The environmental aftermath resulted from chemical bombardment of Halabja Territory for the period 1988-2014

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Abstract— Halabja a small Iraqi city exposed to chemical weapons near the ending of Iraq-Iran war in 1988. This incident caused many death cases as well as injuries for the survivors. Most of the victims were civilians and many of them still suffering after 26 years. In the recent paper questionnaire forms distributed in Halabja territory. The sample volume was 100 forms distributed on four areas of the territory. The study showed that Kani-Vocla gave the highest number of martyrs. The destroyed houses reached 1748 house distributed over the territory. A group of diseases like ocular symptoms, hard breathing, and the body and skin malformation still hurt the survivors. The random immigration increased due to the bombardment that reached 75% of Halabja citizens. The shelling destroyed most of the water and ground environment.

Index Terms— Halabja, shelling, chemical weapons, injuries, environmental aftermath

1 INTRODUCTION

In the southeastern of Sulymania about 80 km, Halabja city located in the northeast region of Iraq, within 35°10'59.22"N latitude and 45°58'59.05"E longitude. It covers an area of about 1260 km² (Fig 1). From topographical point view, it lies in the southeastern Sharazur plain; boarded by the Hawraman Mountain to the north and by Balambo Mountain in the south and the Darbandikhan dam [1, 2].

Halabja and the surrounding regions were attacked with chemical weapons dropped by Iraqi planes during March 16, 1988, in the final stage of the Iran-Iraq war. Till now the used agents are obscure but it is believed that it included Tabun, Sarin, VX, and mustard gas agents. Some researchers suggested that among these chemical weapons cyanide must be included [3, 4]. As an immediate result of this attack at least 5,000 people died and there are estimations that about 7,000 people injured and suffered long-term illness [5].

Till today, no one has confirmed precisely how many people killed in this weapons attack; their gender, ages or death reasons. Also, there is no information about the number of people suffer from long-term effects of the weapons. There is no data about the impact of this attack on the population structure. Many Researches conducted on Iranian victims during the Iraq-Iran war demonstrated the sufferance of defects as congenital malformations in new borne babies due to hormones changes resulted from the exposure of pregnant women to the chemical bombardment [6, 7, 8, and 9]. Many effects on skin, eye and airway (interface tissues) are attached to the dose and period of exposure. The eyes injuries have exhibited a shorter latent period than the skin despite that eye injuries are the most common and it's heal is nearly impossible [10 & 11].

Hama [12] carried out an investigation about the main health conditions of the survivors in Halabja. The study conducted in 2000 between March and October on forty survivors. These victims exposed to the chemical agents during the event. The clinical observations and medical reports clarified that all the studied cases suffered from various health complains. This complains involved respiratory pains about (75%) [13], ophthalmological torment (57.5%) [14], and dermatological excruciations (50%) [15]. Many of these victims suffered from an interaction of the all three above mentioned complain in the same time.

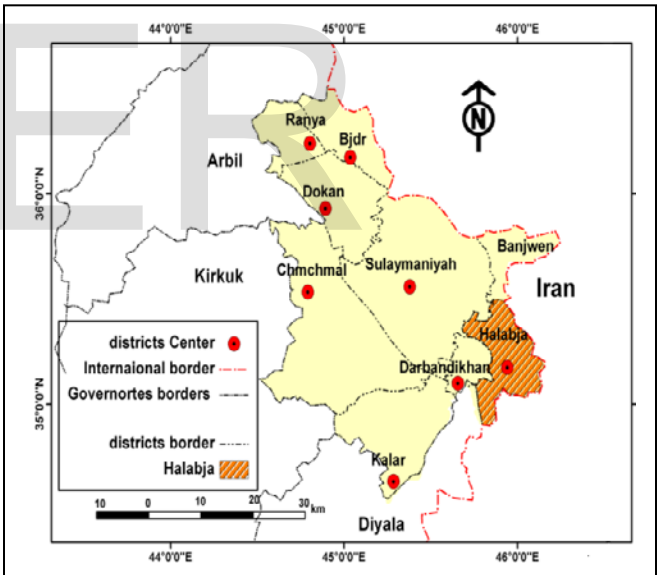

Fig. 1. Geographic location of Kurdustan Iraq governates

From another direction, Al-doski studied the vegetation change in Halabja city employing Landsat-5 Thematic Mapper images. His results showed a drastic decrease in the dense of vegetation by about 55%. In the other hand, the non-vegetation class increased by about 5%. The study conclusion clarified that the field and planted areas were at risk of losing vegetation [16].

