. We estimated the fuel cost for operation of an incinerator at Deido and he

seemed optimistic that funds could be found potentially through efficient operation and user fee collection from smaller clinics.

III. CMA Citè Sic

CMA Citè Sic is one of two CMAs in the catchment area for HD Deido, in a busy market district. It serves a total catchment of 60,000 including 10,000 children under the age of 5. The facility sees 160 new cases per month, similar to HD Deido in makeup of primarily infectious disease. The clinic has 6 doctors (plus a chief of medicine), 23 nurses, one janitor and a special janitor for infectious cleanup. The facility was notably clean and tidy at the time of visit, with the floors recently scrubbed and the courtyard swept. The staff seemed to take pride in their modest facility.

Water supply is via the city and a tanktainer storage tank (ca. 1500 L), the janitor noted that there were occasional water cuts that caused the tank to run dry.

We met with Andre Bakkolom, the Surveillant General (chief administrator), and Ms. Tchougene (a doctor). Waste is segregated at point of generation and accumulated on site for a period of days to weeks. Waste accumulation areas are tidy though a number of deficiencies were noted, particularly that the waste is unsecured, the infectious nonsharps bin is not clearly labeled, and the area is open to rain exposure (under the building eave). The endpoint disposal is uncertain but may involve disposal in needle pits. Waste production was estimated at 4 sharps boxes per month (including ca. 2-3 boxes of waste produced in vaccination campaigns) and ca. 30 bags (ca. 5 kg each) of infectious nonsharps per month.

We also met with the chief doctor who seemed frustrated by our focus on waste. There was a language barrier but it seemed that the general view was that waste was not a major priority for the facility.

IV. CMA Bepanda

CMA Bepanda is in the catchment area for HD Deido, located next to a large Camtel facility on the edge of a busy area. It serves a total catchment of 110,000. 200-300 new cases per month, similar to HD Deido in makeup of primarily infectious disease. The clinic has 5 doctors, 23 nurses, and two janitors, one of which is dedicated for infectious cleanup. The facility seemed quite busy at time of visit though not all beds were full. The land and building area was about two-three times the size of Cité Sic.

We met with Michel Kouchkam, the Surveillant General (chief administrator). Waste is segregated at point of generation, and accumulated on site for nominally two weeks, though the current stockpile has been in storage two months due to the incinerator issues at HD Deido. Waste accumulation areas had a number of deficiencies, particularly that the waste is unsecured within the site, the area is open to rain exposure (under the building eave), a number of infectious nonsharps bags

were without secondary containment, and a large number of sharps were disposed in water bottles that were overflowing without lids. The endpoint disposal is nominally at HD Deido. Waste production was estimated at 12 sharps boxes per month and ca. 40-100L bags of infectious nonsharps per month.

V. Nylon District Hospital

HD Nylon is a district hospital serving the Nylon area, a swampy region near the airport. The facility was spacious and the grounds were well kept. A sign identified funding from the Swiss government though the extent of the funding or its impact was unclear.

We met with the hygienist and saw the incinerator constructed by MSF in 2003 and renovated in 2012 (also by MSF). Based on discussion with the hygienist we understand that the incinerator was built by MSF for an HIV research project and maintenance and operational support (fuel subsidy of 15,000 CFA / month) by MSF was stopped when the project ended.

The incinerator was built on a concrete platform with dedicated aboveground concrete pits for needles, ashes, and chemical waste. All three pits were full at the time of visit. A handwashing station was present and some PPE (thick gloves) was present, though not enough for (or not consistently used by) all operators.

The incinerator was a fireplace type manufactured of firebrick with a severely rusted chimney of < 1 m. The incinerator was in operation, possibly in burndown (visit was at ~9:30 am) and a strong odor of burning plastic was present.

The hygienist was questioned about the fuel consumption of the incinerator. He indicated that some diesel was used to start it when available but that often they used scrap lumber to start the fire. No fuel was added during waste combustion.

There was a test tube and needle shield on the ground in standing water. When pointed out, the hygienist clarified that it wasn't a sharp (presumably not understanding that it was still hazardous). There was also a large overflowing trash can of infectious waste around the corner from the incinerator, which may or may not have been lined.

