UNITED NATIONS ENVIRONMENT PROGRAM
Secretariat of the Basel Convention

PNUE

Technical expert mission in Senegal to determine the best approach for the introduction of environmentally sound procedures for the recovery of Used Lead Acid Batteries in a manner consistent with the Basel Convention Technical Guidelines.

Dakar, Senegal, 21-27 April 2008.

Report prepared for the Secretariat of the Basel Convention by the ILMC Expert (29 May 2008)

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Technical expert mission in Senegal

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1. Introduction

On 15 April 2008, the Ministry of the Environment and Natural Resources in Senegal made an official request for technical assistance to the Secretariat of the Basel Convention concerning a case of contamination of local populations, mainly women and children, from hazardous waste due to lead recovery activities in the informal sector from used lead acid batteries. The communication to the secretariat mentioned the death of at least eighteen babies and young children due to lead poisoning and the likeliness of the contamination from lead of many individuals, including adults.

Assistance was requested with a view to reviewing the situation at Thiaroye sur Mer and ascertaining what actions needed to be considered locally and nationally, in the short-term and the longer term, to prevent further contamination from lead of local populations and assist in developing a national plan for the environmentally sound management of used lead acid batteries in the context of the implementation of the Basel Convention[1]. The mission of an expert from the International Lead Management Centre took place from 21 to 27 April 2008 in Dakar, Senegal. The mission was prepared further to consultations with the WHO Headquarters in Geneva and the UNEP-OCHA office in Geneva.

A report of the emergency measures taken by the Government in March 2008 was transmitted to the secretariat and the expert prior to the mission[2]. After meetings with the local population to explain the course of action the Government intended to take, the Ministry of the Environment and Natural Resources coordinated the removal of three hundred tons of leaded and battery waste from the site Thiaroye sur Mer between March 8th and 13th. The priority for the removal of the contaminated soil was from the areas close to the homes of the families engaged in the informal ULAB recovery operations. All informal ULAB recovery operations at the site were stopped and nearly 300 tons of the lead contaminated soil from Thiaroye sur Mer taken to the Pagrik Senegal Company, a recently opened ULAB recycling plant to be stored under cover in lieu of treatment to render the soil lead free. The lead contaminated soil removed from Thiaroye sur Mer was replaced with lead free sand to a depth of approximately 14 cm.

The Environment Ministry moved the contaminated soil to be stored at the Pagrik Senegal yard because they believe that the company can process and treat the contaminated soil in an environmentally sound manner to remove enough lead to render it safe for disposal in a domestic waste dump, or for use as infill material. Priority at Thiaroye sur Mer was given for the removal of soil in front of the houses of the families engaged in the informal recycling and the area most used to break open the batteries. Nevertheless, the Environment and Health Ministries are not certain of the extent of the lead contamination at Thiaroye sur Mer, but do believe that there is still a lot of soil in and around the Thiaroye sur Mer site that is contaminated with lead and battery acid, which will require more remediation work.

[1] Terms of reference of the mission are available in Annex 1 to this report

[2] 'Rapport d'étape sur les actions menées par la DEEC dans le cadre de la contamination au Plomb constatée à Thiaroye Sur Mer', Direction de l'Environnement et des Installations Classées.

The activities in Senegal of the Blacksmith Institute[3] were taken into consideration as the organization was in the process of conducting an independent survey of "informal" ULAB recovery operations in and around the city of Dakar. Corroborating material from their preliminary surveys was sought and transmitted prior to the mission to the Secretariat confirming that five "Informal" ULAB recovery sites had been located by the Blacksmith Institute in the Dakar area. Thiaroye sur Mer was not the only location for informal ULAB recovery operations. Also, it was made known to the secretariat that the Blacksmith Institute had decided to follow up to its preliminary investigation with site visits, including at Thiaroye sur Mer, because of its focus on remediation of toxic sites and community engagement.

Close liaison with the Ministry of the Environment and the Basel Convention Regional Centre (BCRC) for French speaking African countries based in Dakar was paramount in the preparation for this mission and its successful undertaking. Arrangements made by the Ministry of the Environment and the BCRC, in conjunction with all the other relevant ministries and parties involved, including the Ministry of Health, must be praised.

2. Initial meetings with Government Agencies and the University and preliminary findings.

During the first full day in Dakar a series of meetings (Annex 2) was held with the Ministry of the Environment and Natural Resources, Ernest Dione and his team, including Gatta Soulé BA, Michel Seck (BCRC), Mame Cheikh Ngom, from the Thiaroye sur Mer Municipal Authority and Meredith Block from the Blacksmith Institute to clarify the Objectives of the Mission and the respective roles of the SBC and the Blacksmith Institute in terms of the contribution they could make to the resolution of the population lead exposure and the remediation of the Thiaroye sur Mer site. The Blacksmith Institute would primarily focus on site remediation and community development in terms of self sufficiency, whereas the SBC's focus would be on the development of the ESM of ULAB, whether for internal domestic recovery or export for recycling.

The exact sequence of events that first drew the Government's attention to the lead exposure at Thiaroye sur Mer was the cluster of infant deaths and they prompted an immediate response from the Health Ministry to investigate the deaths. The Health and Environment Ministries, the BCRC, together with the Thiaroye sur Mer Municipal Authority confirmed that they were already working together and in conjunction with two of the Medical Staff from the University to resolve the issues at Thiaroye Sur Mer.

When the informal ULAB recovery operations at Thiaroye Sur Mer came to light during a site visit by the Ministry of Health, discussions with the medical staff at the University raised the possibility of lead poisoning. Indeed, the medical staff at the University strongly suspected that lead poisoning was the most likely cause of the infant deaths.

[3] Blacksmith Institute – http://www.blacksmithinstitute.org/ - An institute based in the USA that specializes in providing remediation support especially in the field of lead exposure.

Accordingly, the University carried out blood tests on 71 children living in houses surrounding the Thiaroye Sur Mer site. Blood samples were sent to a specialist laboratory in France. The results are summarized below (see Annex 4 for the full set of results):

Catégories d'âge	Nombre de sujets	Plombémie µg/l	
		Valeurs moyennes retrouvées	Valeurs normales
0- 4 mois	4	997.50	100.00
5-12 mois	2	1312.50	100.00
1an – 5 ans	25	1584.96	100.00
6ans – 15 ans	10	1212.60	100.00
Sup à 15 ans	30	775.10	300.00

The lead in blood levels are high and there is only one conclusion and that is that the children have high levels of lead exposure, so high in fact as to be above the levels of occupational suspension for lead in blood levels in adults in the workplace.

