E-ISSN: 2788-9297
P-ISSN: 2788-9289
www.agrijournal.org
SAJAS 2022; 2(1): 60-70
Received: 13-01-2022
Accepted: 19-02-2022

Ahmed Ayad Alfaytouri Saeid
Department of Soil & Water, Faculty of Agricultural, Bani Waleed University, Libya

Faizi Tawati Abdulnaser
Higher Institute of Science and Technology- AL Garaboulli, Libya

Bled Abdalah Fadel Abdalah
Department of plant, College of arts & sciences -Kufra, university of Benghazi Libya, Libya

Correspondence
Ahmed Ayad Alfaytouri Saeid
Department of Soil & Water, Faculty of Agricultural, Bani Waleed University, Libya

Analysis of some heavy metals (Hg, Cu, Cr, Cd, As) in a Landfill Kastamonu landfill in Turkey

Ahmed Ayad Alfaytouri Saeid, Faizi Tawati Abdulnaser and Bled Abdalah Fadel Abdalah

Abstract
In modern economies, various types of activity, including agriculture, industry and transportation, produce a large amount of wastes and new types of pollutants. Soil, air and water have traditionally been used as sites for the disposal of all these wastes. Main aim of this present study was to investigate the effects of city rubbish dumping place on soil element concentrations in Kastamonu. Soil samples were taken from 5 locations (distances) (center, 100 m, 200 m, 300 m, 400 m and 2 km) and three directions (east, north and south) away from the city rubbish dumping place. The soil samples were taken randomly from 0-5cm, 5-10 cm, 10-15 cm and 15-20 cm soil depths by digging two soil pits at each sampling site. in our study It was noted that the concentrations of Cd decreased with the distance showing the highest concentration between the distance of (250 to 280 ppm), especially at dumpsite center, and decreased to (175 ppm) at 2 km away. But the concentrations were almost constant with the soil depths. As for as, the concentrations increased highly with the soil depths and almost equal with the distances.

Keywords: Soil pollution, soil contamination, heavy metals, Rubbish dumping site

Introduction
Bulky metals display assessment of metallic, such as, affability, resilience, conductivity, cation dependability, and ligand specificity. They are described by moderately high thickness and high relative nuclear weight with a nuclear number of more prominent than 20 [1, 8] Some overwhelming metals, for example, Co, Cu, Fe, Mn, Mo, Ni, V, and Zn are required in moment amounts by organisms. However, extreme measures of these components can get to be distinctly hurtful to living beings [11]. Other bulky metals, as, Compact disc, Pb, Hg, and as (a metalloid however by and large alluded to as a substantial metal) and can't make any effect on the way of living and shown as "principle threats" since they are extremely destructive to both plants and animals [13].
Metals exist either as particular substances or in mix with other soil segments [2]. These segments may incorporate interchangeable ions sorbet on the surfaces of inorganic solids, nonexchangeable particles and insoluble inorganic metal mixes, for example, carbonates and phosphates, solvent metal compound or free metal particles in the soil solution, metal complex of organic materials, and metals connected to silicate minerals [9, 12] Metals connect to silicate minerals speak to the foundation soil metal focus and they don't bring about tainting/contamination issues contrasted and being of metal as isolated substances or exist in a bigger fixation in the other 4 section [25].
Assessment of soil influence metal accessibility in various methods [7]. Harter stated that soil pH is the main consideration influencing metal accessibility in soil [21]. With increment in soil pH accessibility of Cd and Zn to the establishments of Tulips caerulescens reduced [16, 19]. Through immobilization of these metals natural matter and hydrous ferric oxide have been come to decrease large metal openness [3, 4] Between massive metals and some earth physical properties basic positive connections have similarly been recorded, for instance, water holding limit, and moistness substance. Cd and Zn to the foundations of *Thlaspi caerulescens* diminished with increament in soil pH [45]. Natural matter and hydrous ferric oxide have been appeared to reduction substantial metal accessibility through immobilization of these metals [34]. Critical positive relationships have likewise been recorded between bulky metals and some dirt physical properties, for example, dampness substance and water holding limit [27].

The thickness and kind of charge in soil colloids, the level of complexation with ligands, and the dirt's relative surface zone join various factors that affect the metal availability in soil [6]. The extensive interface and particular surface zones are given by soil colloids help in controlling the grouping of metals bulky normal soil [56, 36]. Likewise, solvent groupings of metals in contaminated soil might be diminished by soil particles with high particular surface territory, however this might be metal particular [5, 14]. Narrated that expansion of revision comprising of hydroxides along big responsive surface zone diminished the solvency of the dissolvability of Ni and Zn were not changed as compact disc, Cu, Mo, and Pb [41, 46]. Mineral sythesis have likewise been appeared to impact bulky metal accessibility in soil aeration, microbial action [10, 33].

Alternately, bulky metals may change soil assets specially soil organic assets [17]. Observing alternation in microbiological soil and biochemical assets after sullying can be utilized to assess the force of soil contamination in light of the fact that these strategies are more delicate and results can be gotten at a quicker rate contrasted and checking soil physical and concoction properties [15, 55]. Bulky metals influence the number, assorted qualities, and exercises the microorganisms soil [18]. The poisonous quality of these microorganisms metals relies on upon various variables, for example, soil temperature, pH, clay minerals, inorganic anions and cations, organic matters, and synthetic types of the metals [20, 49].

