Research Article

Studying the Relationship Between the Hydrogen Sulfide Gas Impact and Some Health Effects in Workers of Oil and Gas Facilities in Syria and the People Residing in their Neighborhood

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ABSTRACT

The workers at oil and gas facilities are exposed to danger of the poisonous hydrogen sulfide gas in addition to some people residing in the neighborhood of such facilities. The aim of this study therefore is to make several enzymes biological laboratory analyses for a number of workers at the oil and gas facilities and persons residing in the neighborhood of such facilities who believe they are exposed to the hydrogen sulfide gas in order to evaluate how those persons are affected by this gas. This study indicates there are harmful effects that have appeared in some workers of the oil and gas facilities and the non-workers who reside in the neighborhood of those facilities.

Keywords: Facilities, Hydrogen sulfide, Laboratory analyses.

INTRODUCTION

Hydrogen sulphide (H2S) is a colorless and poisonous flammable gas with a strong smell of rotten eggs, it is also known as sewer gas and stink damp, it can be detected by smell at concentrations ranging from 0.01-0.3 parts per million (ppm). However, relying solely on its odor is not a good idea because at concentrations above 100 ppm it deadens a person's sense of smell within a few minutes. The pure gas is heavier than air and can collect in low areas Hydrogen sulphide (H2S) occurs naturally in the earth in crude petroleum, natural gas reservoirs, volcanic gases and hot springs. Hydrogen sulphide is also produced from the breakdown of human and animal wastes by bacteria, industrial activities such workers are exposed to hydrogen sulphide most often during drilling and production of natural gas, crude oil and petroleum products.[1] Hydrogen sulphide is extremely toxic. Workers are exposed when they inhale hydrogen sulphide in air, and this toxic gas is quickly absorbed by the lungs. It is believed that exposure to hydrogen sulphide prevents the brain from using oxygen by inhibiting the enzyme cytochrome oxidase. Respiratory symptoms and with eye irritation was associated with wheezing, breathing difficulty, burning eyes, and nasal irritation, endotoxin was associated with increased sore throat, chest tightness, and nausea.[2] Increased anxiety and compromised verbal learning performance.[3] Impaired neurobehavioral function, disturbed moods and increased frequencies of irritation, indigestion, respiration, moods, sleep, balance, memory and limbic system symptoms.[4] Symptoms such as headaches, runny nose, cough, and vomiting.[5] Hydrogen sulfide caused DNA damage to nuclei.[6] This genotoxicity is suggested to be associated with free radicals.[7] H2S activated a stress response and proinflammatory genes in lung and liver tissues of mice exposed to hydrogen sulfide (~5 ppm) containing atmosphere of sulfur baths for 8 hours.[8] In Stein study[9] found that breathing 80 ppm hydrogen sulfide in 10.5% O2 for 6 hours induced hypometabolism in rats. Although this hydrogen sulfide-mediated hypometabolic state could have potential therapeutic applications, under these conditions the hydrogen sulfide caused tissue injury to the lung and heart. Hydrogen sulfide poisoning also caused discoloration of the skin.[10] The exposure limit is 1 ppm (TWA) and 5 ppm (STEL) (ACGIH) [11], and 1.2 ppm for 24 hours and 0.85 ppm for 30 day (NHSRC).[12]

MATERIALS AND METHODS

Hydrogen sulfide gas concentration in the air meters

Two devices to measure the gas concentration in the air have been used, the first CROWCON of CROWCON Company and the other BW of HONEY WELL Company, both are small portable devices measuring the hydrogen sulfide gas concentration in the air through an electrochemical sensor; the first device's measure range is 0-100 PPM of 1 PPM sensitivity and the other is 0-1000 PPM of 0.1 PPM sensitivity, these devices give us H2S concentration directly from the air in 15 second.

The equipment used for measuring the biochemical variables

Spectrophotometer of BIOCOTEK Company to measure the activity of the studied enzymes was used.

Sampling from the air

The hydrogen sulfide gas concentration in the air was measured in several sites of the oil and gas production facilities and wells in Syria and some inhabited areas near them; such sites were located in the northeastern, eastern and central areas as number of the sampling sites has reached 65.

