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SUDAN TRANSITIONAL ENVIRONMENT PROGRAM

PILOT PLASTIC RECYCLING PILOT PROJECT FINAL REPORT



May 2009

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COVER PHOTO

First load of plastic water bottles brought in for compaction in the pilot plastic recycling project, Juba, August, 2008. Credit for cover and photographs 1, 2, 4, 5 in this report: Thomas Catterson. Credit for photograph 3: Remo Khamis

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PILOT PLASTIC RECYCLING PROJECT

Final Report

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ACRONYMS

COPEL	Compagnie pour L'Environnement et Développement, Ltd
GoSS	Government of Southern Sudan (GoSS)
IRG	International Resources Group, Ltd.
JICA	Japanese International Cooperation Agency
MHPIE	Ministry of Housing, Physical Infrastructure and Environment
PET	Polyethylene terephthalate
STEP	Sudan Transitional Environment Program
USAID	United States Agency for International Development
VEGA	Volunteers for Economic Growth Alliance

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I. INTRODUCTION

I.1. PURPOSE OF THE REPORT

Juba's ubiquitous piles of trash must astound many visitors. Trash seems to be everywhere – dumped beside streets, clogging streams, bobbing down the Nile River, littered around buildings, even strewn across the graves in the municipal cemetery.



Plastic trash floating down a creek through Juba

And plastic trash predominates. Almost like raindrops from clouds, the pervasive plastic half-liter, Rwenzori water bottles seem to have been sprinkled down from above and lie wherever you look – some still new, fat and even sparkling a bit; others already old, squashed, and dusty. Imagine Juba inundated – not with water, but with millions and millions of plastic water bottles.

Since 2005, the Sudan Transitional Environment Program (STEP), financed by the United States Agency for International Development (USAID) and implemented by the International Resources Group, Ltd. (IRG), has been assisting the Government of Southern Sudan (GoSS) to identify, assess, and mitigate

the post-conflict urban and rural environmental problems of Southern Sudan. Solid waste, especially plastic waste, certainly is one of Southern Sudan's most evident and serious urban environmental problems. In 2008, STEP financed a small, short-term pilot project to investigate the feasibility of recycling plastic water bottles. The purpose of this report is to report the results of that project.

I.2. JUBA'S SOLID WASTE PROBLEM

According to a study commissioned by the Japanese International Cooperation Agency (JICA), in 2007 approximately 166.1 tons per day of solid waste were being produced in Juba. Of this total amount, only 25.9 tons per day, or 15%, were being collected, all of it from markets, hospitals, and hotels. This trash, however, was simply being dumped along the three main roads that lead out of Juba. The rest of Juba's solid waste was being burned or dumped haphazardly.

In Juba, three public institutions, the GoSS Ministry of Housing, Physical Infrastructure and Environment, Lands and Utilities (MHPIE) the Equatoria State Ministry of Physical Infrastructure, and the Juba Payam, share responsibility for solid waste disposal. Although Southern Sudan has no law that specifically addresses the disposal of solid waste, in 2005 the Ministry of Physical Infrastructure had prepared a master plan for solid waste management in Juba and had requested bids for the construction of a solid waste management facility. As of 2007, the construction on this facility had not started.

Solid waste may cause adverse impacts human health and the environment. No specific studies appear to have been carried out in Juba on the potential link between sickness and improper disposal of trash. Speculation suggests that solid waste sometimes blocks water channels, thereby creating pools of stagnant water, which perhaps provide habitat for the reproduction and development of the mosquitoes that transmit malaria, an endemic disease in Juba. In a study for USAID, however, Kolb and Rainey (2007) concluded that in Juba there is “limited immediate health risks” from heightened risk of vector disease from open dumping and the poor drainage caused by informal disposal of wastes” and concluded that although Juba’s waste problem “...certainly does present health risks, these risk (sic) are not as severed and immediate as those associated with the water supply and sanitation situation.”

Studies elsewhere have shown that when some types of plastic are burned, toxic chemicals, including chlorine, dioxins, furans, heavy metals, benzene, butadiene, acetaldehyde and phosgene, are released (Plastic Recycling Industries, Ltd., 2007). If people breathe these fumes, their health may be affected. No specific data exists, however, on how much burning plastics in Juba may be affecting its people’s health.

If domestic or wild animals ingest plastic, it can block their digestive tracts or make them feel full, so they die of starvation. Wild life can become entangled or snared in plastic debris and die from starvation, exhaustion, infection, or drowning.

I.3. STEP’S SOLID WASTE ACTIVITIES

During 2006 and early 2007, STEP’s team leader, Mr. Thomas Catterson, organized a number of meetings about Juba’s solid waste crises, in which representatives of national and state ministries, the



Woman scavenging trash dumped by the Yei Road

Juba County Council, United Nations organizations, bi-lateral projects, and non-governmental organizations (NGOs) participated. These meetings served to raise awareness of the extent and character of Juba’s solid waste problem. They also led to a few actions, such as the designation by the county government of a dump site on the Yei road and the construction of an anaerobic treatment pond.

In mid-2007, Mr. Catterson made recommendations to USAID/Sudan for further actions regarding the problem of solid waste in Juba (Appendix B). Based largely on these recommendations, in September 2007 USAID modified STEP to add Performance Measure 11 (PM 11), entitled Solid Waste Management.

The purpose of PM 11 was “...to help Southern Sudan local jurisdictions (especially the Juba County Council) to develop capacity to manage a growing volume of solid waste in manner that safeguards public health.” Its activities were “(1) establishing financial and technical capacity to operate a waste management facility; (2) expansion of a UNMIS solid waste dump site; (3) enforcement of regulations governing disposal of solid waste; (4) purchase of equipment;

(5) clean-up of existing dump sites; (6) public education about solid waste; (7) preparation of a funding proposal for a Juba solid waste management system; (8) establishing private sector participation in solid waste collection and separation; (9) reduction of the volume of solid waste. These outcomes were to be achieved through the provision of technical assistance, training, equipment, and funds for operating costs (USAID, 2007); (10) developing a proposal for expanding the management system, including financing of additional sites; and (11) assist the GoSS to develop a comprehensive plan for solid waste disposal”.

Activities 1 through 7 and 10 and 11 involved establishing a large waste management facility in or near to Juba. To establish a waste management facility is a large-scale undertaking, requiring several years and millions of dollars. Moreover, although other organizations, such as the JICA and Multi-Donor Trust Fund (MDTF), were already planning for a solid waste management system, they showed no interest in collaborating with STEP on these plans.



Two boys in Juba collecting plastic bottles for reuse

By contrast, no other national or international institutions or organizations in Juba were involved in activities 9 and 10. The possibility for establishing private sector participation in the collection, separation, and recycling plastic bottles, which are such a large volume of Juba’s solid waste, appeared promising. Therefore, in collaboration with volunteers from another project, also financed by USAID/Sudan, called Volunteers for Economic Growth Alliance (VEGA), a pilot project was designed which would test the feasibility of establishing a private enterprise in Juba that would collect, process, and ship plastic bottles for recycling at the plastic recycling plant in Kampala, Uganda.

This choice of activities proved fortuitous. Early in 2008, USAID/Sudan decided to not obligate additional funds to STEP and to cancel PM 11. Since by then the pilot project had already commenced, it was completed, although reduced in its scope.

I.4. PRELIMINARY INVESTIGATIONS

The STEP team leader first reviewed reports about Juba’s solid waste problem and discussed the problem with various knowledgeable people in Juba. He then visited Plastics Recycling Industries Uganda Ltd., in Kampala, Uganda, to learn about its process for compacting or granulating waste plastic and about the markets for recyclable plastic. He subsequently met with the owners of Safi Cleaners, a Juba waste collection company, who expressed interest in participating in a pilot waste recycling project. The team leader also explored the possibility of collaborating with the United Nations Volunteers in a plastic recycling pilot project.

The STEP Team Leader then discussed the possibilities for collaboration with the Volunteers for Economic Growth Alliance. VEGA was a project being financed by USAID/Sudan that was promoting the establishment and growth of small and medium-scale private enterprises in Southern

Sudan. VEGA agreed to cooperate with the plastic recycling project. Three volunteers with business degrees were assigned to analyze the financial feasibility of recycling plastic bottles. The volunteers investigated and analyzed the source and quantity of waste plastic water bottles in Juba and the markets for compressed and granulated waste PET plastic.