While a few analysts have recorded negative impact of substantial metals on soil biological assets there are disparities in studies looking at the impact of bulky metals on soil biological assets [42, 35]. Another states which is no relationship between big bulky metal focuses and some soil (micro) biological assets [38]. A portion of the irregularities may emerge in light of the fact that some of these reviews were led under lab conditions utilizing misleadingly debased soils while others were completed utilizing soils from territories that are really dirtied in the field [34]. Notwithstanding the birthplace of the utilized as a part of these examinations, the way that impact substantial metals on soil biological properties should be contemplated in more detail keeping in mind the end goal to completely comprehend the impact of these metals ecosystem remains [43]. Facilitate, it is prudent to utilize an extensive variety of techniques, (for example, microbial biomass, C and N mineralization, breath, and enzymatic exercises) while considering impact metals on soil organic properties as opposed to concentrating on a single method since results got from utilization of various strategies would be more far reaching and indisputable [31, 18].

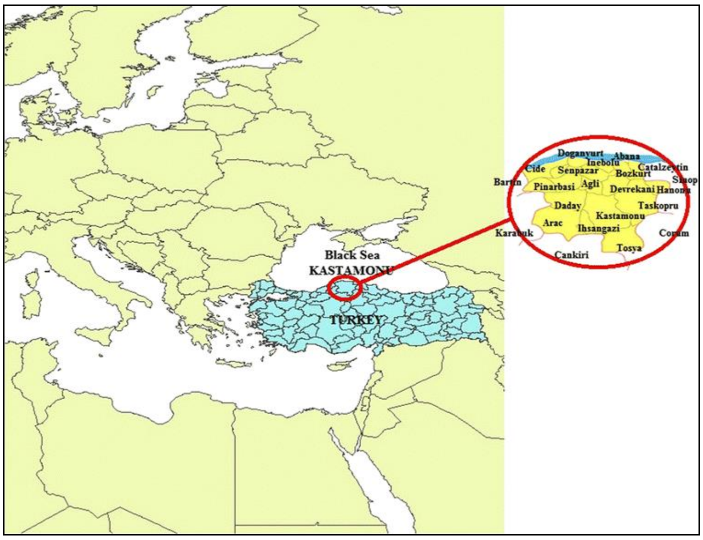
2. Health Risks of Heavy Metals

Human exercises, enterprises, disintegration and the persistent spread of urbanization can initiate soil contamination in different ways [24, 57]. The contamination of soil can be unsafe for human health in light of the fact that the lethal substances can enter the harvests and the ground water [37, 44]. The soil, because of its properties and structures, assume the part of a channel that can hold and can be a store for lethal substances [22, 54]. The most continuous contaminants of soil in Europe are bulky metals and mineral oil [48, 47]. The gathering 'substantial metals' with the end goal of talking about health dangers or effects by and large incorporates: Arsenic (As), Lead (Pb), Cadmium (Album), Chromium (Cr) (albeit just the shape Cr (VI) is poisonous), Copper (Cu), Mercury (Hg), Nickel (Ni), Zinc (Zn) [26, 61]. A few of these components are important for human health and are useful when taken into the body in sustenances or as supplements at fitting, low levels [28, 51]. On the other hand, cadmium, lead and mercury have no known organic capacity and are dangerous to people [40]. The wellsprings of substantial metals that dirty the dirt can be human exercises like metal liferous mining (As, Disc, Cu, Ni, Pb, Zn), smelters (As, Cd, Pb), metallurgy electronic industry (where metals are utilized as a part of batteries, semiconductors, circuits), moving (Ni, Cd, Pb, Hg, Se), colors and paints industry (Pb, Cr, As, Se, Mo, Cd, Co, Ba, Zn), plastics industry (Compact disc, Zn, Pb, Sn are utilized as polymer stabilizers), synthetic industry (utilizing Pb, Ni, Nb, Hg, Pt, Ru as anode impetuses), wood industry (As, Cr and Cu) [50]. In the region of furniture production lines and wood-preparing, these components were frequently recognized as soil and water poisons [23, 29].

3. Materials and Methods

3.1. Study of Area

Kastamonu is located on the nort-east of Turkey along the black sea region. Its geographical coordinates are 41° 22' 20" North, 33° 46' 16" East (Map 1). Kastamonu is located at the altitudes of 775 m, and total area (13.082 km^2. Kastamonu Province is that area of Turkey, that black sea district toward the north of the nation.



Map 1: Location of Kastamonu Province

3.2. Collection of Solid Wastes in Kastamonu Province

Collection of garbage in Kastamonu (Center) is carried out in 2 sections. On the street, the containers are removed by the municipality. In this region, the rubbish of residents of apartments is smashed by the concierge between 20:00 and 21:00. It is left in large bags in front of the door. In other parts of the city, garbage is collected from the containers at intervals. The first collection of the garbage place is Kuzeykent District. The advantage of the containerized system when compared to garbage collection methods is to move away from any desired source, and it is cheap. On the other hand, the way to get from the door, it is preferred in terms of aesthetics since it is not necessary to store it. There are 45 people in the winter and 50 people in the summer for waste collecting services. For the collection of wastes, the number of vehicles used for the collection is 10. Among them, 8 are compressed vehicles, 2 are open vehicles, 2 are sweeping and washing vehicles. The Vehicles are available from 8:00 am to 12:00 noon, after lunch from 1:30 to 17:00 and evening from 19:00 at night from 2:30 to 3:00. They work as shift workers.