The children also show markedly low haemoglobin levels consistently about or just above half that normally found in healthy children at sea level, that is between 8 and 10, instead of 12 to 19, depending on age. (see Annex 4)

It is likely therefore, that siblings, parents and the babies who died in the Thiaroye Sur Mer area were, and are, suffering from high levels of lead in blood. Other tests on the infants were also carried out to corroborate the extent of the lead exposure, including some soil analysis undertaken by the Environment Ministry.

At the time of the initial discussions on Tuesday 22 April at the offices of the Environment Ministry, the exact pathways to lead exposure that caused the high levels of lead in the blood amongst the population at Thiaroye Sur Mer were not explained, although the Ministries of the Environment and Health agreed that the elevations were a direct result of the "informal" ULAB recycling. Confirmation on the most likely pathways to the lead exposure would be sought from the SBC expert.

It was unclear exactly when the Health and Environment Ministries became aware of the extent of the population lead exposures, but once the extent of the exposure became apparent, the Ministry of the Environment and Natural Resources decided very quickly that the contaminated soil at the site had to be removed, stored in a safe place and lead free soil deposited at the site. Nearly 300 tons of soil from the site was loaded into tipper trucks by front loaders and taken to the Pagrik Senegal Recycling plant at Fann Hock in Dakar to be placed in storage under waterproof canvas waiting processing or disposal. The contaminated soil was replaced by clean lead free sand to a depth of approximately 15 cm[4]. The Ministry were uncertain how much more soil needed to be removed from the site and are now awaiting the results the extensive site soil sampling undertaken by the Blacksmith Institute to ascertain the extent of the contamination on the site and to determine how much more soil would have to be removed (see Annex 3)

[4] See the Ministry of Environment presentation notes at the end of this report. (Annex 4)

3. Site visit to Thiaroye Sur Mer

The Community at Thiaroye Sur Mer is poor and living at barely subsistence levels. It is difficult to estimate how many people are living at or close to the site, but it could be as high as a 200 to 300 and as many as half could be infants and young children.

The site is approximately 40 hectares with a rail track running through the middle of the site. The population lives around the site, which is completely open, apart from a Mosque that is currently under construction.

During the visit to the site the SBC expert met a local man who, with his own hand held camera, had filmed a comprehensive series of videos documenting the informal ULAB recycling operation at Thiaroye Sur Mer out of his own curiosity. He offered to let the SBC expert view as many videos as he wanted to see, but would not permit anyone to copy them. However, viewing the videos has clarified exactly how the population was contaminated with lead and confirmed the pathways to the lead in blood elevations and the reasons why so many infants suffered lead poisoning. The sequence of events and the pathways to exposure are now explained as follows.

A large number of ULAB were discovered in an abandoned house surrounding the Thiaroye Sur Mer site and a group of impoverished women decided that if they could break open the ULAB and melt the lead in the battery grids, they could earn much needed cash by selling lead ingots. In total there seemed to be about 20 to 30 local women involved, although a few men were also engaged in the ULAB recovery activity.

The ULAB were broken open with hammers and axes by the women on the open ground in front of their homes and an abandoned shack used as the melting shop, and the core of the cell, that is the grids and separators were removed.

The lead lugs and bridges were hacked off and put to one side. These are easy to melt and were soon in a melting pot.

The lead grids were then separated from the polyethylene separators and also put to one side.

The separators were discarded as they were of no value. Polyethylene Separators can still be found blowing around the TSM site.

The Battery Grids were then taken and shaken and bashed into the ground and on wooden planks to dislodge the lead oxidized from the grid matrix.

The lead oxide was left in the soil in and around the area of operations.

The battery grids, lugs and bridges were then placed in any number of metal cooking utensils and heated over a wood burning fire to melt the lead. This was normally undertaken in an abandoned brick shack approximately 2 meters from the nearest home. Needless to say, when the melting was in progress there was no ventilation and the women did not wear face masks.

Although, melting lead for casting into ingots is not a major pathway in the context of the whole operation – that is because the discarded lead oxide paste poses a far greater threat to the population.

The molten lead was then cast into crude ingots and sold.

When the batteries were being broken in a pond on the site, the women would be standing in the acid rich effluent.

It was clear that the women involved had little, or no idea, of the dangers posed by such poor recycling practices and were unaware that the brown powder removed from the battery grids prior to melting the lead was lead oxide.

All these activities were taking place in a dry climate and overnight the wet oxide deposited in the soils close to the homes of the people involved must have dried and degraded to a dust mixed with the soil.

People walking, working or children playing in these contaminated areas would have produced lead bearing dust clouds, because the lead dust does not migrate into the soil.

However, the most likely reason that so many babies succumbed to lead exposure is probably linked to the practice of the babies being tied to the backs of the women during the day to provide the women with freedom to move and undertake household chores.

As the women spent of lot of time crouched over the ULAB or bending down low to the ground the babies would have been exposed to very high dust levels as the women went about the recycling with considerable enthusiasm and energy.

Although much of the worst of the soils contaminated with the lead oxide had been removed and replaced with sand prior to out visit, the characteristic red/brown lead oxide could still be seen in many places on the site.

Whilst traces of red led oxide could clearly be seen in and around the site, there was no evidence of any recent ULAB recovery activity and when asked, the leader of the women's group told us that all the ULAB on the site had been either recycled or removed.

We were also told that the Women's Group would not be recycling ULAB again. The personal tragedy and loss for many of the women was hard to bear.

The Blacksmith Institute took a large number of soil samples around the perimeter of the site and also specific areas of lead oxide contamination within the perimeter to try to ascertain the extent of the contamination. Swipes were also taken inside some of the homes of the population. Results of these samples will be expected.

Water to the site is clean and can be hand pumped from a central location on the site. The residents drank some of the water during the site visit to show us that they were confident it was lead free.

