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**Report On Contaminated Sites Visits to Morogoro and Arusha Regions
of Tanzania**

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December, 2013**

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Background

Following the Regional Training workshop on Assessment and Remediation of Contaminated Sites which was held in Addis Ababa, Ethiopia during the period of August 6-8, 2012, a questionnaire was sent out to all COMESA and SADC countries to be filled out to help selecting a country to host a pilot demonstration project to remediate a contaminated site using Phytoremediation technology. Six countries from both COMESA and SADC sub-regions submitted a filled out questionnaire. These countries include: Burundi, Ethiopia, Mozambique, Sudan, Swaziland, and Tanzania. Based on the answers submitted by these six countries, Sudan and Tanzania emerged as the most suitable countries to host the aforementioned pilot project, with Tanzania having a slight edge over Sudan, as Tanzania seems to have experts in the area of phytoremediation, which is a great asset to have for the implementation of the pilot.

UNIDO then decided to conduct the pilot demonstration project on remediation of contaminated site using Phytoremediation technology in Tanzania. A letter was then sent to the POPs Focal Point for Tanzania to choose two sites from the four sites presented in Tanzania's filled out questionnaire, and provide more detailed information about these two sites. In response, Tanzania's POPs Focal Point selected Plant Protection Office (PPO) Tengeru in Arusha region, and the other site is National Housing Corporation (NHC) site in Morogoro, Morogoro region. According to Tanzania's report, both sites are high risk sites contaminated with POPs (PPO-Tengeru site is contaminated with Hexachlorocyclohexane (HCH) and Gamma HCH "Lindane" and NHC-Morogoro site is contaminated with DDT).

Subsequently, a UNIDO team comprises of Dr. Mohamed Eisa, Director and UNIDO Representative, Pretoria, South Africa and Mr. Nouri Abdalla, Regional Coordinator for SADC sub-region paid a visit to the two aforementioned sites on December 11, 2013 (NHC-Morogoro) and December 13, 2013 (PPO- Tengeru, Arusha). After the conclusion of the two visits, one site will then be selected to host the pilot demonstration project using Phytoremediation technology.

1. NHC- Morogoro Site and PPO- Tengeru, Arusha Site

Introduction

These two sites ranked highest with regard to the level of risk for public health and the environment using the FAO Environmental management tool kits. (*Source: Report on Buried Pesticides and Contaminated Soils- United Republic of Tanzania*).

Estimated size of contaminated area for the two sites is as follows: NHC Morogoro is estimated to be 1,200 m², whereas PPO Tengeru is estimated to be 100-120 m².

Laboratory analysis has indicated that PPO Tengeru site is contaminated with HCH and gamma HCH (Lindane), while NHC Morogoro is contaminated with DDT.

1.1 NHC site- Morogoro Town, Morogoro Region

1.1.1 Background

The NHC (National Housing Corporation) site is located in Morogoro town which is located about 194km West of Dar es Salaam (Capital of Tanzania). The site is located near Morogoro railway station (about 150 meters from the railway station); 1.5km from the central business district, and 1.8km from Morogoro town bus stand. The site is about 200m from the nearest residential area, 20m from the Institute of Adult Education and some 50m from a sugar store. The estimated size of contaminated soil of the NHC site with DDT is approximately 1,200 m².

The site was owned and operated by a foreign national as a DDT formulating plant which ceased to operate about twenty (20) years ago after DDT for agricultural use was banned globally. The site is currently owned by the National Housing Corporation. Presently, no activities have been taking place at the site due to heavy soil contamination by DDT, i.e. the site is abandoned. Recently, the soil contaminated with DDT, amounting to 397 tons, were excavated (*see Picture-4 & Picture-5 below*) and shipped for destruction in the UK. The remaining less contaminated soil need some form of remediation. The site is well accessible since it is within the Morogoro Municipality and Morogoro Town.

1.1.2 The site visit to NHC site- Morogoro

A UNIDO team made up of Dr. Mohamed Eisa and Nouri Abdalla, together with Mr. Mangalili from the Vice President's Office, department of Environment-Tanzania, and Mr. Msokwa from Africa Stockpile Programme-Tanzania took the three-hour car trip to Morogoro Town in the morning of Wednesday, December 11, 2013.

After arriving to the site, a thorough inspection (walk through) of the 1,200 m² compound took place. The main building, where the DDT formulation took place, is still standing (*see Picture-1 below*) together with two large areas/buildings (made of metal sheets- *Picture-2*) apparently used as an interim storage area (to store the repackaged DDT prior to shipping it). The two storage areas are located at the main entrance of the premises. As soon as you walk into the premises you can smell the strong odor of DDT, even though some of the soil inside the premises (not the main building or the storage areas) has been excavated and shipped to the UK. The smell of DDT is quite strong inside the main building (DDT formulation room) and inside the two storage areas. DDT concentrates bottles and other plastic bottles, used for repackaging of the commercial DDT, are still scattered within the premises and may be as far as 100-150 meters outside the premises and adjacent to the surrounding residential area (after over 20 years since the site was abandoned). Traces of DDT are still quite evident on the soil of

the compound, especially the area in front of the main formulation room (*Picture-1*) and on the corner opposite to the main formulation room (*Picture-3*).