The volunteers found that during early 2008 approximately 2,577,000 plastic bottles were entering Juba per month. The largest single source of plastic bottles was the Rwenzori Beverage Company, Ltd. in Kampala, Uganda, which was sending 1,215,000 bottles of water to Juba each month. The two next largest sources of plastic bottles were the Coca-Cola and Pepsi-Cola bottling plants in Khartoum, which between them were sending another 1,080,000 bottles per month to Juba. The Nile River water bottling plant in Rumbeck was sending 48,000 plastic bottles per month to Juba. The remaining 234,000 bottles came from various other sources.

If 40% of the plastic bottles entering Juba each were to be collected, 1,030,800 bottles could be sent for recycling each month. Since there are 66,000 half-liter plastic bottles in a ton, these bottles would produce 15.6 tons of recyclable plastic per month. The closest market for recyclable waste plastic is Plastics Recycling Industries, Ltd. in Kampala, which is part of the same group of companies as Rwenzori Beverage Company, Ltd.

Table I. Source, Company, and Number of Plastic Bottles Entering Juba, 2008

SOURCE	COMPANY	NUMBER
Uganda	Rwenzori	1,215,000
Khartoum	Coca-Cola	720,000
Khartoum	Pepsi	360,000
Southern Sudan	Nile River	48,000
Other	Various	180,000
Other	Various	54,000
TOTAL		2,577,000

The VEGA volunteers prepared preliminary financial calculations for an enterprise for recycling waste plastic beverage bottles in Juba. These financial calculations indicated that a private enterprise would not be profitable if it depended entirely on income from selling scrap plastic bottles to Plastic Recycling Industries, Ltd.

The VEGA volunteers, however, found that they could not answer some important questions about a plastic recycling enterprise. For example, would it be feasible to compress plastic bottles with a hand-operated compactor rather than a power compactor? Would Juba's hotels and camps cooperate in the separation of recyclable plastic bottles from their other solid waste? Could the separation of plastic for recycling be combined with regular trash collection and disposal? Where in Juba would it be best to collect and compact the plastic bottles? What would the costs really be?

In order to answer such questions, the VEGA volunteers recommended that STEP finance a pilot plastic recycling project. The pilot project would not attempt to establish a recycling enterprise. Rather it would produce more information about the feasibility of starting a recycling enterprise in Juba. STEP and VEGA agreed to collaborate on a pilot project, although the cut in STEP's funds restricted it to only one month's duration.

After evaluating several Juba enterprises, the VEGA volunteers selected Safi Cleaners (SAFI) to collaborate in the implementation of the pilot project. It appeared to be an established company. Its owners expressed their interest. And its clients included hotels and camps that seemed likely to participate. In July 2008, representatives of STEP, VEGA, and Safi Cleaners signed a Memorandum of Understanding that summarized the responsibilities of each organization for implementing the pilot waste plastic recycling project (see Appendix F).

The pilot project required a machine to compact the plastic bottles. The importation of a power compressor was considered, but that option was discarded as too time-consuming, expensive, and uncertain. Instead a metalworking shop in Nairobi was commissioned to design and build a hand-powered compressor, which arrived in Juba in mid-July 2008.

I.5. IMPLEMENTATION OF THE PILOT RECYCLING PROJECT ¹

I.5.1. SUMMARY

A pilot project in plastic recycling was conducted in Juba, Southern Sudan to gather some of the data that is required to determine the best approach to managing recyclable plastic waste. Recyclable plastic was collected twice a week for four weeks during August of 2008. Safi Cleaning Company of Southern Sudan partnered with STEP and Volunteers for Economic Growth Alliance to implement the pilot project. This report presents the information gathered on the following aspects of

Table 2. Expenses: Pilot Waste Plastic Project

EXPENSE	TOTAL	PERCENT
Truck Rental	\$908	13
Labor	\$1,559	22
Materials	\$1,257	17
Misc	\$141	2
Truck to Kampala	\$425	6
Land Rental	\$1,000	14
Press	\$1,925	26
TOTAL	\$7,217	100

collecting, processing, and shipping recyclable plastic: operational expenses, level of cooperation from potential clients, and logistical difficulties.

The results of the pilot project suggest that it will not be feasible to operate a self-sustaining, profitable recycling business in Southern Sudan without significant investment in education and marketing, and a commitment from GOSS to enforce supportive policies. Initial capital investment in trucks, compressors, generators, and other equipment will also be necessary to start up the business. This project was not designed to provide information about all aspects of a recycling business. For example, it did not test the level of payment that would stimulate the collection of plastic bottles.

It also did not cover the potential for other recyclable materials such as aluminum. Experience from this project suggests that financial incentives should play a key role in the collection process, regardless of whether it is operated as an independent or subsidized business.

I.5.2. DESCRIPTION OF THE PILOT PROJECT

Initial capital was required to rent and prepare the land for the operation, and to procure and transport a press to compress the plastic. In addition to the land and a compressor, the operation of the project required the following inputs: garbage truck rental, fuel, three casual workers to collect and press the plastics, garbage bags, baling rope, and a scale.

Prior to the start of the plastic collection, SAFI asked forty of their largest clients to separate recyclable plastic from the rest of their waste during the month of August. These clients largely consisted of restaurants, bars, hotels, and NGOs. Special blue bags were provided for this purpose.

The original plan was to collect plastics on Mondays and Thursdays for four weeks. However, based on the supply over the first two weeks, the schedule was customized depending on the estimated supply from each customer. Several clients were dropped due to low supply and some were added

¹ Section 1.5 was written by Michelle Bahk and Azara Turaki

based on recommendations. After the completion of the collection process in August, it took two weeks in September to negotiate shipment of the plastics from Juba to Kampala.

1.5.3. FINDINGS

A total of 1,018 kg of plastic was collected over eight collection days and sold to Plastic Recycling Industries (PRI) in Kampala for 521 SDP. Operational expenses incurred during the project (excluding land and equipment) came to 6,600 SDP, far outweighing the revenues. Labor and truck rental (including fuel) were the largest expenses, representing 45% and 30% of the total respectively.

Part of the high cost of doing business is specific to Juba, but another contributing factor was the short-term nature of employment for this project. With longer term contracts, workers to collect, sort, and press can be hired at less than 400 SDP per month (and without lunch allowance). Also, a truck was rented at 250 SDP per day for the pilot project, which is significantly higher than what the cost would have been for a long-term operation, or for a business model that did not rely on door-to-door collections.



Michelle Bahk and Azara Turaki compressing bottles

The amount of plastic increased after the second week of collections at a rate of approximately 10-20% at each collection. During the first two weeks, a third to a half of all clients did not separate plastics as requested, despite several reminders from SAFI and the provision of blue garbage bags for this purpose. Some clients were not willing to cooperate at all, citing the increased work required to separate the plastics.

The work mostly involves communication and coordination. As an example, in general, the hotel managers we approached would agree to participate in the pilot project. However, we would arrive on collection day to find that this was not communicated to the appropriate people. For instance, it would not be relayed to

the restaurant or housekeeping manager, who should in turn instruct the kitchen staff and cleaners to separate plastic in the kitchen and when cleaning the rooms. Figuring out the logistics, decision makers, and implementers at larger organizations (most notably UN organizations) took some time, preventing them from meaningfully participating in the pilot. At times, SAFI separated the plastic from regular waste at the pickup location if there was sufficient supply to make it worthwhile. In addition to the challenge of communication and coordination, there were several instances when casual workers at the pick-up locations would demand payment before releasing the separated bags of plastic, even though it was made explicit that no payment would be made during the pilot.

The pilot project reinforced the expectation that operating a recycling business in Southern Sudan will be expensive relative to those in neighboring countries such as Kenya and Uganda, and that there are many challenges which must be addressed in order for the volume of plastic collected to reach sufficient scale.

1.5.4. FINANCIALS

Based on inputs from various suppliers we estimate that about 40 tons of half liter plastic bottles enter Southern Sudan each month. A ton of plastic (or 63,000 bottles) sells at 510 SDP. In order to break even on the operating expenses in the plastic recycling business, approximately 13 tons must be collected, sorted, pressed, and transported on a monthly basis, representing a collection rate of 33%. This is a high target to reach even in locations with a long culture and understanding of recycling. According to one study, the United States has a collection rate of 15%. Investment in an efficient compressor should make the business scalable without significant increase in operating expenses.