Stationary container system (SKS) and mobile container system in Kastamonu province (HKS) is applied. With SKS, the trucks are equipped with 2 loaders and one 3 people, including the driver, collect and dispose of trash. In the center of Kastamonu there is no recycled pyramids [53]. However, the Municipality of Kastamonu is committed to protecting natural resources and enhancing environmental awareness. And recycling pigeons to save raw materials and plastic solid waste Containers are in the effort to get [39, 52].

Table 1: Show Total population 2021

Total population	372,633 Persons
Male Population	184,585 Persons
Female Population	188,048 Persons
Population Less than 15 years	64,139 Persons
Population from 15 to 64 years	246,041 Persons
Population 65 years or over	62,453 Persons
Crude birth rate	11.4 Per 1,000 people
Crude rate of net migration	20.5%
Crude rate of natural change of population	2.3%
Crude rate of total population change	22.8%
Total area	13,158 Square kilometre
Land Area	13,153 Sq. km

Source: World Data Atlas Turkey Kastamonu Population

3.3. Soil Sampling in the Field

Five locations (center, 100 m, 200 m, 300 m, 400 m and 2 km) from three directions (east, north and south) were selected around the city rubbish dumping place in Kastamonu [37, 46]. The soil samples were taken randomly from 0-5cm, 5-10 cm, 10-15 cm and 15-20 cm soil depths by digging two soil pits at each sampling site [53]. Two core samples from each soil pit were also taken and averaged to obtain representative bulk density.

Fig 1: Taking soil samples from the different depths using soil cores

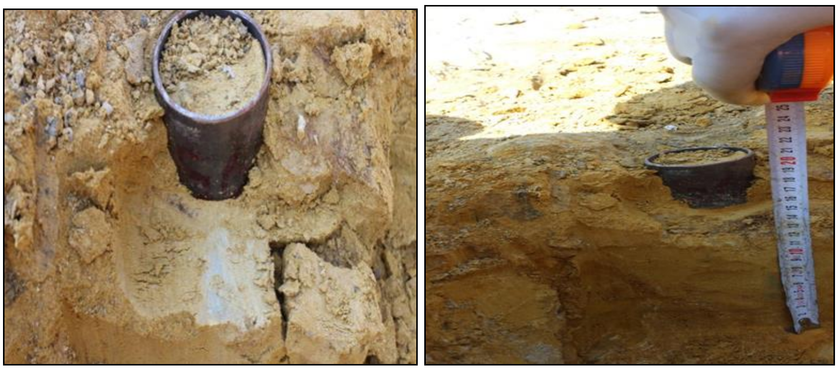


Fig 2: Carefully checking the soil depth

Fig 3: Emptying the soil sample inside the soil core to the plastic bag

3.4. Preparation of Soil Samples and Analysis

The patterns were conveyed to the soil lab and were air-dried ground and go through 2 mm mesh-sized sifter [58]. They put into stamped plastic sacks and kept in a cooler until compound investigation the some soil components fixations (Cu, Cr, Cd and As) [59, 60].

3.5. Analysis of Soil Samples

Some soil elements (Cu, Cr, Cd and As) were determined in Kastamonu University Center Laboratory using Spectro - Xepos II model XRF (X-Ray Fluorescence Spectrometer) [53].

Fig 4: (X-Ray Fluorescence Spectrometer).

3.6. Statistical Analyses

A two-way ANOVA (analyses of variance) was applied for analysing the effects of distances and soil depths on some soil properties and soil elements using the SPSS program (Version 9.0 for Windows). Following the results of ANOVAs, Tukey's Honestly Significant Difference (HSD) test (α= 0.05) was used for multiple comparisons of soil properties and soil elements.

3.7. Duration of study

Started of work September 2017 up to September 2018.

4. Results

4.1. Soil Elements

Some soil elements (Hg, Cu, Cr, Cd and As) of different soil depths (0-5 cm, 5-10 cm, 10-15 cm and 15-20 cm) collected from the three directions (east, north and south) from the five locations at

each direction are shown in Table 2, Table 3, Table 4 and Table 5. General results of each directions and control sites (0-20 cm) are given in Table 6.

Table 2: Some soil elements of the East direction

Direction	Location	Soil depth (cm)	Hg ppm	Cu ppm	Cr ppm	Cd ppm	As ppm
East	Center Mean	0-5	<3,8	25765	183	311	11035
		5-10	<3,8	24965	178	286	11247
		10-15	<3,8	24670	161	230	10955
		15-20	<3,8	24210	152	269	10525
		0-20	<3,8	24903	168	274	10940
	100 M	0-5	<3,8	30315	279	224	10728

	Mean	5-10	<3,8	35815	289	200	10154
		10-15	<3,8	34035	294	268	10016
		15-20	<3,8	38290	592	300	23915
		0-20	<3,8	34614	363	248	13703
	200 M Mean	0-5	<5.9	42645	640	152	16400
		5-10	<5.9	45655	767	143	18705
		10-15	<5.9	49975	1198	158	27435
		15-20	<5.9	41495	1132	136	21430
		0-20	<5.9	44943	934	147	20993
	300 M Mean	0-5	<3,8	30210	380	144	11664
		5-10	<3,8	35660	418	147	14580
		10-15	<3,8	31675	362	142	18960
		15-20	<3,8	39120	400	160	14310
		0-20	<3,8	34166	390	148	14878