Picture-1



The main building of the abandoned NHC site in Morogoro- Dec. 11th, 2013

Picture-2



The two storage areas located at the entrance of NHC site in Morogoro- Dec. 11th, 2013

Picture-3



NHC site in Morogoro- Corner opposite to the main formulating room- December 11th, 2013

Picture-4



NHC site in Morogoro during the excavation of soil a few years ago

Picture-5



NHC site in Morogoro during the excavation of soil a few years ago

1.2 PPO Site- Tengeru Town, Arusha Region

1.2.1 Background

The identified contaminated site is within the compound of the Office of the Plant Health Services also known as Plant Protection Office (PPO). PPO site is located in Tengeru town (about 12km from Arusha Town). The Office of the Plant Health Services is the agriculture zonal center for the regions of Manyara, Arusha, Kilimanjaro and Tanga. The zonal centers were established for purposes of migratory and outbreak pest control. At the time of the contamination, drums of Lindane were stored outside the office. The drums rusted and leaked over some twenty years ago. They were later buried thus contaminating the surrounding environment. The PPO is still being used as a zonal center for outbreak pest control and a new storage room had been built since, about 10 meters from the contaminated area. The estimated size of contaminated soil, with HCH and Gamma HCH (Lindane) within the PPO, is approximately 100-120 m².

The office is within the Tengeru Agricultural Training College thus surrounded largely by college buildings. PPO is off Moshi – Arusha Trunk road and accessible through a well maintained earth road.

1.2.2 The site visit to PPO site- Tengeru, Arusha Region

The same team, that visited NHC site in Morogoro Town, traveled by plane from Dar es Salaam to Arusha Town (644km) on December 12th, 2013 to visit the PPO site in Tengeru Town near Arusha. On December 13th, 2013, the team took the twenty minutes car ride from Arusha Town to the Plant Protection Office (PPO) in Tengeru (12km).

At arrival at the PPO site, the team was received by Mr. Juma, Acting Zone Coordinator for the Tengeru Office, and by Ms. Mary Dominique Leina, and Agricultural Officer within the PPO-Tengeru. The team then held a meeting with some senior staff at the PPO- Tengeru.

Dr. Mohamed Eisa of UNIDO introduced himself and talked about SC NIPs and their updates. He also talked about how inventories of obsolete stockpiles in Africa were not done and there was no regional plan to dispose of those stockpiles which have been identified. ASP made the first phase as GEF decided to stop other projects from rolling out, one of which is the implementation of NIPs. He also mentioned that, showing strong interest, Madam Minister of the Environment invited UNIDO twice for discussions; once to attend the AMCEN meeting last year (September, 2012), whereby Tanzania was selected to chair the BAT/BEP Forum for COMESA and SADC, and the second time in March of this year (2013) when we visited her in her office in Dar es Salaam for discussions.

Dr. Eisa went on to say that we came to Tanzania to visit two sites (Morogoro site and this site- PPO) and then select one. An international expert whose name is Professor Loretta Li will come next March-May, 2014 to do preliminary site investigation and detailed analysis, after which a

remediation technology will be used. It was recommended that a low cost remediation technology (phytoremediation) be selected for this pilot project and the countries of the two sub-regions can learn from such project. There are also other pilot demonstration projects which have been initiated in the two sub-regions which include: Textile Dyeing and Finishing which is currently being conducted in Ethiopia, the other pilot project is municipal solid waste management and open burning project to be conducted in Uganda and Mozambique, and the third project is Leather Dyeing and Finishing which will be conducted in Sudan. The site visit is also to collect as much information as possible about the condition of the site, and gather information about policies and regulations concerning contaminated sites, land use, etc... as well as any other information about current use of the site, and whether it is a government site or a privately owned site. Dr. Eisa concluded his remarks by saying that, Professor Li (the international consultant) will visit the site 3-4 times throughout the life of the pilot project. Local capacity will be used during her (Professor Li) visits, so that other sites can be dealt with by the local experts. Furthermore, Professor Li will provide two days training on contaminated sites management, e.g. investigation, analysis, etc.