Aluminum commands much higher prices (2,500 SDP per ton) but the supply is estimated to be less than a tenth that of plastic bottles. Plastic recycling will have a larger impact on reducing the waste going to the landfills but recycling aluminum will yield greater financial benefits.

The cost of shipping the plastic to Kampala was negotiated down to 850 SDP. This was the lowest of several quotes, some of which were as high as 1,500 SDP. We expected the price for transporting to Kampala to be competitive since most trucks delivering goods from Kampala return empty. However, we found that the quoted prices had a wide range and were difficult to negotiate down. In fact, the truck company contracted by Rwenzori (of which PRI is a sister company) refused to deliver our plastic to PRI even before we got to discussing prices. We suspect that transportation (as with labor wages) costs will be easier to negotiate as part of a longer term contract and with the support of key stakeholders (i.e. PRI). The driver we finally engaged mentioned that about 50 SDP will be paid along the way in informal customs duties. No export duties were charged in crossing over to Uganda.

1.6. DISCUSSION

The most challenging part of the pilot project was not getting buy-in from the participants, but getting them to take it a step further and manage their staff to separate plastic. Even the most enthusiastic participants in the project (NGOs) fell short on the implementation, due to the lack of appropriate communication and instructions. The most costly part was hiring labor and trucks to make the collections. In order to address both issues, we recommend a focus on an education and marketing campaign to sensitize the community to the concept of recycling, and a financial incentive to encourage individuals to bring in the plastics to several central locations. The program must be designed to address the shortage in *piastres* in Southern Sudan.

Both efforts will require significant investments. The education and marketing component should address both the environmental benefits to recycling and the practical ways in which people can participate. The viability of financial incentives can be tested by setting up well publicized collection points in high traffic areas (i.e. Konyo Konyo, Juba Town, All Saints Church) and incrementally increasing the payment to observe the resulting increase in supply. Based on the operation of the pilot we believe other types of plastic and recyclable materials should be managed concurrently to increase profit margins.

The shortage of *piastres* is a serious challenge to managing a payment program. This can be managed by either instituting a minimum number of bottles for payment (in increments of 1 SDP) or a type of voucher program where payment is made after a certain threshold is reached.

With the continued influx of foreign investment and population growth in Southern Sudan, the supply of recyclable material will continue to increase along with the problem of waste management.

Due to the high start-up costs and the initial investment required in education and marketing, some form of subsidies will be required before recycling can be operated as a financially independent business. Stakeholders interested in funding this effort can start by initiating a campaign to sensitize the public about the importance of recycling, setting up several centralized collection points, and offering financial incentives to encourage the collection of bottles. Due to the low profit margin, recycling cannot be operated as a profitable business unless it achieves sufficient scale, which can be achieved by investing in the start-up equipments, and more importantly in sustained education and promotion.

2. PLASTIC RECYCLING INDUSTRIES, LTD.

On December 16, 2008, Mr. Joseph Lam, Director of Wetlands and Biodiversity in the Directorate of Environmental Affairs, and Mr. Bruce Kernan, Team Leader, STEP, met in Kampala with Mr. Alex Byarugaba, the general manager of Plastics Recycling Industries Uganda, Ltd. Their discussion concerned four topics: (1) the market for PET plastic; (2) the comparative advantages of granulated vs. compacted plastic; (3) Rwanda's experience in dealing with waste plastic; and (4) the potential for Plastics Recycling Industries Uganda, Ltd. to support plastic recycling in Juba.

The global economic recession has severely curtailed the demand for recyclable PET plastic, causing its price to drop from US\$ 900 per ton in early 2008 to US\$ 500 per ton in December. Plastic Recycling Industries Uganda, Ltd. had been exporting its partially processed waste PET plastic to China, where it was made into a fabric that was exported to the United States to be used in automobile seats. Plastic Recycling Industries Uganda, Ltd. no longer is exporting to China and consequently no longer is buying waste PET plastic. It is, however, continuing to buy other types of recyclable plastic, for which it still has a market among the Ugandan plastic manufacturers. Very important for Juba is that only waste PET plastic can be compacted while all other types of recyclable waste plastic must be granulated.

So a compactor, manual or power operated, no longer would be a good option for reducing the volume of Juba's waste plastic. A granulating machine, by contrast, not only can process all types of recyclable plastic but reduces the volume of waste plastic to about half the volume of compacted plastic. Handling, storing, burying or transporting granulated waste plastic would thus be cheaper than compacted plastic. A blade sharpening machine and a skilled sharpener are essential for the proper operation of a plastic granulator. A granulator and a blade sharpener cost approximately US\$ 25,000. Plastics Recycling Industries Uganda, Ltd. could provide training in blade sharpening. It could also lease a granulator to a recycling enterprise in Juba.

Mr. Byarugaba noted that Rwanda's urban and rural landscapes are largely free of waste plastic due to its plastic recycling program. Political support from Rwanda's prime minister for recycling plastic has been a deciding factor in removing plastic trash from the landscape. Mr. Joseph Lam mentioned that during the Nile Basin Initiative Forum in November 2008, the Director General of Environmental Affairs in the GoSS Ministry of Housing, Physical Planning and Environment met with the Rwanda Minister for Environment. They discussed how Southern Sudan could learn from the Rwandan experience in recycling waste plastic. The Director General has proposed that staff from the DEA make a trip to Rwanda to learn and borrow from their experience. The team will be headed by the Minister of Housing, Physical Planning and Environment. Mr. Byarugaba recommended meetings in Rwanda with the following people: Mr. Karega Vincent, Minister of Environment and Mines, email: ukarega@gov.rw, Tel: (+250) 580373, Fax: (+250) 587331,

Cellphone: (+250) 08 300 896 and Mr. Thomas E. Wheeler, Plastics Engineer, Nyanza Rubbish Dam, www.kiglicity.gov.rw, email: rwandawheelers@yahoo.com, cellphone: (+250) 03 540 997.

Mr. Byarugaba is an excellent source of specialized technical and financial expertise in waste plastic recycling available to Juba. He said that he would be willing to go to Juba for a few days in order to provide advice in the technical, business, and administrative aspects of plastic recycling. Mr. Byarugaba would not charge his time, since he is interested in receiving plastic waste from Juba. He would request reimbursement for his travel and per diem costs (approximately US\$ 900). Mr. Byarugaba's contact information is the following: Plastic Recycling Industries Uganda, Ltd., email: alexbeaudet@chemist.com and priul@utlonline.co.ug; Tel: 041 288 225, cellphone: (07) 74 015233 and 0772 222834

3. CONCLUSIONS AND RECOMENDATIONS

3.1. SUBSIDIES FOR PLASTIC RECYCLING

The alternative of letting plastic bottles continue to accumulate, strewn across Juba or dumped on its outskirts, should be dismissed from consideration. No municipal government should shirk its responsibility for the proper disposition of solid waste.

Burning or burying recyclable plastic bottles also is not a reasonable option. Assume that the 2,577,000 plastic beverage bottles entering Juba each month were all half-liter size. Their total volume would be 1,288 cubic meters. To bury them under a meter of dirt would fill a pit 25 meters square and 2 meters deep every month, and one 89 meters square and 2 meters deep every year. Handling and exaction costs would be excessive and the disturbance to the landscape unacceptable. Although burning the plastic would reduce its volume, the toxic chemicals released would be unacceptable.

Recycling Juba's waste plastic bottles is an obvious alternative to burying or burning them. However, recycling plastic bottles appears unlikely to provide the sole basis for a profitable, stand-alone, private enterprise (perhaps confirmed by the fact that no entrepreneur has entered the business). In mid-2008, when Plastics Recycling Industries, Ltd. was selling recycled plastic pellets to China for US\$ 900 a ton, and could not obtain enough waste PET plastic to meet demand, the VEGA volunteers calculated that a plastic recycling business in Juba would lose money. In December 2008, Plastics Recycling Industries, Ltd. was receiving only \$ 500 per ton in China for the same plastic pellets. In the pilot recycling project, expenses were US\$ 6,790 and the income only US\$ 260. Thus both financial calculations and actual experience indicated that at present a private plastic recycling enterprise in Juba would require subsidies in order to survive.

Subsidies could be provided in several ways. The income from regular waste collection operations could subsidize recycling of plastics. A regular waste collection operation, for example, could also collect and process recyclable plastic. The costs of recycling plastic could then be combined with the costs associated with the collection of non-recyclable trash. The pilot project did not test this alternative, since Safi Cleaners did not integrate plastic recycling into its regular operations.