Table 3: Some soil elements of the North direction

Direction	**Location**	Soil depth (cm)	**Hg ppm**	**Cu ppm**	**Cr ppm**	**Cd ppm**	**As ppm**
North	Center Mean	0-5	<3,8	21985	92	300	13440
		5-10	<3,8	35015	122	355	13710
		10-15	<3,8	34165	96	216	14060
		15-20	<3,8	27715	219	270	11885
		0-20	<3,8	29720	132	285	13274
	100 M Mean	0-5	<3,8	32325	342	210	16445
		5-10	<3,8	50310	445	261	14635
		10-15	<3,8	39673	220	186	12137
		15-20	<3,8	49740	493	238	11618
		0-20	<3,8	43012	375	224	13709
	200 M Mean	0-5	<3,8	27055	327	191	8570
		5-10	<3,8	21160	253	128	7124
		10-15	<3,8	21625	214	140	6765
		15-20	<3,8	19580	151	121	6558
		0-20	<3,8	22355	236	145	7254
	300 M Mean	0-5	<3,8	35800	554	207	16950
		5-10	<3,8	36085	574	232	17110
		10-15	<3,8	36040	557	229	13450
		15-20	<3,8	30290	508	186	12530
		0-20	<3,8	34554	548	213	15010

Table 4: Some soil elements of the South direction

Direction	**Location**	**Soil depth (cm)**	**Hg ppm**	**Cu ppm**	**Cr ppm**	**Cd ppm**	**As ppm**
South	Center Mean	0-5	<3,8	22620	347	287	14853
		5-10	<3,8	23285	288	191	10496
		10-15	<3,8	32350	389	263	17885
		15-20	<3,8	35485	419	283	18415
		0-20	<3,8	28435	361	256	15412
	100 M Mean	0-5	<3,8	14670	147	170	6955
		5-10	<3,8	17975	158	170	8598
		10-15	<3,8	18840	149	197	10387
		15-20	<3,8	17065	151	187	9194
		0-20	<3,8	17138	151	181	8783
	200 M Mean	0-5	<3,8	29610	837	82	7583
		5-10	<3,8	30450	825	88	5953
		10-15	<3,8	28190	717	71	7480
		15-20	<3,8	30080	779	75	12802
		0-20	<3,8	29583	789	79	8454
	300 M Mean	0-5	<3,8	32535	405	173	12375
		5-10	<3,8	26570	356	152	11895
		10-15	<3,8	30955	376	181	11460
		15-20	<3,8	31135	399	194	11825
		0-20	<3,8	30299	384	175	11889

Table 5: Some soil elements at the location of 400 m and 2 km as control sites

	Location	Soil depth (cm)	Hg ppm	Cu ppm	Cr ppm	Cd ppm	As ppm
Control	400 M Mean	0-5	<3,8	25080	400	120	9583
		5-10	<3,8	25485	408	117	9503
		10-15	<3,8	37015	521	168	17950
		15-20	<3,8	31850	555	151	13805
		0-20	<3,8	29858	471	139	12710
	2 KM Mean	0-5	<3,8	51485	1332	168	21690
		5-10	<3,8	53855	1504	162	22375
		10-15	<3,8	59325	1370	197	27295
		15-20	<3,8	57430	1249	171	22270
		0-20	<3,8	55524	1363	175	23408

Table 6: General results of each directions and control sites (0-20 cm)

Direction	Location (meter)	Hg ppm	Cu ppm	Cr ppm	Cd ppm	As ppm
East	Center	<3,8	24903	168	274	10940
	100	<3,8	34614	363	248	13703
	200	<5.9	44943	934	147	20993
	300	<3,8	34166	390	148	14878
North	Center	<3,8	29720	132	285	13274
	100	<3,8	43012	375	224	13709
	200	<3,8	22355	236	145	7254
	300	<3,8	34554	548	213	15010
South	Center	<3,8	28435	361	256	15412
	100	<3,8	17138	151	181	8783
	200	<3,8	29583	789	79	8454
	300	<3,8	30299	384	175	11889
Control	400	<3,8	29858	471	139	12710
	2000	<3,8	55524	1363	175	23408

The single effects and interactions of east direction and soil depths of Hg, Cu, Cr, Cd and As are listed in Table 7. At the East direction, aamong soil elements, Cu, Cr, Cd and As showed significant differences between the locations (the distance) ($P<0.001$). In general, all soil elements showed an increase with the distances (Table 6). Co and Mn concentrations decreased with the soil depths (Table 2).

Table 7: ANOVA results of Hg, Cu, Cr, Cd and As from East direction

Tests Between Effects of Subjects

Dependent Variable: Cu

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5455052831,250[a]	23	237176210,054	8,565	,000	,891
Intercept	66905066718,750	1	66905066718,750	2416,126	,000	,990
Location	4933047368,750	5	986609473,750	35,629	,000	,881
Soildepth	193489372,917	3	64496457,639	2,329	,100	,225
Location * Soildepth	328516089,583	15	21901072,639	,791	,676	,331
Error	664585150,000	24	27691047,917			
Total	73024704700,000	48				
Corrected Total	6119637981,250	47				

a. R Squared = ,891 (Adjusted R Squared = ,787)