Mr. Boaz Mtobesya, a Principal Agricultural Officer within the PPO, gave a brief historical background of the contaminated site within the PPO. Mr. Mtobesya joined the PPO in 1993 and the site had been labeled as a contaminated site. He (Mr. Mtobesya) basically confirmed that the spills of the concerned pesticide occurred over twenty (20) years ago prior to him joining the PPO. He said that drums of a chemical with a name of Phenothrin were kept outside, and some drums leaked (4-5 drums) then the leaked drums were removed but the smell of the chemical has been there since he joined PPO about twenty (20) years ago. Five years ago, the National Environmental Management Corporation (NEMC) brought some experts and took samples, but no measurements were done to pinpoint exactly where the area of the spills was. Subsequently, test results revealed that the soil was contaminated with HCH and Gamma HCH (Lindane) which is contrary to what Mr. Mtobesya indicated above. Moreover, Mr. Mtobesya indicated that there is a water stream close by (just outside of the premises of the PPO) and connected to the contaminated soil within the PPO (*see picture below*).

The staff at the PPO indicated that there has been no health issues associated with the contaminated soil as the result of the spills in the premises, nor have there been any police or court cases that have been reported by the public or PPO's workers in association with the concerned contaminated soil in the PPO premise. Mr. Juma, Acting Zone Coordinator has brought the subject of the smell coming out of the contaminated area and how cumbersome the smell has been. He (Mr. Juma) also mentioned that the workers at the PPO premise have been experiencing episodes of headaches as the result of the smell coming out of the contaminated area. *We could still smell the chemical while we were inside the office of the Zone Coordinator as the office is just next to the contaminated area- See picture-9 below.*

A driver with a name of Mr. Musawi, who has been working at the PPO for about thirty (30) years also spoke about the fact that there was no a store, *per se*, to store these chemicals and they were kept outside waiting to be used against locust. The store capacity area was about five (5) tonnes.

Dr. Eisa then asked if there is a laboratory in Arusha that could do tests as the international consultant would want to take more samples for analysis and testing. Mr. Msokwa from Tanzania ASP Office said that a local lab could be outsourced. Dr. Eisa also asked if there are labs or universities or research institutions that are currently working on remediation technologies. Mr. Msokwa mentioned the Tropical Pesticides Research Institute (TPRI) which is located in Arusha. The TPRI will need to be investigated about what types of tests that the institution does. Another question that came up whether there is any research institution that does research about the types of plants that could be used in phytoremediation. Mr. Mangalili mentioned a plant with a name of Vetiver which may have been used by an institution in Dar es Salaam for phytoremediation. He (Mr. Mangalili) will liaise with Professor Njau from University of Dar es Salaam to find out more about these plants. Mr. Msokwa will also work with TPRI, University of Dar es Salaam, and University of Agriculture in Morogoro to find out about any soil remediation projects currently exist in the country.

Picture-6



PPO site in Tengeru, Arusha Region- December 13th, 2013

Picture-7



PPO site in Tengeru, Arusha Region- December 13th, 2013

Picture-8



PPO site in Tengeru, Arusha Region next to the offices of PPO- December 13th, 2013

Picture-9



A slope (which is connected to a water stream) lies outside of PPO premise- Dec. 13th, 2013

2. Conclusion

The two sites ranked highest with regard to the level of risk for public health and the environment, based on the laboratory analysis conducted on both sites. Visual inspection and walk through of the two sites by UNIDO team during the visits confirmed that both sites are still heavily contaminated with POPs and they will need to be remediated. The contaminated area of the NHC-Morogoro site is bigger in size compared to that of the PPO-Tengeru site. Even though, an excavation of soil was performed in the NHC-Morogoro site a few years ago, but it was quite evident that the soil is still contaminated with DDT. The PPO-Tengeru site is still heavily contaminated with HCH and Gamma HCH (Lindane) and the smell of the contaminated area is a cause of concern and discomfort to the workers at the Plant Protection Office, as it is within the premises of office.

Both sites are easily accessible as they both lie within two major towns (NHC- Morogoro Town and PPO- Arusha Town). While Arusha has two airports (Arusha and Kilimanjaro airports), Morogoro doesn't have an airport, and the only access to Morogoro Town is via a tarmacked road from either Dar es Salaam, or Arusha. The distance between Morogoro Town and Dar es Salaam is 194km whereas the distance between Morogoro and Arusha is 622km.

3. Recommendations

Since the PPO-Tengeru site is still in use, and more easily accessible in terms of international airports (Kilimanjaro and Arusha Airports), and since it lies about 10km from Arusha Town, PPO-Tengeru site could qualify as the site to conduct a pilot demonstration project using phytoremediation technology. It also lies within the premises of the Plant Protection Office in Tengeru where there will be enough experts to be outsourced to help with maintaining the life of the pilot project. Some laboratories in Arusha town could also be used for analyzing samples that would be taken from the site, even though, the capacity of these laboratories are yet to be investigated.

As for NHC-Morogoro, and since it is an abandoned/legacy site, a case can be made to have the International Council for Chemical Association (ICCA) and GIZ of Germany to get them involved in remediating NHC-Morogoro site. The site fits the conditions set forth by the above-mentioned organizations as it being a pesticide formulating site, evidence of contaminated soil is present and is no longer in use (legacy site).