Many valuable studies conducted on the chemical weapons victims suffered from late pulmonary in the Iranian sector [17, 18, 19, 20, 21], no study conducted to evaluate the chemical agents' long-term impacts on civilians in the Iraqi side. This study aims to present the chemical weapons impacts on victims of Iraqi Halabja region.

1.1 Studied Area and Data Description

Halabja territory located in the northeast Iraq about 83 km southeast Sulimania city and about 16 km far from the Iraqi-Iranian border. Halabja area reaches 1592 km2 that is about 9.7% from the governorate of Sulaimania. Fig.1 represents Halabja location.

1.2 Description of study area

Halabja region surrounded by Shinroy and Makar mountains from the east side, Horman Mountain from North, Balambo Mountains from south and southeast, and Shaherzor Plain from West. Syrwan River that originates in Iran and flow through Syrwan plain to empty in Drebendkhan. This area characterized by its richness as it has archeological location, 12 summer resort, and touristic locations like Khormal and Kabih castles

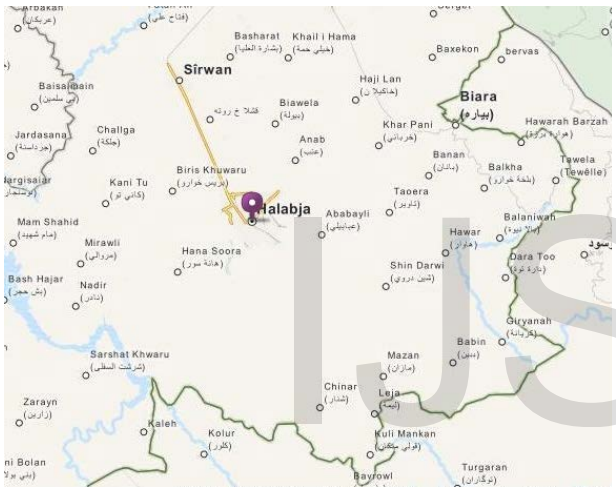

Fig. 2. Halabja territory and the affiliated areas

2. METHODOLOGY

The spatially borders of the study: The study limited to Halabja region one of the Solimania governorate territories.

The transient borders of the study: The study limited in the period from 1988 to 2014. In the last year 2014 the field study conducted by distributing the questionnaire forms in Halabja territory. The sample volume determined by using the equation [23]:

$$n = \frac{(1.96)^2}{(0.05)^2 + \frac{1}{101042}(1.96)^2}$$

Where

n= the required sample volume

T= tabular T value that opposites the allowed error.

N= the number of the social statistical units.

$$n = \frac{(1.96)^2}{(0.05)^2 + \frac{1}{101042}(1.96)^2}$$

$$= \frac{38416}{0.0025 + \frac{1}{101042} \times 38416} =$$

$$\frac{38416}{0.382} = 100.5$$

Then the number 100 represents the questionnaire forms that distributed trough Halabja territory. The territory divided into four parts and the number of the forms distributed in each part depended on the equation:

$$\text{The distributed forms No.} = \frac{\text{the area inhabitants}}{\text{total inhabitants number}} \times 100 \text{ form}$$

Table 1 represents the studied various areas and distributed forms number

TABLE 1
THE VARIOUS STUDIED AREAS AND DISTRIBUTED FORMS NUMBER

Location	Location No.	Inhibitors No.	The distributed forms No.
Yad-Carry	401		
Balambo	402		
Mordeen	404	20500	20 forms
Hassan-Awa	408		
Dorazy-Shar	406		
Sah Ra	301		
Colan	302		
Yamook	303	31150	31 forms
Kani Aashikan	304		
Caz ao	305		
Mamostian	202		
Shinrwi	203	17042	17 forms
Shaheedan	204		
Dabat	210		
Merza Botu	101		
Kani Vocla	102		
Vermayzan	103	32350	32 forms
Sharwany (1)	104		
Sharwany (2)	201		

3 DATA ANALYSIS AND RESULTS

The chemical weapons are considered as a mass destruction weapons as it affects all humans' body parts as well as the surrounding environment. The mustard gas used on Halabja territory on of these internationally prohibited by many international agreements as Geneva agreements in 1925 and 1949. These agreements drafted to protect civilian at war times. Halabja was a victim of this gas where the climate played a significant role in increasing the victims' numbers. As the cold weather increases this gas impacts as well as it helps in its di-

chotomy. The death cases in cold weathers reach about 1 to 16 (victim/hour) in cold weathers while it reaches 1 to 4 (victim/hour) in hot weathers. The resulted environmental effects of the calamity included the followings:

1- Death due shelling: Halabja population reached 91937 people in 1977 and increased to 115540 in 1987. Halabja populations degraded highly after the chemical shelling to about 42000 people. These numbers indicate the large death and emigration of Halabja people to outside the region. In 2003 statistics, Halabja people numbers reached 75086 people and continued its increments to reach to 101042 depending on 2014 estimations. Table 2 and Fig. 3 show the martyrs numbers in Halabja territory.