Plastic recycling also could be part of a broader recycling program that includes other types of recyclable plastic and other materials. The VEGA study notes that aluminum cans are worth ten times more by weight than plastic PET bottles. Scrap metal of other types also may be profitable.

Again, an integrated rather than segregated approach to recycling would permit the profits from the recycling of one material to underwrite the costs of recycling the plastic.

But without subsidies for plastic, private enterprise would be likely to concentrate on only the most profitable segment of the recyclable waste. Such segmentation happens now in Juba. Entrepreneurs are salvaging scrap metal to take to Kampala. But they are leaving recyclable plastic and aluminum behind. Subsidies could give them a financial reason to include plastic in their operations.

Another way to subsidize plastic recycling would be for the government to make direct payments to the private enterprise. The payment could be given by weight of material collected, processed, and transported to the point of recycling, such as, for example Plastic Recycling Industries in Kampala. A direct subsidy has three advantages. Costs and benefits would be clear. Standards could be established and easily monitored. And enterprises would be left free to find the most efficient way to comply with the standards.



Juba solid waste dump on Yei road full with plastic bottles

In-kind subsidies could also make recycling profitable for private enterprises. Of the pilot project's total costs, for example, 22% went for renting space. A free allocation of land from the municipal government would have lowered the project's costs by that much. Likewise, labor took 31% of the pilot project's operating budget. If the hotels and clients had separated recyclable plastic from their other waste, then the project would have reduced its labor costs. A donation of equipment, such as a press or vehicle, would lower an enterprise's initial investment.

The VEGA report on the pilot project identifies another type of subsidy, recommending a "...financial incentive

to encourage individuals to bring in the plastics to several central locations..." No private enterprise would be able to afford to pay for waste plastic. For Juba to achieve a massive clean-up would require this type of subsidy. The government would have to set a price for waste plastic that would stimulate hundreds of people to decide to collect plastic bottles. The pilot project was unable to test what prices would stimulate what quantity of plastic collection. In mid-2008, however, Plastics Recycling Industries Uganda, Ltd. was paying the equivalent of only US\$ 0.0073 for a one-half liter plastic bottle delivered to its plant in Kampala, equivalent to 0.016 SDP. At this price, it was receiving about 33% of Kampala's recyclable plastic.

Subsidies for plastic collection could be an efficient way to channel money into Juba's poorest households, whose members have few alternatives for earning cash. They could collect plastic and receive income in proportion to their efforts. They could decide themselves how to use the cash – for goods, education, health care, or even to start a micro-enterprise. Thus subsidies for plastic recycling could yield Juba social and economic together with environmental benefits. ***Further financial analysis should be undertaken to design a subsidy program for recycling plastic bottles that achieves environmental, financial and social benefits.***

3.2. MUNICIPAL MEASURES IN SUPPORT OF PLASTIC RECYCLING

Municipal measures are required in order to solve the problem of waste plastic bottles in Juba. Municipal regulations would be required to assign clear responsibilities to the municipal government private enterprises, and households, establish mechanisms for monitoring compliance, and set fines for non-compliance. Municipal regulations would also be needed in order to establish how the municipal government would support the recycling of plastic bottles. For example, now the Southern Express company collects and dumps plastic bottles along with other trash. If its contract specified that plastic bottles must be separated from other trash for recycling, it would boost the possibilities of for recycling them. In Rwanda, regulations prohibit the use of some kinds of plastic. In time, perhaps Juba's municipal government could also limit the legal use of plastic either through a ban or by taxing plastic water bottles so heavily that people begin to find other ways to obtain clean drinking water, such as reusable containers. The pilot plastic recycling project did not investigate such measures, however, so this report cannot discuss them further. *The municipal government of Juba should thoroughly investigate different possibilities for regulating the disposal of plastic water bottles and limiting their use.*

3.3. PUBLIC EDUCATION ABOUT PLASTIC RECYCLING

For it to be successful, Juba's population must understand, support, and participate in a plastic recycling program. The VEGA report recommends an "...education and marketing campaign to sensitize the community to the concept of recycling...", without elaborating much further. A "marketing campaign," however, would be more useful and effective if it were to educate the different segments of Juba's population not so much about the "concept" of recycling as about their specific roles and responsibilities in a system for the collection of solid waste generally, and plastic recycling specifically. The outcome of a fully successful campaign would be that every person in Juba would understand not only the reason for plastic recycling program but would know how to carry out their specific role in the program and be willing to do so.

Suppose, for example, that the Juba government decided to subsidize plastic recycling through payments for waste plastic bottles brought to one or more collection points. For the subsidy to achieve its objective, Juba's population would have to understand all its details: What type of bottles? Where to take them? How will they be tabulated? How will payment be made?

Any public confusion about such details and others would undermine public confidence in the program, with the risk that people would become disgusted and stop participating. Once a recycling program loses public confidence it is even more difficult to achieve the public support and participation that its success requires. But, as discussed above, to collect and recycle a large portion of Juba's waste plastic will require massive public participation. *A public education campaign should provide information to Juba's population about the benefits of participating in a specific plastic recycling project.*

3.4. INTERNATIONAL AID ORGANIZATIONS

International aid organizations have a responsibility to assist Juba to organize a system for plastic recycling. The expatriate employees of international organizations almost certainly produce a disproportional part of Juba's waste plastic, since they can usually better afford to buy bottled beverages than most of Juba's permanent residents. Most international organizations are required to

adhere to environmental regulations that require them to take into consideration the effect of their activities on the environment. Deployment of expatriates to Juba increases the demand for plastic beverage bottles and thereby contributes to the waste on Juba's cityscape. Thus, their own environmental regulations and guidelines require international organizations to take actions to assist Juba to resolve its problem with waste plastic beverage bottles. ***The international aid organizations with offices in Juba should collaborate to provide effective support for the collection and recycling of plastic bottles.***

3.5. THE UGANDAN-RWANDAN EXAMPLE

Collaboration with Plastic Recycling Industries, Ltd. in Kampala would help to establish a successful plastic recycling program in Juba. Plastic Recycling Industries Uganda, Ltd. has specialized equipment to process different types of plastic and technical expertise in operating and maintaining that equipment. Its Ugandan and international markets are already established. Its machinery operates at less than full capacity, so it can utilize Juba's waste plastic.

A Memorandum of Understanding (MOU) between Plastic Recycling Industries, Ltd. and the Compagnie pour L'Environnement et Développement (COPED, Ltd.), in Rwanda, provides a model for an agreement between an entity in Juba and Plastic Recycling Industries, Ltd. The MOU provides for COPED to organize the collection, separation, and granulation of plastic in Kigali and its shipping to Kampala. Plastic Recycling Industries leases COPED a granulator and provides it with technical assistance and training. ***The Juba municipal government should investigate the possibility of formulating a Memorandum of Understanding with Plastic Recycling Industries, Ltd. for collaboration on the recycling of plastic bottles.***

APPENDIX A. LETTER FROM THE DIRECTORATE OF ENVIRONMENTAL AFFAIRS TO USAID

GOVERNMENT OF SOUTHERN SUDAN - MINISTRY OF ENVIRONMENT, WILDLIFE CONSERVATION AND TOURISM - JUBA

June 5, 2007

Ms. Makila James
U.S. Consul General--Juba

Mr. David Gressley
UN Deputy Resident and Humanitarian Coordinator

Mr. Allan Reed
Mission Director--USAID/Sudan

Dear Friends of Southern Sudan,

I am writing this letter to you on behalf of the Government of Southern Sudan to appeal for your special help and leadership in addressing the environmental health crisis currently reigning in Juba and its surrounding area.

As you are not doubt aware, presently there are no facilities to accommodate dumping by the many evacuator trucks serving the septic clean-out needs of the City. Nor is there a solid waste dumping site for the garbage produced by this urban area as it rebuilds and renovates.

The result has been a growing area of high environmental hazard along the Yei Road (but also elsewhere around Juba) where the evacuators are simply dumping their contents in the open, some of which must now surely be washing back into the Nile with the onset of the rains. The mounting pile of trash spread several kilometers along the Yei Road should shame us all considering our combined efforts to rescue Juba from years of abandon during the civil war.

