Risk Assessment in Al-Suwaira Site Depending upon Determination of Pollutants in Environmental Samples

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Abstract

Environmental samples (soil ,water and vegetation) were collected from Al-Suwaira site to assess the risk of pollutants such as pesticides and metals. The results indicate that the soils are slightly contaminated by pesticides chlorophenyl mercury , zinc phosphide , calcium cyanide , lindane , diazinon , heptachlor , fenitrothion , malathion , endosulphan , dieldrin , methoxychlor , DDT , and decay derivative DDE . Other contaminants were detected by laboratory analysis of soils include zinc, copper, nickel, lead, chromium, arsenic and selenium metals

Pesticides and metals were not detected in water and vegetation samples , due to its low quantity the analytical techniques are not sensitive enough for determination . These results illustrate that these samples are not contaminated

The present work findings for the Al-Suwaira site:

- i) The site in its current state represents low human health risk
- ii) Approximately 100m³ of waste pesticides are present in the warehouse
- iii) The contaminated warehouse by organo-mercury is unsafe to use and will remain in that condition unless decontaminated
- iv) The soil inside the site could be classed as slightly contaminated by pesticides and metals, but the levels detected to date do not warrant urgent action.

Introduction

Al-Suwaira is the location of the central pesticide store for the ministry of agriculture in Iraq. The site is located 50km southeast of Baghdad, 2km north of the River Tigris and 3km north of the town Al-Swaira . The area of the site was 4 hectare contains six warehouse used to store a range of pesticides over a 30-years period. The empty imported pesticide containers were washed and re-used for local sale of pesticides, with some damaged being dumped on site. The majority of pesticides stored were stolen , together with the containers , but the looters smashed containers and spread pesticides throughout the soil in and site outside the site .

The soil in Al-Suwaira is the primary supplier of pesticides to soil-plant animal system and the soil-foodstuff-water human systems [1, 2]. In these systems, the occurrence and the concentration of pesticides in any individual component depends largely on the source of the pesticides. In this context, the source of pesticides to the ecosystems will be either via the soil or by deposition of aerial particulates [3], i.e the two recognized routes of uptake are from :

- i) Soil sources through the roots and
- ii) Atmospheric sources through aerial portions of the plant [4].

In soil, the total concentration of pesticides indicates the extent of contamination but not the significance [5], the proportion of such pesticides in various chemical forms can demonstrate how the pesticides is bound in soil as a basis for assessing potential availability [6]. In soil solution pesticides may be present as free ion and as soluble inorganic and organic complexes [7]. Pesticides in soil have high affinity to form complexes with fulvic and humic acids while the complex formation is pH dependent [8]. It may be that most pesticides in soil are associated with the organic matter. Little is known about the forms in which pesticides occur in plants [9]. In general, pesticides may be interfered with other organic compounds within plants such as pigments, soluble protein, soluble pectate, polysaccharides, lignine α - cellulose, hemicellulose and amino acids [10].

Ideally the action of pesticides would be target specific. Unfortunately most are nonselective and result in toxic effects to many no target species, including humans . Pesticides come to many different forms with wide range of potential toxic effects. The health effects of short term, low level exposure to most of these agents have yet to be well elucidated [11]. Extended low level exposure to low levels may result in chronic disease states . High exposure may result to acute disease states or death [12].

Experimental Work and Results

The Health and safety equipments were used during collection of samples from Al-Suwaira site footwear, coveralls, disposable masks, eyewear and gloves. Twenty soil samples from different depth

(surface, 0.5, 1 cm) site were collected from Al-Suwaira in plastic bages at june 2005, the samples were labeled and leave in oven at 50 c^o through overnight to remove water, grounded and full to plastic bottle, sealded and sent to Al-contor laboratory in England for analysis by high performance liquid chromatography with mass spectrometer (HPLC-MS) for analysis of pesticides and inductive couple plasma technique (ICP) for analysis of metals, the results obtained in Annex E1 and Annex E2 Twenty samples of water and vegetation were collected from Al-Suwaira site on the same day of collection soil samples, the water samples were collected in polythen bottles, previously rinsed with nitric acid and again distilled water, the polyethene bottles (2.5L) were rinsed three times with the stream water and then filled . After return to the laboratory, the water samples were send to analyzed by Al-contor laboratory in England for pesticides and metals . The twenty vegetation samples were collected in plastic bags on the same day mentioned above and sent to Al-contor laboratory for analysis . The level of pesticides and metals in water and vegetation samples in Al-Suwaira site were not detected by HPLC-MS and ICP techniques . It was found in the warehouse at the **Al-Suwaira site**

purple-pink powder (Fig-1-) expected dimethyl mercury , therefore 5 grams of compound were sealded and send for analysis at Al-control laboratory , the analysis identified that powder chlorophenyl mercury at concentration $6000 \mu g/g$, this compound has a similar appearance , use and toxicity to dimethyl mercury .