However, the water is hand pumped into two open plastic buckets to be decanted into personal storage containers. Bearing in mind the dusty nature of the site, this was not the safest way to store the water. The large buckets should be replaced by narrow necked plastic containers, preferably with caps.

It was also clear during the visit that the Government Agencies and the Doctors from the University had succeeded in convincing the women that they should not be recycling the ULAB on the site.

It was also apparent that the women were in desperate need of help to enable them to earn a living and feed their families.

4. Site Visit to the Pagrik Senegal Recycling plant at Fann Hock, Dakar.

The Pagrick Group has about eight (8) ULAB recycling plants in Africa and Brazil. (www.pagriksenegal.com) and is planning to extend its operations to Senegal.

When the Government and the SBC Expert visited the plant it had been open for one week and the Development Manager, Piyush Sharma, informed them that more equipment would be installed over the next few months.

On site, and already commissioned was a small blast furnace connected to an off-gas cyclone, a cooler and then a bag-house filtration plant. The equipment had been fabricated in India and shipped to Senegal for installation and commissioning. Unfortunately on this visit photographs of the plant were not permitted. However, the equipment was well designed, engineered and installed on solid concrete plinths and bases. The furnace and battery breaking area were housed in a covered warehouse.

Outside the warehouse, the company had also installed a battery case chipper to cut the polypropylene battery cases into small pieces, then when bagged the chips are exported to a recycler to produce new battery cases.

The Company had undertaken one test run of the furnace to produce approximately 15 tons of lead bullion ingots (unrefined lead).

Whilst the engineering seemed to have been proven, there was no hygiene ventilation over the front tapping area of the Blast Furnace.

Battery breaking was in progress during the visit. The ULAB were being broken manually using small hammers and axes – crude by any standards.

Rudimentary safety equipment was being worn, but manual breaking is not safe and not consistent with the standards of the Basel Convention for environmentally sound management (Technical Guidelines).

ULAB are delivered to the site without electrolyte. We were informed that the dealers drain the acid into pits and then a neutralization agent is added to prevent pollution – this is a serious issue that needs further investigation. Whether the dealers actually neutralize the battery acid is in doubt. In any case, the Basel Convention Technical Guidelines state clearly that ULAB should be delivered to the recycling plant complete with battery acid.

Even though the battery acid had been drained from the deliveries, residual acid was still dripping onto the concrete floor in the breaking areas.

There was no effluent treatment plant installed and as far as was apparent during the visit there were no plans to install one.

As a result of a test run on the Blast Furnace to ensure that the equipment had been installed correctly, about 2 tons of leaded baghouse dust and fume had been collected by the filter plant. This leaded waste material is a fine powder or dust with a lead content that normally has a range between 30 and 50%, although in some operations it can reach up to 80%. The Blast Furnace at the Pagrik plant is not suitable for the reprocessing of the baghouse dust. The Pagik management agreed that the dust cannot be treated at the Dakar plant and informed the SBC Expert that it had been bagged and sealed in 25 kilo lots, and stored for export. The company planned to export the dust to one of its plants overseas where it would be processed.

The key issues here are that the export of the baghouse fume, whether from the test run of the Blast Furnace or any accumulations arising from the treatment of the soil from Thiaroye Sur Mer will be subject to the Basel Convention for the Transboundary movement of hazardous waste. Bearing in mind that the Pagrik plant in Dakar falls short of the requirements for recycling ULAB in an environmentally sound manner because of the manual battery breaking methods and the lack of an effluent treatment plant, considerable care would be necessary to ensure that the baghouse dust will be processed in an environmentally sound manner if it is exported to another Pagrik operation.

Just inside the entrance to the plant the 300 tons of contaminated soil from Thiaroye Sur Mer is stored under plastic sheets. The sheets were secured and there was no evidence of any soil dispersion.

The Pagrik Plant has the appropriate technology to treat the contaminated soil from Thiaroye Sur Mer, but additional hygiene ventilation hooding will have to be installed over the tapping hoods of the Blast Furnace to minimize any leaded emissions during metal and slag tapping. In addition, a test run can and should be arranged because the soil is dry and processing through the furnace to decontaminate it does not require a water treatment plant. The baghouse fume and dust collected during any test run to determine the feasibility of processing the soil would have to be collected in sealed bags and stored on the site until a decision could be made about the export of the dust.

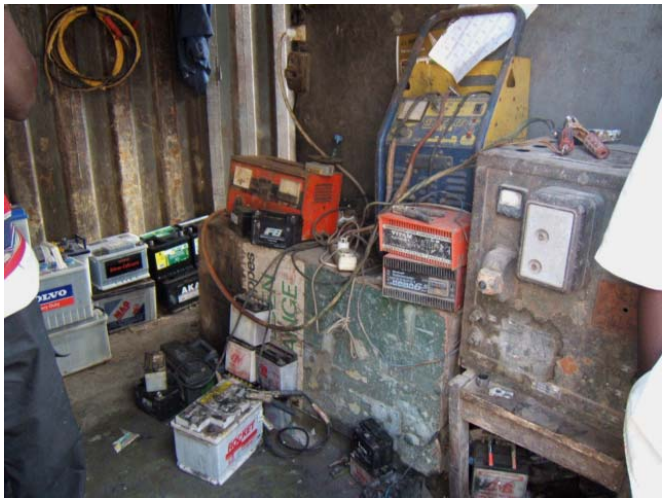
Brief discussions on the Site between the Pagrik management and the SBC Expert about the long term plans of the Company concerning the treatment of by-products such as the Baghouse fume/dust revealed that the Company is planning to process all by-products through a Rotary Furnace as soon as one could be installed. Rotary furnace technology is suitable for the treatment of baghouse dust and fume, but only if the process produces an inert slag, such as that produced by the Green Slag process developed in Mexico by Lead Metal Technologies.

5. Site Visit to Crédit Foncier, Rue Clémanceau

This converted shipping container at Crédit Foncier, Rue Clémanceau houses an “informal” sector battery reconditioning and service center employing three people.

As crude as the operation appeared from the outside, the center was well equipped with instruments for recharging 12 volt automotive and 6 volt motorcycle batteries, testing battery charge and reconditioning.