I am asking you to put your heads together and help us plan and finance the means to deal with the daily load of septic waste being spread on the landscape around Juba and increasing the likelihood of disease. We understand that UNMIS has a small solid waste facility on the Yei Road but this should be opened to public use and expanded. As you know, the septic residues and garbage from your respective compounds are being dumped along with those of everyone else including the GOSS so I appeal to you for some assistance and leadership at this critical juncture.

USAID is planning on convening a special workshop on “Improving Public Health for All” on June 13 and 14 here in Juba. While we welcome the opportunity to plan and strategize how to address the growing urban sanitation problem of Juba, we hope your representatives will come to that meeting with word of tangible support from you our key donors and benefactors.

Thank you very much for your attention to this request. Please do not hesitate to be in contact if there are questions or clarifications required. Please accept the assurances of my highest regard.

Sincerely,

Victor Wurda LoTombe
Director-General of Environmental Affairs
Acting Under-Secretary

CC: H.E. the Minister of Environment, Wildlife Conservation and Tourism
H.E. the Minister of Housing, Land and Public Utilities
H.E. the Minister of Health

APPENDIX B. WASTE ISSUES IN JUBA TOWN

BRAINSTORMING ON THE WASTE ISSUES IN JUBA TOWN

PREPARED BY TOM CATTERSON, USAID STEP TEAM LEADER...JUNE 25, 2007

Present Situation/Problem Statement:

- Large number of formal and informal haulers taking trash (solid wastes, including construction wastes) and liquid wastes (sewage pumped from latrine holding tanks by evacuators trucks) and dumping it randomly and illegally outside of town, primarily on the Yei Road. Dumping is starting along other roads as well, including the road to Gomba (eastern access of the City, across the bridge) and the road to Terekeka (road north towards Mundri) (see photo 1 - 3).
- These haulers are mainly servicing organizations and institutions such as hotels, camps and compounds, including the compounds of all the donor and bilateral/multilateral community. It has been noted that the Roko Construction Company which is the contractor for the rehabilitation of the GOSS Ministry buildings has started dumping construction waste along the road. They have been sent a letter asking them to cease and desist and to participate in cleaning up the mess.
- Sewage is being dumped into a stream, about 15 kms out the Yei Road from Customs Market. This stream drains south and east getting back to the Nile above the point where water is extracted from the river by the Cistern trucks just below the bridge and also upstream of the official city water plant intake point on the river (see photo 4).
- There are smaller piles of garbage, mainly household garbage found through out the city, occasionally burned but never cleaned or collected. This takes place because there are no collection services servicing individual households nor are there garbage bins distributed around town (see photo 5).
- It would appear that some of the market areas are being cleaned, at least one a week but who does it and where the refuse is disposed of is unknown.
- Many households living near to the intermittent streams that flow through the city (the “khors”) use them as a means of disposing of garbage. These rivers are now heavily polluted and much of this pollution winds up in the Nile as well, most of it upstream of the City Water Plant. Similarly, local people use these streams as a source of surface water and small children can often be seen playing in them (see photo 6).
- UNMIS had attempted to build a Solid Waste Disposal Site on the Yei Road, in cooperation with the Juba City Council and reportedly with the local Payam (Rejaf Payam?), in order to serve their own solid waste disposal needs in line with UN regulations. That facility established at about kms. 14 on the road does not appear to be functioning because vehicles, presumably including UNMIS vehicles (and those of every or any one else), cannot now reach the site because the access road is blocked with garbage!
- Similarly, USAID with resources from its Office of Transition Initiatives (OTI) through Development Alternatives, Inc. (DAI) had attempted to build an Anaerobic Treatment Ponds site

on the Yei Road, just to the north of the checkpoint. The site was poorly chosen and became a pole for development in the area. Before the ponds were finished, but not after considerable expenditure, it was clear that they could not be completed and operated because of the NIMBY syndrome (Not in My Back Yard). USAID ordered that the ponds be decommissioned and the site restored in February 2007 after the visit of a water and sanitation assessment team from AID/Washington.

Problem: A city characterized by relatively fast population growth as the result of an influx of new inhabitants (returning IDPs or refugees or others from the rural areas seeking employment and social services) producing more wastes that are contaminating the surface-based drinking water supply (in large measure the River Nile) and adding to the general unsanitary and unhealthful conditions. Garbage and human wastes openly deposited around the city are also a source of flies that carry disease into the household. There can be little doubt that there is a growing vulnerability, especially among the poor segments of society here, to diseases like cholera. It is a big problem which was discussed in considerable detail in a recent two day (June 13-14) Juba Sanitation Workshop. It was generally agreed at the workshop that although the overall solution was a long-term proposition related to general infrastructure development in the city, that there were things that can and should be done now.

Getting started on cleaning up the city, whether for solid wastes or sewage effluent from latrine systems, can and should get underway soonest. It will not resolve all the problems but concerted efforts to clean up the solid waste and properly dispose of sewage will be an important indication to local people that the government and its partners are serious about the sanitation situation and the environmental health status of their people. It was also pointed out that the organizations and institutions that contribute to the waste stream currently fouling the Yei Road corridor, can and should be expected to do their part in contributing to the solution of these problems.

Potential Partners: A number of humanitarian and development partners of the Government of Southern Sudan have tentatively indicated their willingness to participate in this effort. They include: USAID, the US Consul General, UNMIS, the UN System (?), and the E.C. It was also felt that the appeal to participate in these efforts should be extended to the World Bank, the Joint Donor Team and the representatives of the Multi-Donor Trust Fund. An appeal for support to the private sector should also be made, at a minimum to secure their cooperation in using improved waste disposal facilities.

Government Participation: Governmental concern for these problems have now been manifest and expressed at various levels from the GOSS level, to the State and local government level (Juba City Council). Recommendations and advice received at the Juba Sanitation Workshop suggested that the more local the solution, the greater the chance for success.

Tentative List of Tangible Short to Medium-Term Actions to Address the Issues:

- **Re-establish the dumping site that UNMIS and the Juba City Council** attempted to start on the Yei Road and get it operational again. It should be expanded for public use, a management team put in place and signage directing trucks carrying waste set up along the road leading to it. A modest tipping fee should be assessed to offset the costs of management and pay the local Payam for agreeing to host this facility. *Estimated cost: donated services by UNMIS, incremental cost- nil; implementation by UNMIS.*

- **Expansion of Juba City Council Dump Site on Yei Road.** The above mentioned site should clearly become one of several operating around the City of Juba to absorb the growing solid waste stream. Support would be required to study its management requirements, ensure its suitability for the task, and to purchase the equipment needed to operate it (e.g., a bulldozer or payloader capable of compacting the trash and burying it at the end of each day with soil excavated from the site) and to hire and train the staff who would be provided by the Juba City Council. *Estimated cost: \$500,000. per year for five years; implementation- a private sector contractor working with the Juba City Council, funded by a donor (STEP working with USAID funds).*
- **Clean-up of existing waste dumping along the Yei Road, other roads and within the city itself.** It is suggested that the UNMIS Engineers could deploy some of their earthmoving equipment to begin a clean-up along the Yei Road and elsewhere (including in their own compound), and in the city. This would be a one time event that would give the Juba City Council a chance to jumpstart its own municipal cleaning services. *Estimated cost: donated services by UNMIS, incremental cost- nil; implementation by UNMIS.*
- **Immediately carry out a feasibility study on Sewage Disposal.** The many evacuees serving the city need someplace to dump their sewage. Two options have been suggested...open application on a land site (not into a drainage way!) or anaerobic treatment ponds. There is a need to bring in a consultant from one of the neighboring countries to study the problem and identify an economically, socially, technically, and environmentally sound course of action. *Estimated cost: consultant team @ \$50,000.; funded by a donor and working with the Juba City Council; Estimated cost of establishing a facility in which to dispose of sewage from town latrines-- \$500,000. first year establishment plus \$50,000. to \$100,000. per year operational costs; implementation—private sector contractor with Juba City Council; funded by a donor.*
- **Engagement of Private Sector/Enforcement of Dumping Restrictions:** There is a need to approach the organizations and institutions that now send solid or liquid wastes for disposal outside the city and obtain their agreement to proper disposal. Some level of governmental oversight (which level...city, state or federal?) will be required to monitor and enforce compliance and take appropriate action against violators. *Estimated cost: \$200,000 to \$500,000. per year for five years; implementation by a local government agency; GOSS funded and State Government implemented.*
- **A Sanitation and Environmental Health Awareness and Education Campaign:** The actions mentioned above will provide a vivid demonstration that the GOSS and its foreign partners are serious about cleaning up Juba and will be the cache against which an awareness and education campaign is launched. This campaign will be aimed at informing people of the need for changing behaviors and the linkages between an unclean environment, dirty water and disease. *Estimated costs: \$500,000 to \$1,000,000. per year for five years; implementation: by a community development or health services oriented NGO, either local or international or in combination; donor funded.*
- **Municipal environmental and sanitary services:** Bring in consultants to develop an MDTF proposal to finance the establishment of garbage services within Juba City...whether a series of street bins and trucks to service them or collection services, for both households and marketplaces and other establishments (e.g. schools). *Estimated costs: \$250,000 for a consultant team to devise an MDTF proposal; investment costs from the MDTF to be determined.*