Sampling from oil and gas facilities workers and the non-workers residing in their neighborhood

A group of oil and gas facilities workers and non-workers residing in the neighborhood of such facilities who believe they were exposed to the hydrogen sulfide gas aged 19 – 56 years excluding smokers, alcoholics and patients of chronic and genetic diseases have been selected for making some enzyme biological analyses including liver enzymes: alanine aminotransferase ALT(SGPT),aspartate aminotransferase AST(SGOT),gamma glutamyl transferase (GGT),alkaline phosphatase (ALP), and comparing them with the analyses of a group of healthy people unexposed to the hydrogen sulfide gas.

Table 1: Shows the sampling group

Group	Persons number	Region (in Syria)	Nature of Group	Exposure to H2S	The average exposure to H2S during the year (PPM)
1	14	Northeastern	Worker in gas facility	8 hrs/5day a week	8.6
2	14	Eastern	Worker in gas facility	8 hrs/5day a week	16.3
3	12	Northeastern	Non-worker live near gas facility	Chronic More 90 times/year	6.1
4	15	Northeastern	Non-worker	No exposure	-

Table 2: The measuring of hydrogen sulfide gas concentrations in some oil facilities and some inhabited areas near them in Syria

Site	Measure (ppm)	Region	Nature of site	Site	Measure (ppm)	Region	Nature of site
1	138,6	Northeast	Facility	**15**	16	East	Residential
2	11,6	Northeast	Residential	**16**	2	East	Residential
3	3,8	Northeast	Residential	**17**	20	East	Well
4	0,8	Northeast	Residential	**18**	3	East	Facility
5	1,3	Northeast	Residential	**19**	6	East	Facility
6	0.7	Northeast	Residential	**20**	2	East	Agricultural
7	46,6	Northeast	Facility	**21**	2	East	Well
8	12,2	Northeast	Well	**22**	4	East	Facility
9	2,8	Northeast	Residential	**23**	22	East	Facility
10	0,6	Northeast	Residential	**24**	4	East	Residential
11	8	Northeast	Well	**25**	7	East	Agricultural
12	13	Northeast	Well	**26**	4	East	Well
13	69	Northeast	Facility	**27**	23	Intermediate	Facility
14	2	Northeast	Residential	**28**	102	Intermediate	Facility

Statistics

(SPSS computer program) T-Student test were conducted for statistical comparisons.

RESULTS

Hydrogen sulfide gas concentration in the air meters

It has been indicated the presence of Hydrogen sulfide gas concentrations in the air at 28 sites whether in some oil and gas production facilities in Syria or some inhabited areas in their neighborhood which in some cases exceeded the allowed limits of exposure, while no presence of the gas concentrations in the rest of the areas has been recorded on the devices.

Results of the laboratory analyses for some enzymes

It has as well been indicated the presence of considerable impacts as a result of exposure to that gas on certain enzyme analyses in workers of oil and gas facilities and non-workers who are exposed to hydrogen sulfide gas.

Comparing between analysis results people of group (1) and group (4) ((Comparing group))

AST: sig (2-tailed) =0.01

ALT: sig (2-tailed) =0.006

Statistically important statistical difference at 0.05 and 0.01 level of indication.

Comparing between analysis results people of group (2) and group (4) ((Comparing group)):

AST: sig (2-tailed) =0.001

ALT: sig (2-tailed) =0.008

Statistically important statistical difference at 0.05 and 0.01 level of indication.

Comparing between analysis results people of group (3) and group (4) ((Comparing group))

AST: sig (2-tailed) =0.01

Statistically important statistical difference at 0.05 and 0.01 level of indication.

Table 3: Results of the laboratory analyses for some enzymes in the northeastern area's workers

Sampling	ALT	AST	GGT	ALP
The reference values	4-36U/L	8-33U/L	5-40U/L	290U/L
1	22	16	17	180
2	26	22	30	193
3	11	16	20	156
4	25	18	26	171
5	59	38	36	209
6	29	24	20	180
7	45	30	35	233
8	22	19	20	201
9	37	34	18	301
10	20	12	14	146
11	11	16	20	155
12	24	15	12	180
13	30	15	26	167
14	22	18	26	210

There was a statistical difference between the exposed workers and unexposed persons for AST and ALT analysis; a statistically important statistical difference at 0.05 level of indication.