Normally, lead acid batteries do not have a long working life in hot climates. Indeed, eighteen months to two years is the norm. There is no doubt that prevailing high daily temperatures have an adverse effect on battery life, but other factors also contrive to shorten battery life. For example, in the developing world many of the vehicles are not serviced regularly and the battery recharging systems are not optimised to maintain battery charge.



Battery Testing Meter

Ideally, automotive batteries should never fall below a level of 80% of full charge in order to maximize life. But as this is not always possible, automotive batteries very often appear to “fail”, when, in fact, they just need recharging or servicing.

The center at Crédit Foncier can therefore provide a very useful service to motorists by testing a battery to determine whether it needs to be changed or recharged.

During the visit to the center a motorist in an old vehicle stopped outside the shop and the driver asked the service mechanic if he could test his battery because it was flat and he had to "push start" his car that morning. Using the battery testing meter the mechanic was able to confirm that the battery was in good condition and that the reason it was flat, was because the alternator was not functioning properly.

Literally, another battery that did not require recycling will be put back into service. The motorist duly paid a small fee for the service and set off to have the alternator checked at the local garage. Had the alternator been working correctly, the service center might have suggested a boost charge for the battery to bring it quickly up to optimum charge.

Occasionally when a battery is tested by the center and deemed to have failed, the motorist will ask if the faulty cell or cells in the battery can be identified, replaced and the battery put back into service. Well, current battery technology does facilitate such a procedure and the owner of the service center took out a battery that he had cut open to replace a "failed" cell. Once refilled with electrolyte, resealed and recharged the battery life can be extended by a few weeks or months.

However, this "reconditioning" of ULAB is not condoned. It is argued that such "reconditioning" extends battery life, and that may be true, although changing "failed" cells does not guarantee any significant increase in longevity. The main reason why this practice is to be discouraged is because opening up a battery to replace a failed cell leads to acid spillage, albeit normally a small quantity in the case of the center at Crédit Foncier, it is often a large quantity. Very often the battery acid is drained into the soil or the sanitation system, although at Crédit Foncier they save the battery acid to top up reconditioned batteries. The mechanics at the center did not know about the Pagrik recycling plant and were in the practice of throwing away the failed cells. So, the "reconditioning" at Crédit Foncier may have extended battery life, but did not mean that all the lead originally in a battery is recovered.

The criticisms make here have to be tempered with the fact that battery service centers are most welcome and should be encouraged as they normally provide a very useful service to motorists' that definitely prolongs battery life.

6. Discussions following the Site Visits

Following the site visits, discussions were held with the Mayor of Thiaroye Sur Mer and Cheikh Ndiaye, WHO, Dakar.

Everyone recognized the need to resolve the acute lead poisoning at Thiaroye Sur Mer, but also the requirements to install an environmentally sound method of recycling ULAB.

WHO stated that they would offer assistance where possible and appropriate, but were waiting for the appropriate requests from the Government to enable the WHO to proceed.

On the last full day of the visit a meeting of all stakeholders was convened to provide a forum for the ILMC, on behalf of the Basel Secretariat, and the Blacksmith Institute to present their views, conclusions and recommendations.

7. Conclusions and Recommendations

Short Term – 1 to 3 months

- Translate the SBC ULAB Training Manual for the Technical Guidelines into the French language so that all the personnel involved, especially the engineers at the Pagrik Plant had access to the correct procedures in the national language. This was seen by all the government agencies as a priority.

- Agree with all stakeholders the appropriate ULAB recovery procedures that conform to the legal requirements of Senegal's environmental, health and safety legislation, and the methodologies set out in Basel Convention Technical Guidelines for the environmentally sound recovery of ULAB. It was suggested by the BCRC that such agreement from all the stakeholders might best be sought through a workshop or even a series of workshops held in the Capital and some the provincial capitals.

  Although, no decision was taken at the meeting to hold a workshop or a series of workshops throughout the country; it was agreed that without all the procedures, and especially the Training Manual for the Basel Technical Guidelines, available in French, the Workshop could not be convened. All the relevant documents and procedures had to be available in French.

  It was also suggested by the SBC expert that it would be necessary to conduct a National Inventory of ULAB in Senegal in accordance with the procedure set out in Chapter 1 of the Training Manual to determine the extent of the requirements for the ESM of ULAB recycling and establish what infrastructure was already in place and what needed to be introduced to prepare a National Action Plan (NAP). The inventory would also require an examination of the current legislation governing ULAB recovery and provide an insight into any deficiencies. It was agreed that this would be an essential requirement for a lasting solution to the problems identified in Dakar and any similar issues in the provinces.

- Use the “Green Lead” ESM Form to determine the environmental performance of the local recycling plant. The BCRC and the Environment Ministry thought that this would be very useful, especially as then form gave a clear indication of the degree of conformity with the Basel Convention Technical Guidelines. There would also have to be some training from the SBC in the use of the form and the assessment process before it could be used by the Government Agencies to carry out any ESM Assessments.

- There are few secondary lead recycling technologies that can be adapted to decontaminated soil, but the blast furnace technology installed at the Pagrik Plant can process the soil to produce a non toxic solid waste residue that should pass the TCLP[5] thereby enabling the decontaminated soil to be disposed of in a domestic waste dump or used as hardcore. However, a trial batch of the TSM soil currently stored the Pagrik site should be processed to ensure the furnace can treat the material in an environmentally sound manner and that a sample of the solid waste is analyzed and undergoes a TCLP. Then, if the sample of the solid waste is found to have been decontaminated and passes the TCLP, it is recommended that all the lead contaminated soil from TSM is processed through the Pakgik blast furnace.

  The Ministry of the Environment stated that they would visit the Pagrik site again the following week with a view to discussing working arrangements with the Company to try to work out a program to process and treat the contaminated soil. No firm decisions were taken on the treatment and disposal of the soil at the meeting and any decisions taken by the Government would depend on the forthcoming meetings between the Government Environment Ministry and the management of the Pagrik plant.

  The reason that the Pagrik Recycling Plant was able to commence operations at the Site in Fann Hock without all the equipment to have an environmentally sound operation was a “loop hole” in the National legislation that allowed small enterprises to start up – and then apply for a license or what ever approval was necessary. This means that despite the inadequacies of the Pagrik operation, they were not operating outside the law. However, in the long term they would need to have an operating permit and so it is in their interest to work with the Government, especially as the Environment Ministry is now very well aware of the requirements of the Basel Convention Technical Guidelines. Indication are that the Pagrik plant will not be able to operate at its present location, because it is located in a semi residential area and the operation would have to relocate to an industrial zone.