TABLE 2
THE MARTYRS' NUMBERS IN HALABJA TERRITORY DISTRIBUTED BY REGIONS

No.	Region name	Martyrs' numbers
1	Merza Botu	387
2	Kani Vocla	427
3	Vermayzan	67
4	Sharwany (1)	230
5	Sharwany (2)	135
6	Balambo	310
7	Yad-Carry	75
8	Mordeen	285
9	Dorazy-Shar	273
10	Hassan-Awa	72
11	Mamostian	61
12	Shaheedan	287
13	Kani Aashikan	108

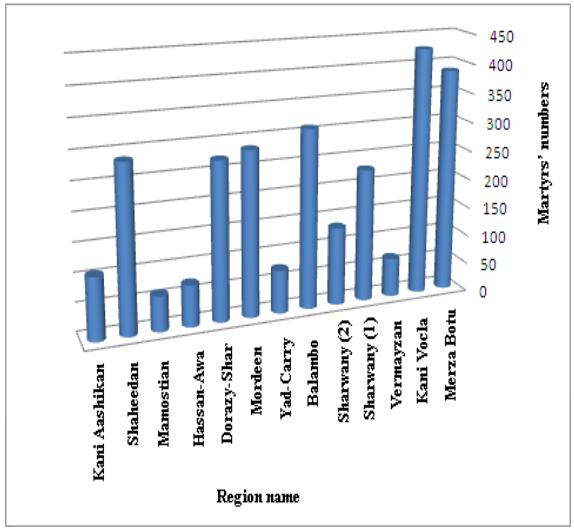

Fig. 3. The martyrs' numbers in Halabja territory

2- Demolition of homes: The resident homes exposed to demolition due shelling. Table 3 and Fig. 4 demonstrate the regions names and the demolition homes' numbers. Dorazy-Shar ranked the higher number of destroyed homes with 487 homes, followed by Balambo with 225 house and Mordeen with 269 houses. The lowest number of destroyed housed was in Hassan-Awa with 9 homes.

3- Having Diseases: The questionnaire results indicated that some diseases accompanied Halabja residents due to the selling. Some of the shillings effects remained till the study time. Hard breathing recorded the higher number of injuries inside the families' persons for the studied samples. The hard breathing injuries were 98 at 1988 while at 2014 reached 15 people. The eyes injuries have the higher degree compared with other injuries numbers for 2014. All the questionnaire families confirmed that the cause of the injuries was the shelling at 1988. Table 4 and Fig. 5 clarify the injuries accompanied the shilling of Halabja region from 1988 to 2014.

TABLE 3
DESTROYED HOUSES IN HALABJA TERRITORY

No.	Region name	Destroyed houses numbers
1	Merza Botu	165
2	Kani Vocla	85
3	Vermayzan	22
4	Sharwany 1&2	167
5	Yad-Carry	19
6	Balambo	225
7	Mordeen	269
8	Dorazy-Shar	487
9	Hassan-Awa	9
10	Mamostian	25
11	Shaheedan	67
12	Kani Aashikan	208

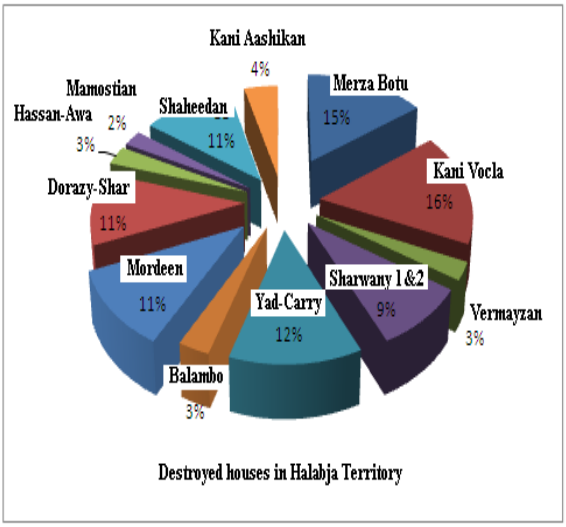

Fig. 4. Destroyed houses in Halabja Territory

TABLE 4
DISEASE GROUP ACCOMPANIED THE SHILLING OF HALABJA REGIONS BETWEEN 1988 AND 2014

No.	Injuries group	Injuries at 1988	Injuries at 2014
1	respiratory pains	98	15
2	Cancer	30	15
3	Sterility	97	25
4	Body malformation	79	60
5	Skin diseases	96	67
6	Eye diseases	99	75
7	diabetes	60	53
8	Thrombus	45	67
9	Blood high pressure	55	47

4- Immigration: Due to the chemical shilling many citizens from Halabja immigrated away from their lands. The immigration to aboard Iraq reached 75% of the immigrants. The other immigrants divided into two sections, the little immigrated to the borders areas. The large portion immigrated outside the Halabja territory. The immigration motives were the chemical shelling and business opportunities search. Table 5 reveals these results.