VI. San Padre Pio

We visited San Padre Pio briefly based on a referral from Bocom (see below). It is a Catholic facility operated by the Diocese. We did not gather demographic data, but the facility seemed to be a busy urban medical center of size between HD Deido and CMA Bepanda. We met with Sr. Charlotte Dzemuyra, chief administrator, and Sr. Bertilla Berinyuy and Sr. Carole Kenson, who all spoke English preferentially. They were forthcoming about their waste management processes and needs despite our unannounced visit.

San Padre Pio indicated that they used to send waste to Bocom but stopped because it was too expensive, about 2500CFA / kg (which corroborates the 3000 CFA/kg quote Bocom had provided us directly). They generate about 30-35 kg / day. They indicated that they now give their waste to someone who claims to be from Laquintinie for 24,000 CFA per pickup. Upon further questioning they indicated they hadn't verified where the waste was disposed, but expressed confidence it was being disposed correctly.

We briefly discussed an unused 80 ha plot of land on the outskirts of the city near Bikoko (near road to Buea, on the Douala electric grid). The site seems ideal but the sisters indicated that management would likely balk at its use for an incinerator as they plan to build a full hospital there.

VII. Laquintinie

Following up on further leads from Bocom, we visited Laquinitinie, the national reference hospital located on a large campus in the Deido district. The facilities were generally well kept and the staff we spoke to extremely professional.

The hospital has two computer-controlled incinerators, one of which has been out of service since 2013, and the other of which is actively used except for a very recent shutdown for a strange noise. We took this to mean that the incinerators are well cared for, though the lack of maintenance attention to the 2013 incinerator may suggest upstream funding or prioritization problems.

We met briefly with the director, Mary Nior, who gave us permission to meet with George Jemchi, the senior nurse in charge of hygiene. George seems to be in charge of the incinerator operation, though it was not clear if he is assisted by a staff. He said "we're doing our best, but it isn't the best". They manage separate streams of solid waste, liquid waste, and sharps. Wastes are sorted into different bins. Their incinerator goes to 1200˚C, and will turn 12 kg of waste into 2 kg of ash. He noted that Bocom once came to destroy three 20' containers of expired drugs totaling 5000 kg but that there is no ongoing relationship, contradicting our discussions with Bocom representatives.

George brought up the possibility that the other incinerator could be rehabilitated to serve Deido, which would require transport and some operating funds. He said that incineration generally needs more fuel than they expect, about 220 L each month. He indicated it was a fixed amount of fuel for each firing though waste volumes varied, but averaged 14-15 T / year (= 30-35 kg/day, which we believe to be a very low estimate for a 700-800 bed facility on 9 ha).

They fire the incinerator 3-4 times each week depending on activities. He gave us some documents and was the only person in all of our Douala facility visits who

gave us PPE for the site tour. The supply of masks and other PPE seemed to be abundant, a stark contrast to any other facility we toured.

The older incinerator was in a building shared with George's office and some other facilities. It was a two-chamber model, George noted that the chimney system was better than the other unit and that the problem was with the burner units not with the controls. The area around the incinerator was neat though the outer area had been repurposed for lawn equipment storage (weed whackers). They had cleaning supplies stocked up around and the area was quite clean despite it not being used.

The second incinerator was in a dedicated building, also a computer controlled two chamber unit manufactured by Inciner8. George mentioned that he had stopped the previous cycle at about 600 ˚C because he heard a noise, and showed us the ash which was carefully removed and placed in a box for further treatment. The ash looked comparable to that generated at Deido with recognizable vials and needles though George assured us it would be treated again after the incinerator was inspected. The area around the incinerator doubled as a storage area for papers, cleaning supplies, etc, and the floor of the building had collapsed due to construction defects. The waste loading area was clean. We note that masks were used as PPE though the incinerator area didn't have a noticeably high quantity of particulates.

Overall the standards and practices observed at Laqunitinie were leaps and bounds above those at any other facility we visited, which is consistent with its position as a national reference hospital. It seemed to be the sole facility which prioritized waste management in any meaningful way.

VIII. BOCOM

Though not a healthcare facility, in the interest of completeness we visited the sole commercial provider of waste disposal in the area, BOCOM International, located on the other side of the river in an industrial area. The facilities were modern and offered a comprehensive, on-site removal and disposal service at a substantial cost of 3,000 CFA/kg.