  It would therefore seem appropriate to review the legislation that allowed the Pagrik Group to start up a recycling plant that clearly was not and is not environmentally sound. It is recommended that any such operation involving the treatment of hazardous waste, such as ULAB are subject to full planning and environmental impact legislation, even at the “start up” phase.

[5] The EPA TCLP: Toxicity Characteristic Leaching Procedure - The TCLP is designed to determine the mobility of both organic and inorganic analytes present in liquid, solid, and multiphasic wastes and in the case of ULAB recycling wastes – the test would be for lead mobility.

Medium to long Term – 3 to 12 months

- Establish an Environmentally Sound ULAB recovery procedure in compliance with the Basel Convention Technical Guidelines covering all aspects of the recovery and recycling process:

a. Collection – in both the formal sector through retailers, garages and scrap yards and the informal sector that scavenge for ULAB using leak proof collection methods.

b. Storage – on purpose built racking or concrete plinths as set out in the Base Training Manual and employed in the OECD such as Mexico, and the developing world as seen in El Salvador, Trinidad and the Philippines.

c. Transport – using purpose built trucks for moving palletized ULAB as used by ACL in Trinidad[6] or specially adapted trucks as used in Mexico by the Enertec Company of Monterrey.

and

d. Recycling – Using only Government licensed and approved Recycling Plants with proven ESM for ULAB that comply with all Government environmental, safety and health legislation applicable to ULAB and comply with the procedures for ESM set out in the Basel Technical Guidelines. In the absence of a recycling plant in Senegal that has the necessary environmental credentials, that is full compliance with Government legislation and the Basel Technical Guidelines, the only option is to export the ULAB to a country with an environmentally sound recycling plant, which in the case of Africa, and at the time of the visit in April 2008, would be the Frys Metals[7] plant in Johannesburg because this plant meets all the South African environmental legislation and is ISO 14001 Certified.

   However, the option to export any ULAB to South Africa also needs careful consideration, because exporting ULAB means that they will have to be stored in a covered warehouse, palletized, shrink wrapped and containerized to comply with the safety and environmental requirements of exporting ULAB in an environmentally sound manner. Setting up such a warehouse, including staffing, requires investment, which may not be forthcoming from the Private Sector and may therefore need "seed" capital before the ULAB warehousing and export becomes a "self sustaining" operation.

   This was seen by all parties present at the long term aim, but the immediate priorities would be the implementation of the Short term Goals. It was also suggested by the Basel Convention Regional Centre that consideration should be given to undertaking a ULAB inventory and the preparation of a National Action Plan in accordance with the procedure set out in the Training Manual.

[6] ACL ULAB Center, Trinidad : ESM Assessment, http://www.greenlead.com/Documents/English/Audits_Assessment_Procedures/ACL/GL%20Assessment%20Report%20-%20ULAB%20Collection%20Center.pdf

[7] Frys Metals - http://www.zimco.co.za/metals_frys.html

- Decide whether to export the ULAB for processing in South Africa – Frys Metals…….

OR

- Recycle the ULAB locally

No decision was taken on these two recommendations.

- When the initial stages of the ULAB inventory have been completed and the outline of a NAP has been prepared a briefing paper should be prepared by the SBC setting out possible options for the implementation of the NAP with particular reference to compliance with the Basel Convention and the Technical Guidelines.

- There should then follow a multi-stakeholder consultation process to define a national policy for the ESM of ULAB in Senegal, explore regional options, and set out an ESM implementation process, including any legislative program deemed essential to enforce the requirements of ESM for ULAB in Senegal

The Environment Ministry need to consult with the management at Pagrik, agree a program to test the furnace's suitability to process the contaminated soil and the company's commitment to install the necessary equipment and plant to conform to the standards required for ESM. Only then could an environmental assessment take place and only then, and this might take a month or so, would the Government be in a position to decide whether to proceed with domestic recycling of ULAB or the export of ULAB.

With job opportunities in Senegal at a premium it would appear to all concerned about the ULAB problem that if at all possible, discussions should proceed with the management of the Pagrik plant to raise its environmental performance, gain the necessary commitments to install the additional plant; such as the effluent treatment plant; make sure that its suppliers delivered whole un-drained ULAB; that the ULAB recycling process included adequate provision for the treatment of by-products such as the bag-house fume/dust, and the installation of a mechanical breaking system for the ULAB.

However, if discussions with the management of Pagrik fail to improve the working conditions and the environmental compliance, serious consideration would have to be given to exporting the contaminated soil for treatment. In the absence of a hazardous waste dump in Senegal, this would appear to be the only other option. It has to be stated that this option would be very expensive and it may be difficult to find a smelter prepared to treat the soil.

In any event, the SBC expert informed the Government that expertise to help them at any stage was available from either the ILMC or Frys Metals in South Africa.

Recommendations made by the Blacksmith Institute concerning Site Remediation can be found in Annex 5 to the report.

Annex 1 – Terms of reference for the mission of the expert, 21-27 April 2008, Dakar.

(French)
Mission d'expertise technique au Sénégal pour assister le Gouvernement du Sénégal dans la détermination de la meilleure approche pour l'introduction de procédures de gestion écologiquement rationnelle de la récupération des accumulateurs de plomb usagés, de manière cohérente avec les directives techniques de la Convention de Bâle.

Objectifs généraux
L'objectif principal de la mission de l'expert sera d'apporter les conseils techniques nécessaires au Ministère de l'Environnement dans les domaines suivants :

a) L'évaluation des conditions générales de collecte, transport et recyclage des accumulateurs plomb-acide usagés dans l'agglomération de Dakar ;
b) La réalisation de mesures d'urgence pour protéger les populations les plus exposées, y compris femmes et enfants, et l'environnement des effets dus aux activités liées à la récupération du plomb effectuées dans les secteurs formel et informel ;
c) le développement de plans d'action à court et long terme pour la gestion écologiquement rationnelle des accumulateurs usagés plomb-acide de dans l'agglomération de Dakar, dans le contexte de la mise en œuvre de la Convention de Bâle.