Tests Between Effects of Subjects

Dependent Variable: Cr

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8664463,110[a]	23	376715,787	13,201	,000	,927
Intercept	18157137,075	1	18157137,075	636,262	,000	,964
Location	7969613,201	5	1593922,640	55,854	,000	,921
Soildepth	146610,544	3	48870,181	1,713	,191	,176
Location * Soildepth	548239,365	15	36549,291	1,281	,286	,445
Error	684893,325	24	28537,222			
Total	27506493,510	48				
Corrected Total	9349356,435	47				

a. R Squared = ,927 (Adjusted R Squared = ,857)

Tests Between Effects of Subjects

Dependent Variable: Cd

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	159212,463[a]	23	6922,281	11,444	,000	,916
Intercept	1705434,902	1	1705434,902	2819,544	,000	,992
Location	134497,369	5	26899,474	44,472	,000	,903

Soildepth	3293,232	3	1097,744	1,815	,171	,185
Location * Soildepth	21421,861	15	1428,124	2,361	,029	,596
Error	14516,685	24	604,862			
Total	1879164,050	48				
Corrected Total	173729,148	47				
a. R Squared = ,916 (Adjusted R Squared = ,836)						

Tests Between Effects of Subjects`						
Dependent Variable: As						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	1589855739,813[a]	23	69124162,601	2,719	,009	,723
Intercept	12450292354,688	1	12450292354,688	489,728	,000	,953
Location	981495219,687	5	196299043,937	7,721	,000	,617
Soildepth	230192968,563	3	76730989,521	3,018	,050	,274
Location * Soildepth	378167551,563	15	25211170,104	,992	,493	,383
Error	610149190,500	24	25422882,938			
Total	14650297285,000	48				
Corrected Total	2200004930,313	47				
a. R Squared = ,723 (Adjusted R Squared = ,457)						

The single effects and interactions of North direction and soil depths of Hg, Cu, Cr, Cd are listed in Table 8. At the North direction, all soil elements (Hg, Cu, Cr, Cd and As) showed significant differences between the locations (the distance) (P<0.001). Only Cu significantly varied between the soil depths. In general, all soil elements showed an increase with the distances (Table 6). Ni and Cu concentrations increased with the soil depths (Table 3).

Table 8: ANOVA results of Cu, Cr, Cd and As from North direction

Tests Between Effects of Subjects						
Dependent Variable: Cu						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	6616842396,000[a]	23	287688799,826	11,712	,000	,918
Intercept	61645947312,000	1	61645947312,000	2509,672	,000	,991
Location	5565055315,000	5	1113011063,000	45,312	,000	,904
Soildepth	222559246,000	3	74186415,333	3,020	,049	,274
Location * Soildepth	829227835,000	15	55281855,667	2,251	,037	,584
Error	589520308,000	24	24563346,167			
Total	68852310016,000	48				
Corrected Total	7206362704,000	47				
a. R Squared = ,918 (Adjusted R Squared = ,840)						
Tests Between Effects of Subjects						
Dependent Variable: Cr						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	7984159,670[a]	23	347137,377	19,815	,000	,950
Intercept	13026667,320	1	13026667,320	743,590	,000	,969
Location	7732832,510	5	1546566,502	88,281	,000	,948
Soildepth	20878,608	3	6959,536	,397	,756	,047
Location * Soildepth	230448,552	15	15363,237	,877	,595	,354
Error	420446,670	24	17518,611			
Total	21431273,660	48				
Corrected Total	8404606,340	47				
a. R Squared = ,950 (Adjusted R Squared = ,902)						
Tests Between Effects of Subjects						
Dependent Variable: Cd						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	162697,370[a]	23	7073,799	2,213	,029	,680
Intercept	1859523,870	1	1859523,870	581,739	,000	,960
Location	122422,685	5	24484,537	7,660	,000	,615
Soildepth	3238,670	3	1079,557	,338	,798	,041
Location * Soildepth	37036,015	15	2469,068	,772	,693	,326
Error	76715,820	24	3196,493			
Total	2098937,060	48				
Corrected Total	239413,190	47				
a. R Squared = ,680 (Adjusted R Squared = ,372)						
Tests Between Effects of Subjects						
Dependent Variable: As						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	1308634753,813[a]	23	56897163,209	4,379	,000	,808
Intercept	9715988206,688	1	9715988206,688	747,855	,000	,969
Location	1095980461,187	5	219196092,237	16,872	,000	,779

Soildepth	29004327,896	3	9668109,299	,744	,536	,085
Location * Soildepth	183649964,729	15	12243330,982	,942	,536	,371
Error	311803484,500	24	12991811,854			
Total	11336426445,000	48				
Corrected Total	1620438238,313	47				
a. R Squared = ,808 (Adjusted R Squared = ,623)						

The single effects and interactions of South direction and soil depths of Hg, Cu, Cr, Cd and As are listed in Table 9. At the South direction, all soil elements (Hg, Cu, Cr, Cd and As) with the exception of Cu showed significant differences between the locations (the distance) (P<0.001). In general, all soil elements showed an increase with the distances (Table 6). Co concentrations decreased with the soil depths (Table 4).