APPENDIX C. UPDATE ON BRAINSTORMING ON THE WASTE ISSUES IN JUBA TOWN

BRAINSTORMING ON THE WASTE ISSUES IN JUBA TOWN—AN UPDATE

PREPARED BY TOM CATTERSON, USAID STEP TEAM LEADER...JULY 7, 2007

Subsequent to the first “Brainstorming Note” on this subject circulated on June 25, 2007, a number of other interested parties both within GOSS and among partners have been contacted about the issues of sewage and solid waste in Juba Town. Contacts were made with USAID, the Joint Donor Team, UNICEF/UN Humanitarian Mission, and the EC; all contacted were keen to be of assistance and be part of the solution within their present means.

Lest there be any mistake, the very distressing garbage situation along the portion of the Yei Road leaving Juba Town continues to expand and multiply. At every site, the garbage is growing deeper and some truckers are barely leaving the road itself to dump their trash. New dumping sites are appearing at an ever increasing rate. Disposal of the sewage by the evacuator is a relentless stream of waste being dumped into the stream site at about kilometer 15.

A great deal more needs to be done to translate these ideas into action. Any partners and/or government agencies willing to take an active part are encouraged to get in touch with STEP (thomasc782@aol.com or by phone at 0477111068). Comments, questions, corrections and suggestions on the contents of this brief note are encouraged.

The following note has been prepared in the light of these meetings, using the Tentative List of Actions proposed in the last round of thinking as a key to presenting the update and highlighting the new parts in yellow for your ease of reference².

Tentative List of Tangible Short to Medium-Term Actions to Address the Issues:

- **Re-establish the dumping site that UNMIS and the Juba City Council** attempted to start on the Yei Road and get it operational again. It should be expanded for public use, a management team put in place and signage directing trucks carrying waste set up along the road leading to it. A modest tipping fee should be assessed to offset the costs of management and pay the local Payam for agreeing to host this facility. *Estimated cost: donated services by UNMIS, incremental cost- nil; implementation by UNMIS.*

Update: A visit was made to the proposed dumping site along the Yei Road with UNMIS Civilian Administrative personnel and confirmation was obtained that UNMIS would proceed within two weeks to begin excavating the dumping area, opening a large hole to be used for depositing solid wastes brought out from the town in trucks. Materials excavated from the site would be useful in strengthening the access road to the site which is approximately 900 meters north off the Yei Road at about kilometer 14.

² Although this note represents the collective thinking of those involved, it has been produced by Mr. Catterson without final vetting by the parties and thus no commitments can be construed. There is, however, a realization among all concerned that something needs to be done. The old environmental adage that “either you are part of the solution or you are part of the problem” applies very well to this situation and the responsible authorities and partners seem very ready to act for a solution.

- **Expansion of Juba City Council Dump Site on Yei Road.** The above mentioned site should clearly become one of several operating around the City of Juba to absorb the growing solid waste stream. Support would be required to study its management requirements, ensure its suitability for the task, and to purchase the equipment needed to operate it (e.g., a bulldozer or payloader capable of compacting the trash and burying it at the end of each day with soil excavated from the site) and to hire and train the staff who would be provided by the Juba City Council. *Estimated cost: \$500,000. per year for five years; implementation- a private sector contractor working with the Juba City Council, funded by a donor (STEP working with USAID funds).*

Update: The STEP Program will pursue a pilot activity for the remaining two years of its project life with the Juba City Council to develop the operational capacity to get this solid waste facility going. Among the activities envisaged is hiring a crew of workers to manage trash separation as required, foremen to manage the operation, stationing power equipment and operators to move, compact and bury accumulating waste. The idea of a private sector contractor to provide these services will be explored. Signage would be erected to direct truckers to the site and a tipping fee is under consideration to offset the costs of operating the site. Instructions and limitations about use and general trash hauling will be established (no night hauling or dumping, separation at point of origin by organizations and institutions, etc); assistance with enforcement of these rules will be sought from the Central Equatoria State Government. The original cost estimate seems very high and a much lower figure, after some initial investment, and especially in light of the services provided by UNMIS, is being considered, on the order of US\$100,000. per year.

Additional funding and continuation of the pilot will be developed so as to establish this solid waste management site as a municipal service facility of the Juba City Council, and as a model for what are likely to be several such facilities required to serve the solid waste disposal needs of Juba Town. World Bank or MDTF or other donor resources will be sought for this purpose.

Greg Wilson of UNOPS has furnished us with some information on recycling technology for plastic bottles, suggesting that the opportunity to study the feasibility of doing so would be worthwhile. More information on this topic is being compiled. Clearly, separating out plastic bottles from the solid waste stream is something that should begin already. There could be stored on an interim basis until a solution is found rather than spread across the landscape of Southern Sudan or buried in the solid waste facility or worse, burned.

- **Clean-up of existing waste dumping along the Yei Road, other roads and within the city itself.** It is suggested that the UNMIS Engineers could deploy some of their earthmoving equipment to begin a clean-up along the Yei Road and elsewhere (including in their own compound), and in the city. This would be a one time event that would give the Juba City Council a chance to jumpstart its own municipal cleaning services. *Estimated cost: donated services by UNMIS, incremental cost- nil; implementation by UNMIS.*

Update: This matter was raised with the UNMIS Civilian Administrative authorities during the site visit and they have promised to address the issue with the Military Engineering Corps who are part of the UNMIS deployment and have the necessary equipment to carry this out. They felt that a willingness to take on this activity would require some guarantees from government authorities in Southern Sudan that they would enforce dumping regulations and require haulers to use the new solid waste facility. Because the majority of the illicit dumping is happening on the road side just beyond the existing checkpoint, it is felt that it will be easy to ensure that truckers are fully

informed of their responsibilities and the consequences (e.g., having their vehicles impounded) of failure to obey the regulations.

We will be working with the GOSS Ministry of Environment, Wildlife Conservation and Tourism and the Central Equatoria State Government to post two Inspectors at the checkpoint on the Yei Road. Initially, they will survey trucks and evacuator exiting the city to establish the amount of solid and sewage wastes that are flowing out of the city. They will also handout **an interim flyer** that will direct those dumping solid wastes to avoiding dumping in new sites and to use existing areas (perhaps specifying the distance from the checkpoint to the selected roadside site), and to alert them to the fact that a Juba City Council Solid Waste Facility is being built and will be brought on line soonest. The flyer will inform perspective users of the need to begin separation of trash, the handling of sensitive materials and about the probable tipping fee. It will make it clear that using this facility in the future will be mandatory and that the regulations will be enforced.

- **Immediately carry out a feasibility study on Sewage Disposal.** The many evacuators serving the city need someplace to dump their sewage. Two options have been suggested...open application on a land site (not into a drainage way!) or anaerobic treatment ponds. There is a need to bring in a consultant from one of the neighboring countries to study the problem and identify an economically, socially, technically, and environmentally sound course of action. *Estimated cost: consultant team @ \$50,000.; funded by a donor and working with the Juba City Council; Estimated cost of establishing a facility in which to dispose of sewage from town latrines-- \$500,000. first year establishment plus \$50,000. to \$100,000. per year operational costs; implementation—private sector contractor with Juba City Council; funded by a donor.*

Update: The Inspectors mentioned above will carry out a daily count of the evacuators exiting the city at the Yei Road Checkpoint to ascertain the amount of sewage being deposited daily in order to furnish information essential to the choice of options mentioned above and their eventual design. We are looking for expertise in this field and a donor to fund a consultant study on the management and disposal of latrine waste. They will also give them a copy of a one page flyer indicating that open dumping of these effluents will soon end and a facility with a tipping fee will be put in place and usage will be obligatory.