Principales activités
Dans ce contexte, l'expert réalisera les activités spécifiques suivantes :

i. Rencontrer les fonctionnaires du Ministère de l'Environnement et des Ressources Naturelles (Point Focal de la Convention de Bâle), le Ministère de la Santé, le Ministère de l'Industrie, le Ministère des Transports et toute autre institution nationale exigée par le Gouvernement pour débattre de l'organisation de la mission et de ses conclusions ;
ii. Rencontrer le représentant local de l'OMS, le Centre Régional de la Convention de Bâle à Dakar, afin de partager les informations concernant le projet de la mission et discuter d'éventuelles collaborations ;
iii. Visiter et inspecter le site « informel » de recyclage des accumulateurs plomb-acide usagés de Thiaroye à Dakar, ainsi que tous les sites similaires identifiés par le Gouvernement. A chaque fois, conduire une évaluation empirique sur les impacts probables des opérations de récupération des accumulateurs plomb-acide usagés.
iv. Visiter l'usine de recyclage Pagrik Sénégal et conduire une évaluation empirique sur les performances environnementales et la conformité avec les directives techniques de la Convention de Bâle ;
v. En concertation avec toutes les parties impliquées, faire des recommandations pour la mise en place de mesures d'urgence pour protéger les populations les plus exposées, y compris femmes et enfants, et l'environnement des effets dus aux activités liées à la récupération du plomb effectuées dans les secteurs formel et informel ;
vi. Préparer un projet de Plan d'Action à court et long terme pour la gestion écologiquement rationnelle des accumulateurs de plomb-acide usagés

dans les secteurs formel et informel dans l'agglomération de Dakar, dans le contexte de la mise en œuvre de la Convention de Bâle ;

vii. Identifier les besoins en formation et en renforcement des capacités dans le secteur de récupération des accumulateurs plomb-acide usagés et faire des recommandations pour la mise en œuvre de programmes visant à répondre à ces besoins.

Idéalement, en guise de conclusion à la mission, un programme détaillé pour la mise en œuvre des dispositions à court terme pour la récupération des accumulateurs plomb-acide usagés, ainsi qu'un projet de plan à long terme, aura été approuvé par toutes les parties intéressées.

Résultats concrets de la visite

a) un rapport de mission à soumettre au Secrétariat de la Convention de Bâle (5 pages). Le rapport doit décrire les institutions rencontrées, les activités accomplies, les principales conclusions et recommandations ;
b) les principales recommandations pour les mesures d'urgence à prendre pour protéger les populations les plus exposées, y compris femmes et enfants, et l'environnement des effets dus aux activités liées à la récupération du plomb effectuées dans les secteurs formel et informel;
c) l'ébauche d'un plan pour la gestion écologiquement rationnelle à court et long terme des accumulateurs plomb-acide usagés dans les secteurs formel et informel de l'agglomération de Dakar, dans le contexte de la mise en œuvre de la Convention de Bâle (20 – 30 pages).

Organisation de la mission

Un expert mandaté par le Secrétariat de la Convention de Bâle se rendra au Sénégal du Mardi 22 au Dimanche 27 Avril 2008. Le Gouvernement du Sénégal prendra les mesures suivantes pour assurer la bonne conduite de la mission de l'expert :

- Prendre toutes les dispositions logistiques nécessaires pour la conduite de sa mission (notamment le transport vers et depuis l'aéroport si besoin est, transport local pour les missions terrains, etc) ;
- Assurer l'interprétation (Anglais / Français) si nécessaire durant les réunions et lors des visites de terrain ;
- S'assurer que le Centre Régional de la Convention de Bâle à Dakar est entièrement associé à la conduite de la mission et qu'il participe aux activités ;
- Mettre à la disposition de l'expert toutes les informations et le personnel nécessaire qui lui seront utiles pour la conduite de ses tâches.

Annex 2: Meeting schedule for the Technical Missions of the Basel Secretariat and Blacksmith Institute on the ESM of ULAB in Thiaroye sur Mer in Dakar, Senegal

DATE	Time	Object/Purpose	Participants	Location
Tuesday 22/04/08	15h – 15 h 30	Discussion of the Missions and Clarification of Objectives	DEEC, DREEC Dakar, CAP, Direction Santé, Mairie Thiaroye Sur Mer, Service d'Hygiène, CRCB, Industrie, Transports Terrestres, Africaclean, Promécabile, OCHA, Ministère de la Femme	DEEC 106, Rue Carnot
	15h 30 – 15h 45	Discussions on the Meeting and Visit Schedule		
	15h 45 – 16h 00	Presentation by the Department of the Environment (analysis of the situation and activities) - DEEC		
	16h 00 – 16h 15	Presentation by the Department of Health (analysis of the situation and activities) - Center of Toxicology		
	16h 15 – 16h 30	Discussions		
Wednesday 23/04/08	09h 00 – 13h 00	Visit to the site of ULAB recycling and the area of contaminated soils in Thiaroye sur Mer	DEEC, DREEC Dakar, CRCB	On Site - Thiaroye sur Mer
	15h 00 – 15h 30	Courtesy visit of to the Mayor of Thiaroye	DEEC, DREEC Dakar, CRCB	Office of the Mayor of Thiaroye Sur Mer
	15h 00– 17h 00	Meeting with the authorities at the local level	Sous – Préfecture, DEEC, DREEC Dakar, CRCB, Service d'Hygiène, CAP, Africaclean, Mairie de Thiaroye. District sanitaire de Thiaroye	Office of the District of Thiaroye
	17h 30 – 18h 00	Visit to the PAGRIK enterprise ULAB Recycling Plant	DEEC, DREEC Dakar, CRCB, CAP	PAGRIK – Fann Hock, Dakar
Thursday 24/0408	09h 00 – 10h 00	Meeting with the WHO	DEEC, DREEC Dakar, CRCB, CAP	Siège OMS
	11h – 11h 30	Meeting with the Road Transportation Department	DEEC, DREEC Dakar, CRCB	Direction des Transports Terrestres
	11h 40 – 12h 10	Meeting with the Department of Industry	DEEC, DREEC Dakar, CRCB	Direction Industrie
	15h – 15h 30	Meeting with the Minister of State – Did not take place	DEEC, DREEC Dakar, CRCB,	MEPNBRLA
	17h 00 – 17h 30	Meeting with the Minister of Health – Did not take Place	DEEC, DREEC Dakar, CRCB, CAP	Ministere Santé
Friday 25/04/08	09h 00 – 10h 00	Meeting with the Director and Assistant Director for the Women's Enterprise Unit	DEEC, DREEC Dakar, CRCB, CAP	DEF