Table 9: ANOVA results of, Hg, Cu, Cr, Cd and As from South direction

Tests Between Effects of Subjects						
Dependent Variable: Cu						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	6985294966,667[a]	23	303708476,812	9,061	,000	,897
Intercept	48557329633,333	1	48557329633,333	1448,722	,000	,984
Location	6400580841,667	5	1280116168,333	38,193	,000	,888
Soildepth	264901050,000	3	88300350,000	2,634	,073	,248
Location * Soildepth	319813075,000	15	21320871,667	,636	,817	,284
Error	804416400,000	24	33517350,000			
Total	56347041000,000	48				
Corrected Total	7789711366,667	47				
a. R Squared = ,897 (Adjusted R Squared = ,798)						
Tests Between Effects of Subjects						
Dependent Variable: Cr						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	7659439,300[a]	23	333019,100	10,097	,000	,906
Intercept	16520885,335	1	16520885,335	500,882	,000	,954
Location	7514508,319	5	1502901,664	45,565	,000	,905
Soildepth	1335,207	3	445,069	,013	,998	,002
Location * Soildepth	143595,774	15	9573,052	,290	,992	,154
Error	791605,475	24	32983,561			
Total	24971930,110	48				
Corrected Total	8451044,775	47				
a. R Squared = ,906 (Adjusted R Squared = ,817)						
Tests Between Effects of Subjects						
Dependent Variable: Cd						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	154407,380[a]	23	6713,364	7,047	,000	,871
Intercept	1345460,785	1	1345460,785	1412,284	,000	,983
Location	134213,804	5	26842,761	28,176	,000	,854
Soildepth	7863,536	3	2621,179	2,751	,065	,256
Location * Soildepth	12330,041	15	822,003	,863	,608	,350
Error	22864,425	24	952,684			
Total	1522732,590	48				
Corrected Total	177271,805	47				
a. R Squared = ,871 (Adjusted R Squared = ,747)						
Tests Between Effects of Subjects						
Dependent Variable: As						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	1506123921,479[a]	23	65483648,760	4,244	,000	,803
Intercept	8673826896,021	1	8673826896,021	562,158	,000	,959
Location	1221774669,854	5	244354933,971	15,837	,000	,767
Soildepth	131998378,729	3	43999459,576	2,852	,059	,263
Location * Soildepth	152350872,896	15	10156724,860	,658	,798	,291
Error	370308559,500	24	15429523,313			
Total	10550259377,000	48				
Corrected Total	1876432480,979	47				
a. R Squared = ,803 (Adjusted R Squared = ,614)						

5. Discussion

Among the heavy metals studied (Hg ,Cu, Cr, Cd and As) It was noted that Cr in the East direction gradually increased from a distance of 100 m to 2 km to reach (16,6ppm). Despite the lack of access to the maximum levels of pollution but the high percentage at 2km indicates to dangerous pollution by Cr. There is also a disparity in the descent, especially in depths which recorded a low rates for Co as shown in Table 4.

Cu concentrations in soil also increased with the distance and with the soil depths. Cupper concentration in soil rose 44943 ppm at the distance of 200 m. and the highest level at the distance of 2 km (55524 ppm) (Table 6).

Soil Cd and As concentrations also varied between the distances and the soil depths. It was noted that the concentrations of Cd decreased with the distance showing the highest concentration between the distance of (250 to 280 ppm), especially at dumpsite center, and decreased to (175 ppm) at 2 km away. But the concentrations were almost constant with the soil depths. As for As, the concentrations increased highly with the soil depths and almost equal with the distances

Turkish and EU (European Union) Department of the Environmental Trigger Concentrations for Environmental Contaminants are shown in Table 10.

Table 10: Comparisons of Environmental Contaminants in Turkey and EU

Heavy metals (ppm)	**Belgium**		**Germany**	**Denmark**	**France**	**Finland**
	Flanders	**Wallonia**				
Cadmium (Cd)	1.2	2	1.5	0.5	2	0.5
Chromium (Cr)	78	100	100	30	150	200
Copper (Cu)	109	50	60	40	100	100
	Ireland	**Luxembourg**	**Poland**	**Scotland**	**England**	**Turkey**
Cadmium (Cd)	1	1-3	3	0.4	3	1
Chromium (Cr)	-	100-200	200	60	-	100
Copper (Cu)	50	50-140	100	40	135	50

According to Turkish and EU (European Union) Department of the Environmental Trigger Concentrations for Environmental Contaminants, cadmium level changes from 0.5 ppm (Denmark) to 3 ppm (Poland, England, Luxemburg). Our results showed that Cd level ranged from 79 ppm to 285 ppm (Table 6) which was so higher than the required level.

Chromium level changes from 30 ppm (Denmark) to 200 ppm (Poland, Finland, Luxemburg). Our results showed that Cr level ranged from 236 ppm to 1363 ppm (Table 6) which was so higher than the required level.

Copper level changes from 40 ppm (Denmark, Scotland) to 140 ppm in (Luxemburg). Our results showed that Cu level ranged from 17138 ppm to 55524 ppm (Table 6) which was so higher than the required level.

Mercury level changes from 0.2 ppm (Finland) to 5.3 ppm in (Flanders). Our results showed that Hg level ranged from <3,8 ppm to <5.9 ppm (Table 6) which was so higher than the required level.