This cost, while potentially negotiable through long-term contracts, is prohibitive for all the facilities we visited.

IX. Options Analysis

Several facts are clear from the site visits performed:

1) It appears that waste management is systematically underfunded at all district hospitals visited.
2) The national reference hospital Laquintinie appears to have excellent capabilities for waste management with two incinerators, one of which

was until recently operating. The premises are well-kept, and the staff well-trained.

3) Within the district hospital system, there is no site that meets guidelines for construction of a new incinerator. The best candidate sites we saw were CMA Bepanda and HD Nylon, but both have substantial issues with logistical support (trained operators at Bepanda and waste transport at Nylon).

Based on these observations, we analyzed the following options for handling the waste of HD Deido and associated clinics, as a model for other districts (see also Appendix 1).

1) Laquintinie

   Concordia Humana, Hôpital Laquintinie, HD Deido, and the Regional Delegation would partner for Laquinitinie to provide incineration services to regional hospitals (initially HD Deido and satellite clinics) for a reasonable user fee that covers the unit costs of incineration and transport.

   The specific contributions of the parties would be:

   - HD Deido and the Regional Delegation would arrange and pay for the existing site to be professionally cleared of infectious waste (including contaminated construction waste) as a precondition for construction. The only party with the expertise to perform this decontamination (to our knowledge) is BOCOM.
   - Concordia Humana would provide a service visit for repair and preventative maintenance of Laquintinie's existing incinerators and a vehicle to be dedicated for only transport of medical waste.
   - HD Deido and the Regional Delegation will commit to a dedicated budget to completely cover operating costs of the scheme via payments to Laquintinie.
   - Laquintinie would agree to manage and host the program on a cost-recovery basis, to employ and train a driver, waste handler, and incinerator operator, and to not use the donated vehicle for any purpose than waste transport.

   If successful, the partnership could be expanded to include expanded facilities for other district hospitals.

2) New Deido Incinerator – Field Fabricated

   The existing site at HD Deido is (barely) large enough for a small, inexpensive field-fabricated incinerator, and a tall chimney would help to mitigate the significant public health hazard of particulate and chemical pollution from the exhaust of such units.

The specific contributions of the parties would be:

- HD Deido and the Regional Delegation would arrange and pay for the existing site to be professionally cleared of infectious waste (including contaminated construction waste) as a precondition for construction. The only party with the expertise to perform this decontamination (to our knowledge) is BOCOM. HD Deido and the Regional Delegation would also commit to a dedicated budget to cover operating costs of the incinerator, including operators, fuel, and PPE.
- Concordia Humana would arrange for the construction, commissioning, and initial operator training of a field-fabricated incinerator of international standard design on the cleared site using local contractors and materials. This would include a two-stage firebrick incinerator with a chimney at least two meters taller than the tallest nearby building, a weather-protected waste storage area, and concrete lined ash pit.

3) New Deido Incinerator – Manufactured

The existing site at HD Deido could alternately be used for a commercially manufactured diesel- or LPG-fired incinerator with a tall stack. The pollution output of such units is significantly less than that of field fabricated units, though the fuel costs for operation are also higher.

The specific contributions of the parties would be:

- HD Deido and the Regional Delegation would arrange and pay for the existing site to be professionally cleared of infectious waste (including contaminated construction waste) as a precondition for construction. The only party with the expertise to perform this decontamination (to our knowledge) is BOCOM. HD Deido and the Regional Delegation would also commit to a dedicated budget to cover operating costs of the incinerator, including operators, fuel, and PPE.
- Concordia Humana would arrange for the purchase, installation, commissioning, and initial operator training of a commercial incinerator of international standard design on the cleared site. This would include a chimney at least two meters taller than the tallest nearby building, a weather-protected waste storage area, and concrete lined ash pit.

4) New CMA Bepanda Incinerator

At CMA Bepanda, there is a small plot of land already elevated over the nearby residential area, and topographically below a large CAMTEL campus which is mostly empty land. This plot of land could serve as a less expensive option for a brick incinerator due to the reduced chimney height required. Waste would need to be transported from Deido to the Bepanda site and one or more trained incinerator operators would need to be employed at the Bepanda site.