DATE	Time	Object/Purpose	Participants	Location
	15h – 18h 00	Presentation of the recommendations, draft plans of action for short and long term strategies for the elimination of the lead exposure issues at Thiaroye sur Mer and the long term ESM of ULAB in Dakar and Senegal	DEEC, DREEC Dakar, CAP, Direction Santé, Mairie Thiaroye Sur Mer, Service d'Hygiène, CRCB, Industrie, Transports Terrestres, Africaclean, Promécabile, OCHA, Ministère de la Femme	DEEC

Annex 3

Contamination à Thiaroye Sur Mer : actions menées par la DEEC

Mission conjointe Convention de Bâle/Blacksmith Institute

Dakar, Avril 2008

Présenté par Gatta S. BA

Profil Géographique

Thiaroye Sur Mer est une cité historique du Sénégal situé entre au sud est de la presqu'île du Cap – Vert (entre la Route Nationale n°1 et l'océan)

Les estimations de populations de 2007, montrent que Thiaroye Sur Mer compte plus de 40 000 habitants

A l'origine TSM était un village traditionnel de pêcheurs lébous, mais gagné par le développement du tissu urbain Dakarois

Principales activités: pêche, transformation des produits halieutiques, maraîchage urbain et activités économie informelle

Problèmes sérieux d'environnement urbain (gestion des ordures ménagères, pression foncière et occupation d'une zone humide…)

Vulnérabilité sociale des populations, en particulier des femmes

Cette précarité sociale et la croissance de la part du recyclage dans le commercial international du Plomb est à l'origine de la situation de contamination actuelle.

État de la situation

Magasin de Stockage au niveau d'un site d'exploitation

Sol pollué dans une ruelle

Actions menées par la DEEC

Exposition continue des populations

Site de transfert pour la
commercialisation locale et l'exportation (site contaminé)

Entre le 10 et le 13 mars, 297 Tonnes de déchets souillés au plomb ont été collectés et transférés vers un site sécurisé

Les déchets ont été déchargés sur une aire de stockage à l'entreprise PAGRIK (entreprise de récupération de batteries usagées et de fusion de plomb)

Travaux de confinement entre le 12 et le 14 avril (décapage de sols pollués et remblaiement avec du sable de dunes)

Zones concernées: ruelles et sites de transfert

Perspectives

- ***Réduire significativement le niveau d'exposition des populations, en particulier celui des femmes et des enfants et maintenir les activités de récupération qui sont rémunératrices de revenus dans un contexte de pauvreté***
- ***Analyse plus détaillée de la situation***
- ***Développer un plan d'actions axé sur une gestion globale et intégrée (environnement, santé, industrie, …) de la problématique***

Annex 4

Ministère de la Santé et de la prévention Sénégal

JOURNEE D'INFORMATIONS

SITUATION SANITAIRE A
NGAGNE DIAW – THIAROYE / MER
DIMANCHE, 20 AVRIL 2008

INTRODUCTION

JANVIER 2008 :

- ✓ 28 CAS AFFECTION INCONNUE,
- ✓ 18 DECES,
- ✓ ENFANTS 1-6 ANS.

SITUATION

- PRESENCE DE MINERAI ;
- EXPLOITATION LOCALE ;
- EXPOSITONS :
  - ✓ RESPIRATOIRE,
  - ✓ DIGESTIVE,
  - ✓ CUTANEE,
  - ✓ TRANSMISSION MERE-ENFANT.

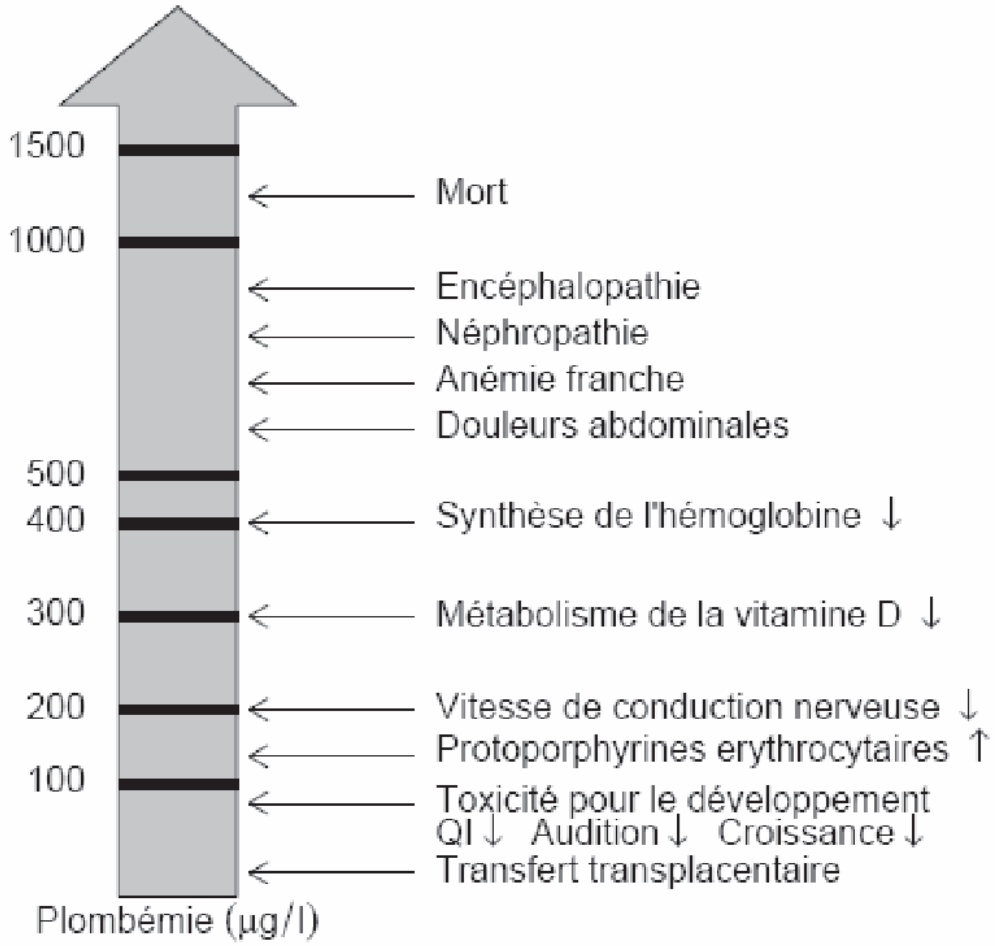
TABLEAU CLINIQUE NON SPECIFIQUE

- TROUBLES DIGESTIFS ET NEUROLOGIQUES ;
- EVOCATEUR DU PLOMB ;
- CONFIRMATION PAR LES ANALYSES BIOLOGIQUES.