6. References

1. Ene A, Popescu IV, Stihi C. Applications of proton-induced Xray emission technique inmaterials and environmental science, Ovidius Univ. Ann. Chem. 2009;20(1):35.
2. Marques APGC, Rangel AOSS, Castro PML. Crit. Rev. Environ. Sci. Technol. 2009;39(8):622–654.
3. Wang AS, Angle JS, Chaney RL, Delorme TA, Reeves RD. Plant Soil. 2006;281(1-2):325–337.
4. Adamo P, Dudka S, Wilson MJ, Mchardy WJ. Distribution of trace elements in soils from the sudbury smelting area (Ontario-Canada), Water and Soil Pollution. 2002;137:95-116.
5. Afzal Shah, Abdul Niaz, Nazeef Ullah, Ali Rehman, Muhammad Akhlaq, Muhammad Zakir, *et al*. Comparative Study of Heavy Metals in Soil and Selected Medicinal Plants", Journal of Chemistry, 2011. 2013, 5.
6. Agency for Toxic Substances & Disease Registry (ATSDR). Public Health Statement for Lead, 2007. http://www.atsdr.cdc.gov/PHS/PHS.asp?id=92&tid=22 (accessed in April, 2010).
7. Agency for Toxic Substances & Disease Registry (ATSDR). Public Health Statement for Chromium, http://www.atsdr.cdc.gov/PHS/PHS.asp?id=60& tid=17 (accessed in April, 2010), 2008.
8. Asanousi Lamma O, Swamy AVVS, Alhadad AA. Assessment of Heavy Metal Pollution in Ground Water and its Correlation with other Physical Parameters at Selected Industrial Areas of Guntur, AP, India, 2018.
9. Saeid AAA. Remote Sensing in Water Quality and Water Resources Management. International Journal for Research in Applied Sciences and Biotechnology. 2022;9(1):163-170.
10. ALnaass NS, Ibrahim NAAHK Remote sensing of water and soil environments. IJAR. 2022;8(1):381-388.
11. ALnaass NS, Agil HK, Ibrahim HK. Use of fertilizers or importance of fertilizers in agriculture.
12. Battarbee R, Anderson N, Appleby P, Flower RJ, Fritz S, Haworth E, *et al*. Lake Acidification in The United Kingdom, ENSIS, London, 1988. http://www.geog.ucl.ac.uk/~spatrick/f_r_pubs .htm.
13. Belluck DA, Benjamin SL, Baveye P, Sampson J, Johnson B. Widespread arsenic contamination of soils in residential areas and public spaces: an emerging regulatory or medical crisis? International Journal of Toxicology. 2003;22:109-128.
14. Bradl HB. Adsorption of metal ions on soils and soils constituents. Journal of Colloid and Interface Science. 2004;277:1-18.
15. Cojocaru V, Pantelica A, Pincovschi E, Georgescu II. EDXRF versus INAA in Pollution Control of Soil, J. Radioanal. Nucl. Chemistry. 2006;268(1):71.
16. Constantinou G. Ancient copper mining in cyprus and its effect on the environment, Geologial Survey of Cyprus, Nicosia, 1994.
17. Clarkson DT, Luttge U. Mineral nutrition: divalent cations, transport and compartmentation. Progress in Botany. 1989;51:93-112.
18. Day PR. Particle fractionation and particle-size analysis. Chap. 43 in Methods of Soil Analysis, Part 1. C.A. Black, ed. American Society of Agronomy, Madison, 1965, 545-567.
19. Dudka S, Ponce-Hernandez R, Hutchinson TC. Current level of total element concentrations in the surface layer of Sudbury' s soils, Sci, Total Environ. 1995;162:161-171.