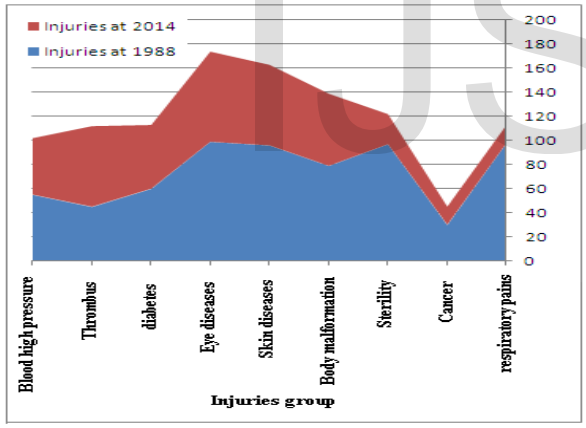

Fig. 5. Disease group accompanied the shilling of Halabja regions between 1988 and 2014

TABLE 5
IMMIGRANTS' NUMBERS AND IMMIGRATIONS REASONS

Immigration directions	Numbers	Percentages
Outside territory	20	%20
Borders areas	5	%5
Outside Iraq	75	%75
Immigration reasons	Numbers	Percentages
Chemical shilling	80	%80
Business search	18	%18
Possessions loss	2	%2

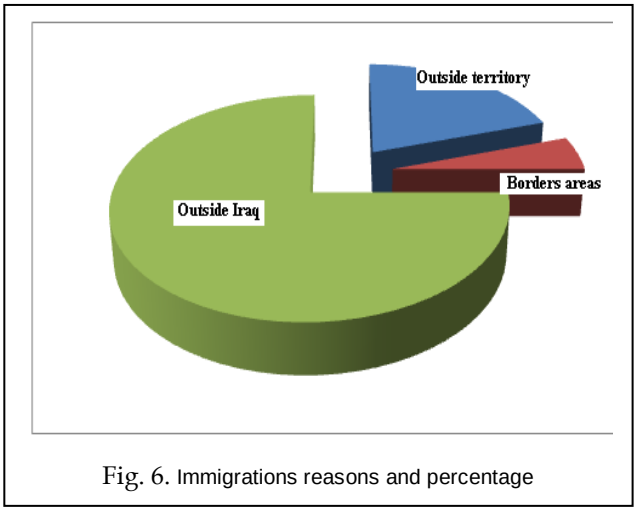

Fig. 6. Immigrations reasons and percentage

5- Environmental pollution: There are many environmental pollution problems related to the chemical shilling declared by the distributed questionnaire forms. Most of the environmental pollution comes from soil and water pollution. The majority of the sample individuals pointed out these two problems. The largest part of the questionnaires reveals that the government negligence played a significant role in increasing these issues. The others demonstrated that the lack of enlightenment from citizen caused a part of these problems especially because most of the citizens are villages. Table 6 and illustrates these results. Halabja territory faced a degradation and reduction in the botanical cover besides the pollution of the water environment with chemicals due to shilling. Also, the distillation stations and electrical power generators broke down and destroyed. All these factors affect in a way or another on Halabja territory given a negative results that their impact and figure still present till today.

TABLE 6
POLLUTION CAUSES IN HALABJA TERRITORY.

Reasons	Percentage	Pollution problems	Percentage
Lack of environmental enlightening	%40	Water pollution	%35
The government negligence	%60	Ground pollution	%55
		Others	%10

4 CONCLUSION

The results confirm that the victims of Halabja, who exposed to chemical weapons, suffer after 26 years of the health and environmental effects of the shelling. There were a large number of martyrs, where Kani-Vocla gave the highest number. The destroyed houses were 1748 house distributed all over the territory. Until today, there are people in the contaminated area who suffer from a group of diseases like ocular symptoms, hard breathing, and the body and skin malformation.

The random immigration increased due to shelling; where the immigrants' percentage from the total number of Halabja citizens reached 75%. The shelling destroyed most of the water and ground environment. The idea id environmental pollution of the territory prevents the investments in Halabja territory.

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