The specific contributions of the parties would be:

- HD Deido and the Regional Delegation would commit to a dedicated budget to cover operating costs of the incinerator and safe waste transport, including a driver, incinerator operators, fuel, and PPE.
- Concordia Humana would arrange for the construction, commissioning, and initial operator training of a field-fabricated incinerator of international standard design on the cleared site using local contractors and materials. This would include a two-stage firebrick incinerator with a chimney at least two meters taller than the tallest nearby building, a weather-protected waste storage area, and concrete lined ash pit.

5) Refurbish Nylon Incinerator

At HD Nylon, there is a field-fabricated brick incinerator built in 2003 and refurbished in 2012 by MSF. The incinerator site at HD Nylon has a setback of ca. 100 m from any non-hospital buildings, which is advantageous for exhaust distribution. The refurbishment of the incinerator at HD Nylon would likely be extensive, comparable in cost to building a new incinerator due to the completely full ash and needle pits and the degradation of the chimney. Additionally, a vehicle would be needed to securely transport waste from Deido to Nylon, a distance of ca. 5 km.

X. Conclusion and Options Selection

Based on this analysis, we have elected to present options (1) and (2) to the parties for their input before making further decisions.

XI. Glossary of abbreviations

PPE: Personal protective equipment
HD: Hôpital District. [District Hospital].
SG: Surveillant General. [Chief Administrator].
CMA: Centre Médical d'Arrondissement. [Neighborhood medical center].
MSF: Médecins Sans Frontières. [Doctors Without Borders].
HIV: Human immunodeficiency virus.

CFA: Central African Franc. As of Feb. 2018, the exchange rate with the US dollar is approximately 525 CFA to US$1.

BOCOM: A multinational firm whose diverse operations include professional medical waste disposal. Operates a facility in Douala.

T: metric tons.

ha: hectares.

XIII. Appendix 1: Options Analysis

Option	Laquinitinie	Field-Built @ Deido	Commercial @ Deido	Field-Built @ Bepanda	Refurbishment @ Nylon
Strengths	- Little training required - Inexpensive (truck and incinerator repairs) - No design needed - Easy upkeep, car repair common. - Waste incineration is done by experts.	- Inexpensive - Relatively simple design - Local labor = easy, cheap repairs	- Low pollution - Little training needed - As designed, runs properly or not at all	- Inexpensive - Relatively simple design - Local labor = easy, cheap repairs - Site presents low risk of severe pollution.	- Site is isolated, reducing chimney cost. - Inexpensive existing design and facilities to build on.
Weaknesses	- Deido and Laquintinie do not have working relationship - Fully adequate waste management is not already in place at Deido (past failures in segregation and storage indicate possibility of future failures in transport).	- Lack of apparent buy-in from HD Deido and Regional Delegation (see current site). - Need training to prevent fuel overconsumption or pollution of surrounding area. - Categorically higher pollution than commercial options.	- High fuel cost - High upfront cost - Local maintenance nearly impossible	- Need training to prevent fuel overconsumption or pollution of surrounding area. - Categorically higher pollution than commercial options. - Requires transport from other facilities - Staff at CMA Bepanda are untrained for incineration and undertrained for general waste handling.	- Waste management standards are not fully met already. - Example of an incinerator left to disrepair for lack of any preventive maintenance. - We don’t know the people at Nylon as well as at Deido. - Long distance between Deido and Nylon.

				- Low likelihood of funding for ongoing costs.	
Opportunities	- System is scalable to other facilities	- Other facilities can use for a fee.	- Other facilities can use for a fee.		- Scalable for other facilities' use *if* successful.
Threats	- Possibility that operations at Laquintinie may not able to accommodate Deido in future. - Truck is used for anything else (even once). - Funding cut causes HD Deido to end up where it started (but with a dirty truck).	- Tall chimney structural failure could cause injury - Continued operation after failure or improper operation causes severe pollution.	- Back to square one with a broken incinerator that can't easily be fixed. -	- Continued operation after failure or improper operation causes severe pollution. - Infectious waste transport – likely in taxis. - Mismanagement results in high pollution open pit fires.	- This incinerator is abandoned just like the last one. - Transport is mismanaged resulting in public health disaster.