20. Khalifa H, Ahmed AA, Abusaediyah A, Yousuf A, Grimida S. Gas chromatography-mass spectrometry (gc-ms) in organic geochemical investigation of crude oils from kikinda and velebit fields in serbia. International Journal of Research–Granthaalayah. 2017;5(6).
21. Ramos L, Hernandez LM, Gonzalez MJ. J Environ. Qual. 1994;23(1):50–57.
22. Lamma OA. Groundwater Problems Caused By Irrigation with Sewage Effluent. International Journal for Research in Applied Sciences and Biotechnology. 2021;8(3):64-70.
23. Yi L, Hong Y, Wang D, Zhu Y. Geochem. J. 2007;41(4):235–240.
24. Miftah NS, Ibrahimi HK. Microbiological Status of Foods Served in Food Vending Centers in the Cagayan State University, 2007.
25. Lamma O, Swamy AVVS. E-waste, and its future challenges in India. Int J Multidiscip Adv Res Trends. 2015;2(I):12-24.
26. Land and Housing. Greater Gaborone Structure Plan (1994-2014), Ministry of Local Goverment, Gaborone City Council, Botswana, 1993.
27. Lamma OA, Swamy AVVS. Assessment of Ground Water Quality at Selected Industrial Areas of Guntur, AP, India. Int. J. Pure App. Biosci. 2018;6(1):452-460.
28. Lenntech Water Treatment and Air Purification. Water Treatment, Published by Lenntech, Rotterdamseweg, Netherlands (www.excelwater.com/thp/ filters/Water-Purification.htm), 2004.
29. Hutton M, Symon C. The Quantities of Cadmium, Lead, Mercury and Arsenic Entering the U.K. Environment from Human Activities. Sci. Total Environ. 1986;57:129-150.
30. Bedassa M. Effect of heavy metal contamination on soil physicochemical propertiesin selected areas of central rift valley of eastern shoa zone, Oromia region, Ethiopia. Int. J Hortic Food Sci. 2020;2(2):40-47. DOI: 10.33545/26631067.2020.v2.i2a.51
31. Lamma OA, Moftah MA. Effect of vermicompost on antioxidant levels in Andrographis paniculata. International Journal of Applied and Pure Science and Agriculture. 2016;2(3):1-6.
32. Bedassa M. Effect of heavy metal contamination on soil physicochemical properties in selected areas of central rift valley of eastern Shoa zone, Oromia region, Ethiopia. Int J Hortic Food Sci. 2020;2(2):40-47.
33. Lamma OA, Mohammed AM, Aljazwei HAA. Studying altitude influence on Uludağ fir soil macro nutrients in Kastamonu, Turkey, 2016.
34. Lamma OA. Waste disposal and landfill: Potential hazards and their impact on groundwater, 2016.
35. Lamma OA. Discussing the waste management expectations of the future, 2016.
36. Lamma OA, Swamy AVVS, Subhashini V. Ground Water Quality in The Vicinity Of Industrial Locations In Guntur, Ap, India.
37. Lamma DOA. Study on groundwater analysis for drinking purpose in Mangalagiri Mandal regions, Andhra Pradesh, India. International Journal of Appl ied Research. 2020;6(1):148-153.
38. Mohammed AM, Lamma OA. Studying altitude influence on Uludağ fir, scots pine and black pine growth and soil properties in Kastamonu, 2020.
39. Mohammad MJ, Krishna PV, Lamma OA, Khan S. Analysis of water quality using Limnological studies of Wyra reservoir, Khammam district, Telangana, India. Int. J. Curr. Microbiol. App. Sci. 2015;4(2):880-895.
40. Mohammed AM, Lamma OA. Studying altitude influence on Uludağ fir, scots pine and black pine growth and soil properties in Kastamonu, 2015.
41. Outhman AM, Lamma OA. Investigate the contamination of tissue paper with heavy metals in the local market. IJCS. 2020;8(1):1264-1268.
42. Mohammed AM, Lamma OA. Studying altitude influence on Uludağ fir, scots pine and black pine growth and soil properties in Kastamonu, 2020.
43. Lamma OA, Mohammed AM, Aljazwei HAA. Studying altitude influence on Uludağ fir soil macro nutrients in Kastamonu, Turkey.
44. Patterson MM, Cohen E, Prommer H, Thomas DG, Rhodes S, McKinley AI. Origin of mixed brominated ethane groundwater plume: contaminant degradation pathways and reactions. Environmental Science & Technology. 2007;41:1352-138.
45. Ministero Dele Risorse Agricole, Alimentari e Forestali, Metodi ufficiali di analisi chimica Del Suolo, Ministero Dele Risorse Agricole, Roma, 1994, 276.
46. Mirsal İA. Soil Pollution Origin, Monitoring & Remediation (Second Edition). Springer-Verlag, Berlin Heidelberg, 2008.
47. Lamma OA, Swamy AVVS, Subhashini V. Ground Water Quality in The Vicinity Of Industrial Locations In Guntur, Ap, India.
48. Lamma OA. Waste disposal and landfill: Potential hazards and their impact on groundwater.
49. Nriagu JO. A global Assessment of Natural Sources of Atmospheric Trace Metals, Nature. 1989;338:47-49.
50. Lamma OA, Krair SSA. to study the relation between the environmental law and climate change.
51. Nriagu JO, Pacyna J. Quantitative Assessment of Worldwide Contamination of Air, Water and Soil by Trace Metals, Nature. 1988;333:134-139.
52. Ogoyi O, Mwita CJ, Nguu EK, Shiundu PM. "Determination of Heavy Metal Content in Water, " Sediment and Microalgae from Lake Victoria, East Africa", The Open Environmental Engineering Journal, 2011;4:1.
53. Pantelica A, Cercasov V, Steinnes E, Bode P, Wolterbeek B. Investigation by INAA, XRF, ICPMS and PIXE of Air Pollution Levels at Galati (Siderurgical Site), Book of abstracts, 4th Nat.Conf. of Applied Physics (NCAP4). Galati University Press, Galati, Romania, 2008.
54. USEPA. Technology Transfer Network Air toxics Web Site, Cadmium Compounds, 2000. http://www.epa.gov/ttn/atw/hlthef/cadmium.html (accessed in May, 2010).
55. Singh RP, Singh P, Araujo AS, Ibrahim MH, Sulaiman, O. Management of urban solid waste: Vermicomposting a sustainable option. Resources, conservation and recycling. 2011;55(7):719-729.
56. Vries W de, Romkens PF, Schutze P. Critical soil concentrations of cadmium, lead, and mercuryin view of health effects on humans and animals. Reviews of Environmental Contamination and Toxicology. 2007;191:91.

57. Wilckle W, Mathor S. Urban soil contamination in Bangkok: heavy metal and aluminium partitioning in topsoils, Geoderma. 1998;86:211-228.
58. Yahşi S, Arıkan S, Kaftanoğlu B. "Contemporary One of the Solid Wastes of Cities On Collecting and Evaluating by Method ", Environment'87 Symposium, İzmir, 1987, October 26-28.
59. Yükselen MA. Characterization of heavy metal contaminated soils in Northern Cyprus, Environmental Geology. 2002;42:597-603.
60. Zhai M, Kampuzcu HAB, Modisi MP, Totolo O. Distribution of heavy metals in Gaborone urban soils (Botswana) and its relationship to soil pollution and bedrock composition, Environmental Geology. 2003;45:171-180.
61. Lamma OA, Swamy AVVS. Assessment of Ground Water Quality at Selected Industrial Areas of Guntur, AP, India. Int. J. Pure App. Biosci. 2018;6(1):452-460.