SUJETS CIBLES :

- ✓ FEMMES EN AGE DE REPRODUCTION,
- ✓ ENFANTS.

Effets du plomb sur les enfants
Plombémie minimale pour laquelle un effet a été observé



D'après : Preventing Lead Poisoning in Young Children, Centers for Disease Control and Prevention, 1991

ACTIONS MENEES PAR LE CAP

- SELECTION ET SENSIBILISATION DE LA POPULATION A PRELEVER ;
- PRELEVEMENTS DE SANG ET URINES CHEZ 71 SUJETS ;
- ANALYSES BIOLOGIQUES DANS DES CENTRES DE REFERENCE :
  - ✓ PLOMBEMIE ET MARQUEURS BIOLOGIQUES,
  - ✓ NFS,
  - ✓ FER SERIQUE.

RESULTATS

- **PLOMBEMIE (MARQUEUR D'IMPREGNATION)**

  - ✓ **10 A 15 FOIS SUPERIEURE A LA NORMALE CHEZ LES ENFANTS,**
  - ✓
  - ✓ **2 A 3 FOIS SUPERIEURE CHEZ LES ADULTES.**
  - ✓

Catégories d'âge	Nombre de sujets	Plombémie µg/l	
		Valeurs moyennes retrouvées	Valeurs normales
0- 4 mois	4	997.50	100.00
5-12 mois	2	1312.50	100.00
1an – 5 ans	25	1584.96	100.00
6ans – 15 ans	10	1212.60	100.00
Sup à 15 ans	30	775.10	300.00
Total	71		

- **ALA (MARQUEUR D'EFFET) EGALEMENT TRES ELEVEE ;**

Catégories d'âge	Nombre de sujets	ALA (mg/g de créatinine)	
		Valeurs moyennes retrouvées	Valeurs normales
0- 4 mois	**4**		
5-12 mois	**2**	**102.66**	**5.00**
1an – 5 ans	**25**	**87.01**	**5.00**
6ans – 15 ans	**10**	**54.40**	**5.00**
Sup à 15 ans	**30**	**16.78**	**5.00**
Total	**71**		

PPZ (MARQUEUR D'EFFET) EGALEMENT TRES ELEVEE ;

Catégories d'âge	Nombre de sujets	PPZ µg/g Hb	
		Valeurs moyennes retrouvées	Valeurs normales
0- 4 mois	4	18.30	3.00
5-12 mois	2	9.61	3.00
1an – 5 ans	25	18.28	3.00
6ans – 15 ans	10	16.68	3.00
Sup à 15 ans	27	17.51	3.00
Total	68		

ANEMIE ;

Catégories d'âge	Nombre de sujets	HBG g/dl	
		Valeurs moyennes retrouvées	Valeurs normales
0-4mois	4	9,85	15 – 19
5 12 mois	2	8,70	12 – 16
1an – 5 ans	25	8,53	12 – 16
6ans – 15 ans	10	8,94	12 -16
Sup à 15 ans	30	9,86	12 -16
Total	71		

Catégories d'âge	Nombre de sujets	Fe µg/L	
		Valeurs moyennes retrouvées	Valeurs normales
0-4 mois	4	57.32	37 à 145
5-12 mois	2	103.87	37 à 145
1an – 5 ans	25	103.49	37 à 145
6ans – 15 ans	10	91.81	37 à 145
Sup à 15 ans	30	88.24	37 à 145
Total	71		

CONDUITE A TENIR

- ARRET DE L'EXPOSITION ; PROBLEME DE L' ENVIRONNEMENT
- TRAITEMENT SYMPTOMATIQUE ;
- UTILISATION DE CHELATEURS.

Annex 5 - Protecting Children's Health – Recommendations by the Blacksmith Institute

Short term

- Expand the monitoring of blood lead levels using a LeadCare kit donated by the Blacksmith Institute to the University. The test kits will enable the university to set up a surveillance program and obtain instant results instead of having to wait for the test results from the French laboratory.
- Provide treatment to extreme cases – consideration would have to be given to Chelation, although this would be a last resort. Actions would depend on medical advice and on the level of lead in the blood. Normally intervention would take the form of improved diet and supplements.
- Education and awareness campaign to mitigate exposure. And this would be a continuation of the good work already undertaken by the University, but with support from the BI for additional campaign materials and literature that would appeal to children.
- Store contaminated soils before the rainy season because the site at TSM can flood in up to one metre of water. So, if the contaminated soil is not removed before the start of the rainy season in July, then the remaining lead oxide paste in the soil will be spread over the whole site, including the areas just remediated.

Long term

- Remediate contaminated soils and in this respect the BI will (and Have) secured funds to assist with the treatment process for the soil.

Interventions

Short term

- Provide LeadCare Blood Lead Analyzer and Test Kits and the kit was presented to the University during the meeting.
- Provide $5000 USD funding for the awareness campaign and this money would be administered at local level through the Municipality, the University and the local community.

Long term

- Provide technical assistance for contaminated soils remediation in terms of sampling and remediation options
- Help to find funding from the multilateral community to implement remediation activities using the BI extensive contacts with donors

Meredith Block also stated that she would be having further meetings with the Director of the Women's Development Bank in Dakar with a view to providing support and ideas for the women at TSM to start up their own businesses.

All these recommendations by the Blacksmith Institute were welcomed by the respective agencies present at the meeting.