Fig.1 Mercury Compound was readily identified as a pink purple colored powder

Discussion

The results in Annex E1 indicate that :

- 1- Al-Suwaira site contaminated with metals in order
- Zn > Cu > Ni > Pb > Cr > As > Se > Cd
- 2- Hydrocarbons and volatile organic compounds (VoCs) were found at high level
- 3- The analysis results indicate the Al-Suwaira soil are contaminated with pesticids in order fenitrothion > p,p -DDE > diazinone > endrin > p,p -DDT > dieldrin > p,p -methoxy chlor > endosulphan sulphate > endrin > lindane > heptachlior > Aldrin > p,p -TDE (DDD) > Heptachlor epoxide .
- 4- The site is highly contaminated with Ca , Mg , K , Na , CaCO3 , sulphate , Chloride , asbestos and organic fibre
- 5- The pH of the soil in Al-Suwaira site from 5.68-8.31

The results in Annex E2 indicate :

- 1- According to Dutch 1 Tier 1 screening criteria for soil, only Zinc, Copper and mercury in alsuwaira soil can be consider as pollutants.
- 2- The pollutants concentrated at surface soil, it is clear no relation between concentration of pollutants and depth of soil.

The results in Annes E1 and Annes E2 represent that Al-Suwaira site is currenty consider to a low risk to human health especially site workers if they enter the warehouse without protection .the hazardous waste in the site need to treated (decontaminated) to decrease the human health risk. Most of the pollutants present in the site will break down over time with contact with water, oxygen and heat [13] and they migrate from waste to soil and surface water[14], migration as dust is only relevant for short distance out side the warehouse [15]. The organic mercury stored at Al-Suwaira, it was previously used in Iraq as fungicide to coat wheat seeds . In 1971 methyl mercury was the cause of an infamous poisoning when 6,500 people were hospitalized and 459 died from eating bread made from the treated seeds [16]. Chlorphenyl mercury was used as fungicide. Its toxicity and other characteristics are very similar to methyl mercury [17]. The high level of calcium and zinc in Al -Suwaira soil due to zinc phosphide and calcium cyanide storage in the site.

The pesticides DDT,DDE, dieldrin are organo chlorine compounds present in Al -Suwaria soil could be related to its use up to 30 years ago[18]. They used as insecticide of moderate toxicity to human [19]. They are no longer widely used internationally ,due to concern about its impact and stability in the environment [20]. Organo-mercury pesticides are limited, especially in host climates and with exposures to air over time , the organic form breaks down to form mercuric oxide and elemental mercury , therefore mercury was detected in Al-Suwira site ,due to storage of organo -mercury pesticide in the site.

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تقيم الخطر في موقع الصويرة اعتمادا على تقدير الملوثات في النماذج البيئية

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الخلاصة

جُمعت نماذج بيئية (تربة ، ماء ، نباتات) من موقع الصويرة لتقيم خطر الملوثات مثل المبيدات والعناصر المعدنية ولقد بينت نتائج التحليل المختبري تلوث بسيط لنماذج التربة بالمبيدات فينتروثايونين ، دايزنون ، اندرين ، دايروكلوروابوكسايد ، ميثوكسي كلور ، كبريتات الاندو سلفون ، اندرين ، لندرين ، سباعي الكلور ، الدرين و دي دي تي .

بينت نتائج التحليل المختبري تلوث نماذج التربة بملوثات اخرى بضمنها العناصر المعدنية الزنك ، النحاس ، النيكل ، الرصاص ،الكروم ، الزرنيخ والسلينيوم

تراكيز المبيدات والعناصر المعدنيّة في نماذج المياه والنباتات كانت قليلة جدا حيث لم يتم قياسها من قبل التقنيات التحليلية وهذه النتائج تدل إن هذه النماذج غير ملوثة

توصل البحث الحالي حول موقع الصويره الى مايلي : 1- لا يشكل الموقع خطر على الصحة العامة في الوقت الحاضر وان خطورته قليلة على صحة الانسان 2- حوالي 100 م³ من المبيدات تعتبر مخلفات ضارة موجودة في المخازن

3- يعتبر المخزن الملوث بالزئبق غير آمن للأستخدام ويبقى بحالة الى ان يتم تطهيره من التلوث

4- يمكن تصنيف التربة داخل الموقع الى انها ملوثة بالمبيدات والعناصر المعدنية لاكن مستوى التلوث لحد الان لا يحتاج الى اجراء طارئ