Results of the laboratory analyses for some enzymes in the eastern area's workers

Table 4: Results of the laboratory analyses for some enzymes in the eastern area's workers

Sampling	ALT	AST	GGT	ALP
The reference values	4-36U/L	8-33U/L	5-40U/L	290U/L
1	15	11	18	156
2	58	37	42	37
3	40	28	16	126
4	18	19	32	180
5	9	9	15	109
6	40	35	26	188
7	38	23	32	188
8	22	18	20	156
9	20	15	18	174
10	19	13	20	138
11	22	18	22	166
12	16	11	18	222
13	29	27	25	175
14	51	47	41	156

There was a statistical difference between the exposed workers and unexposed persons for AST and ALT analysis; a statistically important statistical difference at 0.05 and 0.01 level of indication.

Results of the laboratory analyses for some enzymes in the northeastern area's non-workers

Table 5: Results of the laboratory analyses for some enzymes in the northeastern area's non-workers

Sampling	ALT	AST	GGT	ALP
The reference values	4-36U/L	8-33U/L	5-40U/L	290U/L
1	22	16	17	180
2	26	22	30	193
3	39	48	22	299
4	20	13	15	190
5	33	20	29	172
6	30	38	30	144
7	20	20	25	195
8	29	22	21	174
9	11	16	20	156
10	25	18	26	171
11	37	50	37	209
12	29	24	20	180

There was a statistical difference between the exposed and unexposed persons for AST analysis; a statistically important statistical difference at 0.05 level of indication.

DISCUSSION

The study has showed the presence of hydrogen sulfide gas concentrations in the air at some oil and gas production facilities in Syria or some inhabited nearby areas, some of which exceeded the allowed limit of exposure to this gas according to (ACGIH) American Conference of Governmental Industrial Hygienists and (NHSRC) National Homeland Security Research Center.

It has as well been indicated the presence of considerable impacts as a result of exposure to that gas on certain enzyme analyses in workers of oil and gas facilities and non-workers who are exposed to H2S gas, there was a statistical difference between the exposed and unexposed workers and persons; a statistically important statistical difference at 0.05 and 0.01 level of indication, for enzymes AST and ALT and this results compatible with the study of (HOOSER 2000)[13] and (Van Aalast 2000).[14]

It then could be said that hydrogen sulfide gas has an obvious effect on some values of the enzyme biological features in the persons who are exposed to this gas; as this gas also causes several harmful health impacts due to exposure.

CONCLUSION

Some oil facilities pollute the air with hydrogen sulfide gas in these faculties, exposing thus their workers and non-workers who reside in their neighborhood to the danger of such gas and its negative impacts on health.

The hydrogen sulfide changes certain values of the enzyme biological features in the people who are exposed to this gas; and this gas causes harmful impacts on the health of the persons who are exposed to this gas.

It is recommended to take measures and procedures for reducing the hydrogen sulfide gas emission from the oil and gas facilities with the aim to avoid its negative effects on environment and humans.

Studying a number of the impacts suffered by some oil facilities Workers and non-workers residing in their neighborhood who believe they were exposed to inhaling of the hydrogen sulfide gas

Table 6: Some health symptoms resulting from exposure to hydrogen sulfide gas

Story	Age and Sex	Source of Emissions	Exposure time	Symptoms
Story 1	Male 51	Oil and gas facility	Ongoing occupational	headache, fading of consciousness,nasal irritation, balance and memory impairment, nosebleeds, nerve inflammation.
Story 2	Male 35	Oil and gas facility	Ongoing occupational	shortness of breath,Oblurred vision, memory impairment lack of energy,and strength, occasional diarrhea, loss of libido, abnor mal heart rhythm,and anxiety-like attacks .
Story 3	Female 54	Sour natural gas wells	Ongoing residential	severe sinus headaches, blistering of the skin when showering, severe burns on the bottoms of her feet, fatigue, vomiting.
Story 4	Male 43	Sour natural gas wells	Ongoing residential	chronic sore throat, coughing, headaches, congestion , insomnia, occasional nosebleeds, and lack of energy, burning eyes. heart palpitations.
Story 5	Male 38	Oil and gas facility	Ongoing residential	bloody nose burning eyes, throat itching, and itching all over, severe headaches, severe rashes.
Story 6	female 44	Sour natural gas wells	Ongoing residential	headaches, hypersensitivity of the skin, concentrations proble ms, eye irritation, problems sleeping,general pain, low muscle strength, problems with memory retention, balance problems.

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