- **Engagement of Private Sector/Enforcement of Dumping Restrictions:** There is a need to approach the organizations and institutions that now send solid or liquid wastes for disposal outside the city and obtain their agreement to proper disposal. Some level of governmental oversight (which level...city, state or federal?) will be required to monitor and enforce compliance and take appropriate action against violators. *Estimated cost: \$200,000 to \$500,000. per year for five years; implementation by a local government agency; GOSS funded and State Government implemented.*

Update: Once it has becomes certain that we are making progress with the establishment of the Juba City Council Solid Waste Facility on the Yei Road, we will prepare a flyer to be circulated widely in town among businesses and institutions that generate a significant waste stream to inform them of the new facility and advise them of the requirements for using it. The matter of enforcement has been addressed above but it is clear that it will be a critical element to the success of the overall effort.

- **A Sanitation and Environmental Health Awareness and Education Campaign:** The actions mentioned above will provide a vivid demonstration that the GOSS and its foreign partners are serious about cleaning up Juba and will be the cache against which an awareness and education

campaign is launched. This campaign will be aimed at informing people of the need for changing behaviors and the linkages between an unclean environment, dirty water and disease. *Estimated costs: \$500,000 to \$1,000,000. per year for five years; implementation: by a community development or health services oriented NGO, either local or international or in combination; donor funded.*

Update: USAID/Sudan has recently completed a basic design for a Water and Sanitation for Health (WASH) initiative that is planning on funding. This plan includes a substantial component for Awareness Raising and Behavioral Change related to water and sanitation and avoiding diarrheal diseases. It is suggested that the message about the importance of avoiding throwing garbage in the streams running through the city, not allowing children to play in these fouled streams and avoiding at all costs using surface waters from these streams could be incorporated into the overall message without significant cost increments. STEP will advise its USAID colleagues to consider same.

- **Municipal environmental and sanitary services:** Bring in consultants to develop an MDTF proposal to finance the establishment of garbage services within Juba City...whether a series of street bins and trucks to service them or collection services, for both households and marketplaces and other establishments (e.g. schools). *Estimated costs: \$250,000 for a consultant team to devise an MDTF proposal; investment costs from the MDTF to be determined.*

Update: Several individuals have pointed out the need to do something about existing garbage piles within the town and how to get them cleaned up and keep them from spreading. It seems that a number of Partner organizations have cash for work or labor intensive public works programs funded within the family of UN organizations (UNICEF or UNOPS) or funded by other donors with implementation by NGOs. Several of them are known to have taken up neighborhood and marketplace clean-up programs as part of their past efforts.

These should be re-started and some planning for broader coverage and coordination attempted. It is imperative that such programs, however, provide tools and protective clothing or gear (gloves, gum boots, dust masks, smocks or coveralls) for those engaged in this manual labor and that young children be prohibited from being at the site when the clean-up is going on. Efforts will also have to include community and neighborhood associations so as to develop the collective will and peer pressure that is so often required for successful adherence to such a program.

APPENDIX D. STEP PERFORMANCE MEASURE NO. 11

PM # 11 - Solid Waste Management: Southern Sudan authorities, including local jurisdictions (especially the Juba County Council), develop capacity to manage a growing volume of solid waste in a manner that safeguards public health.

Juba and other Southern Sudanese towns are experiencing economic growth and an influx of population with the end of a protracted civil war, refugees and IDPs are returning, and people seek out expanded economic opportunities. Nascent governmental institutions are not yet able to handle attendant problems, among them, management of a rapidly growing volume of solid waste. Currently, un-segregated waste is dumped along roadsides in ever growing piles, creating (or exacerbating) public health problems. STEP has produced a "think piece" on opportunities related to dealing with solid waste and sewage for the City of Juba and the health and environmental problems related to these.

STEP would work in concert with other donors and Southern Sudanese authorities, including the Juba County Council, to develop capacity for financial and technical management of a waste management facility on the Yei Road. More specifically, it is expected that arrangements can be made for UNMIS to expand the solid waste dump site developed for its own use, improve the site's access road, and open it to the public. STEP will work with MEWCT, the County Council, other governmental institutions and the donor community to develop management systems and capacity, using the UNMIS site as a pilot.

In coordination with other donors, STEP support would include activities aimed at: (1) promulgating and enforcing regulations governing the use of the dump site, e.g. separation of wastes at source, tipping fees, etc.; (2) providing equipment as needed, including trucks and pay loaders; (3) cleaning up existing, unhealthful sites; (4) publicizing the new system, including signage, instructions to solid waste generators regarding requirements for separation at source, fees, and limitations; (5) public education; (6) developing a broader proposal for city wide solid waste management services, including collection from households, markets and other establishments; cost recovery; and enforcement; (7) encouraging Private sector participation, especially in collection and separation, (8) reducing the volume of Solid waste generated and (9) developing a proposal for expanding the management system, including financing of additional sites.

This project would assist the GOSS to develop a comprehensive plan for solid waste management. The focus of initial work would be on Juba, but training and assessments would cover other major municipalities (expected to include Yei, Malakal, and Wau).

Other resources for the STEP project to address this issue would likely include: technical assistance, training, and operating costs for establishing and operating solid waste disposal sites.

APPENDIX E. RECYCLING FACT SHEET

RECYCLING FACT SHEET II BY KHARY DICKERSON

Recycling Fact Sheet II

Southern Sudan currently has no public waste management system. Most citizens and businesses are unwilling to pay for trash clean-up. The vast majority of this trash consists of plastics which contain food and drink products.

The major distributor of beverage containers in Juba is the Rwenzori Beverage Company Limited based in Kampala, Uganda.

The empty bottles are often:

- Discarded by the road side creating unsightly and unsanitary road and living conditions
- Re-used for alcoholic or acidic juices, releasing unhealthy ingredients
- Burned, releasing hazards in the air and on the ground

Rwenzori Distribution: Mahmoud, owner (spelling?) stated 35% of business is export and S. Sudan accounts for 20% of that number. Mr. Mahmoud said 160,000 bottles are sent per day, but Prashanta, sales director, said 600,000-800,000 bottles are sold per month.

Other Plastic Container Distributors: Nile River has a bottling plant in Rumbek. Nile River sells in some parts of Juba, but is heavily concentrated in Rumbek and Wau.

I have sent an e-mail to the owner but I have not received comments as of yet.

I do not know of any other large suppliers of plastic bottle distributors.

Plastics Buyer: A recycling facility owned by the Plastics Recycling Industries Limited in Kampala, Uganda, a sister company of Rwenzori, purchases certain plastics from the public. The Netherlands Government partially funded the plant with a \$1 million donation. The plant is managed by Alex Byarugaba. As of now, I am unaware of any other buyers.

Incentive for Rwenzori: Mr. Mahmoud is seriously interested in assisting S. Sudan with establishing a recycling facility. He is happy there are no plastics on the streets of Kampala, but he is losing \$5000-\$10,000 per month on the plant. He stated S. Sudan may assist him getting the recycling plant to profitability or covering costs.

Aluminum Buyer: Shumuk Group, recycles soft, hard cast, plane material, print plates, and hard sections. The plant receives 15 tons of aluminum from S. Sudan through appointed collection agents. The plant pays between \$1200-\$1400 per ton depending on quality, after 1 week of sorting and grading. Hard cast aluminum receives 20%-50% lower cost. There are buyers of steel and copper scrap metal, but no contact has been made. It takes 50 to 60 aluminum cans/ kilogram; approximately 50,000 cans/tonne (1000kg).

Contacts: Shukla (owner?) and Vkumar Kumar

Market: After the bottles are processed in Kampala, the material is shipped to China to make carpet and other products. Local producers are unable to afford the recycled plastics.

Demand: The Kampala plant can handle and sell 6 tons/day but can only get 3 tons. They are only able to receive 40% of demand.

Partners: Currently, VEGA is partnering with STEP, managed by Bruce Kernan, to develop the plan to recycle plastics. Bruce is willing to fund the equipment necessary for the Juba facility and other smaller facilities, if feasible. VEGA is responsible for all business related technical assistance. Louis Berger is providing technical assistance relating to machinery and engineering and financial assistance.

There is much interest in this field; other partnerships may develop, if appropriate.

Machinery for Juba Site: Compressor-needs to produce at least 150 lbs/sq ft. of pressure, very little maintenance required. Compressor can reduce plastic to 10% of size allowing 30 tonnes of plastic to fit on a 40 tonne truck. Bottles do not need to be cleaned. Advised to buy German compressor over Chinese compressor because of quality. Costs approximately \$5000

Granulator (shredder)-Plastics must be washed; buyers will not accept plastics not washed. Blades must be sharpened, sharpener must be bought and training must be provided. Costs approximately \$10,000.

Purchase Price of Plastics: Compressed plastic=\$235/tonned; Granulated plastic=\$350
Alex will pay on delivery after weighing.

Transportation: Maximum size of load: The Ugandan Truckers Association contact stated between 30-35 tonnes was possible, depending on conditions and location.

Costs: Ugandan truckers, who bring the vast majority of supplies to S. Sudan, return virtually empty. Alex Byrugaba said he may be able to negotiate a deal with truckers that bring in the Rwenzori bottles, but did not know costs.

Ugandan Truckers Assn estimated a price of \$875, though this price is very, very negotiable. I asked on the price from Wau/Rumbek to Kampala, but the gentleman didn't know.

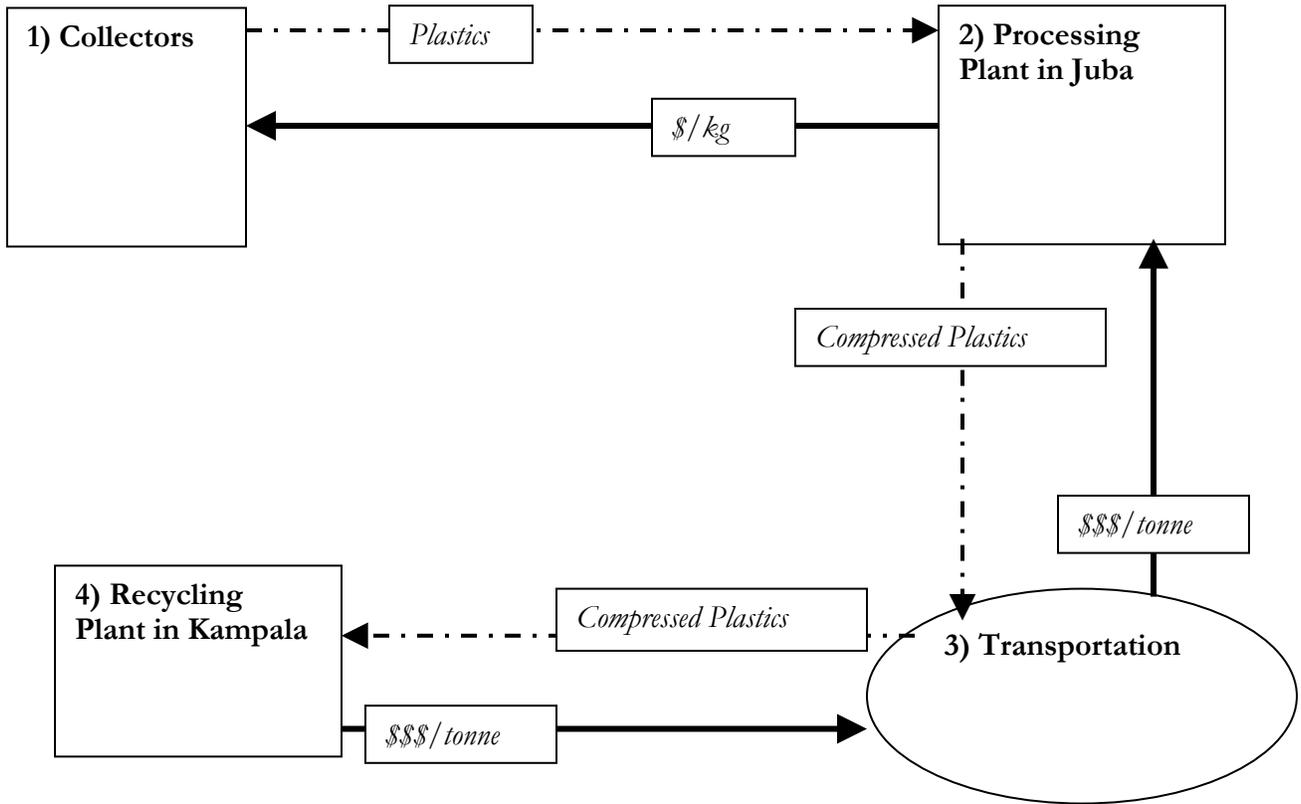
Recycling Process: The recycling process would involve four stakeholders: **(see Exhibit)**

- 1) **Collectors**-businesses, NGOs, and citizens will take their plastics to the Processing Plant in Juba for a fee per kg.
- 2) **Processing Plant in Juba**-plastic collections center where plastics would be dropped off, compressed, and then loaded onto a container.
- 3) **Transportation**-a trucker would either buy the plastics from the Processing Plant to be sold in Kampala or a truck would be leased.
- 4) **Recycling Plant**-the recycling plant in Kampala would pay the trucker in Kampala.

Physical Data: 1 tonne of plastic=20,000 bottles of 2 litre=63,000 bottles of 1/2 litre

Collections Payout: The Recycling Plant in Kampala pays \$.23/kg or \$230/ tonne for used plastic.

Exhibit: The Recycling Process



1-Month, 1-Load Scenario

Notes:

- 1) The monthly operational costs are assumptions based off of similar equipment and/or industries based in Juba.
- 2) The **Collections Payout** is based off the amount of profit the processing plant would have after paying all of its operational costs, **if this remains strictly a private sector, plastics only, business without any monthly NGO or government support.**
- 3) The **Capital Investment** section is the capital provided by an NGO needed to purchase the machinery, equipment, and supplies. This section is not included in monthly operational expenses, but included only as information to the reader.

REVENUE

4) Recycling Center in Kampala

Plastic purchase amount:

\$230/tonne or .23/kg

Load: 30 tonne

Total Revenue (30 tonne*\$230) **\$6900**

COSTS

2) Processing Plant in Juba

Monthly Operational expenses

Labor:

Bookkeeper/Accountant (\$600)

Chief Operator/Engineer (\$600)

Laborer (\$500)

24-hour security (3 guards) (\$1350)

Total: (\$3050)

Fuel:

Generator Fuel (10L/day*24*\$1.25/L) (\$300)

Total Operational Expense **(\$3350)**

3) Transportation

Juba to Kampala-30-ton container

Dry Season (November-March) (\$875)*

*amount used for example

Rainy Season (April-September) (\$1166)

(Ugandan Truckers Association quote)

Profit **\$2675**

1) Collections Payout

Profit/Collected amount

\$2675/30,000kg or 30-tonnes **\$.089/kg**

Capital Investment Needed:

Compressor		\$5000
Plastic weighing scales	?	
Generator		\$7,000
Structure/Storage		\$?
Loader/Forklift		\$?

APPENDIX F. MEMORANDUM OF UNDERSTANDING. STEP, VEGA, SAFI CLEANER'S

MEMORANDUM OF UNDERSTANDING (MOU)

This MOU is between **Sudan Transitional Environment Program (STEP)**, **SAFI Cleaning** and **Volunteers for Economic growth (VEGA)** on the 10th day of July in the year 2008.

Purpose of this MOU is to form a contract between STEP, SAFI Cleaning and VEGA/AMED for the first phase of the pilot recycling program in Juba, Southern Sudan. This MOU will outline responsibilities of all parties.

STEP agrees to financially support the incremental cost of operating the pilot project. This includes the purchase of the following items:

- Manual press and shipping
- Renting of the land
- Land clearing
- Containers for plastic storage on the site
- Security
- Labor
- Truck hire
- Shipping to Kampala
- Travel expenses
- Misc – garbage bins, sacks, bailing twine, scale rental

SAFI agrees to the support pilot project program by managing business operations.

- Communicate with clients
- Collection and separation of plastics
- Press, bale, and ship to Kampala
- Hire labor for project
- Provides information and responds to inquiries from VEGA and SAFI.

VEGA agrees to provide technical and consulting assistance.

Monitors the progress of the pilot project and provides reports on the results

Bruce Kernan
STEP Team Leader
Date: _____

Scott Allen
VEGA/AMED Chief of Party
Date: _____

Elizabeth Majok
SAFI Cleaning Director
Date: _____

