GuLF Study Biospecimen Data

whole blood/serum/packed cells
plasma
urine
saliva
toenail

BTEX, liver, kidney, cytokeratin, DNA and proteomics results all used home visit samples.
Univ. of Minn., and toenail metals results used home visit and clinical exam samples

Study Event / Subgroup

Analyte/ Biomarker	Home Visit Collection N=11,038		Biomonitoring Substudy (N=1,061)		Clinical Exam Collection (N=3,400)		Univ. of Minnesota (N=3,062)		Liver Injury (N=924)		Kidney Injury (N=924)		Toenail Metals (N=413)		Cytokeratin (CK18) (N=213)		DNA Methylation (N=1,531)		Proteomics (N=1,215)	
	Workers (N=8,853)	Non-Workers (N=2,185)	Workers (N=904)	Non-Workers (N=157)	Workers (N=2,873)	Non-Workers (N=527)	Workers (N=2,600)	Non-Workers (N=462)	Workers (N=924)	Non-Workers (N=0)	Workers (N=924)	Non-Workers (N=0)	Workers (N=413)	Non-Workers (N=0)	Workers (N=191)	Non-Workers (N=22)	Workers (N=1,531)	Non-Workers (N=0)	Workers (N=1,215)	Non-Workers (N=0)
Complete Blood Count																				
Hematocrit	3,177	333			266	53														
Hemoglobin	3,178	333			266	53														
Platelets	3,171	333			265	53														
White Blood Cells	3,177	333			266	53														
Red Blood Cells	3,178	333			266	53														
Lymphs	3,145	326			266	53														
MCH	3,176	333			266	53														
MCHC	3,176	333			266	53														
MCV	3,176	333			266	53														
Monocytes	3,144	326			266	53														
Neutrophils	3,145	326			266	53														
RDW	3,176	333			266	53														
Lipids																				
HDL					2,853	524	2,600	462												
LDL					2,853	524	2,600	462												
Total Cholesterol					2,853	524	2,600	462												
Triglycerides					2,853	524	2,600	462												
Nicotine/Cotinine																				
Nicotine			890	153																
Cotinine			890	152																
Metabolic/Other																				
Urinalysis	3,464	367			2,837	519														
Cortisol					281	53														
Hemoglobin A1C					2,845	521	2,592	461												
Albumin			345	69					923	0	924	0								
ALP									920	0										
ALT			344	69					914	0										
AST			344	69					917	0										
Bilirubin			345	69	2,837	519			922	0										
BUN			345	69					924	0										
Creatinine			345	69			2,600	462	924	0	924	0								
CystC									924	0	924	0								
GGT									923	0										
GLDH									913	0										
Urine glucose	8,824	2,180			2,837	519														
Blood glucose			345	69			2,600	462												
Total Protein			345	69							924	0								
Alkaline Phosphate			345	69																
Globulin			345	69																
Calcium			345	69																
Sodium			345	69																
Potassium			345	69																
Chloride			345	69																
Carbon Dioxide			345	69																
GSTA											924	0								
KIM1											924	0								
TFF3											924	0								
Calbindin											924	0								
Clusterin											924	0								
Osteoactivin											924	0								
VegF											924	0								
B2M											924	0								
EGF											924	0								
NGAL											924	0								
OPN											924	0								
UMOD											924	0								

As of February 6, 2026

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	Workers (N=8,853)	Non-Workers (N=2,185)	Workers (N=904)	Non-Workers (N=157)	Workers (N=2,873)	Non-Workers (N=527)	Workers (N=2,600)	Non-Workers (N=462)	Workers (N=924)	Non-Workers (N=0)	Workers (N=924)	Non-Workers (N=0)	Workers (N=413)	Non-Workers (N=0)	Workers (N=191)	Non-Workers (N=22)	Workers (N=1,531)	Non-Workers (N=0)	Workers (N=1,215)	Non-Workers (N=0)
Metabolic/Other																				
Insulin							2,600	462							191	22				
CRP							2,600	462												
Uric Acid							2,600	462												
M65															188	22				
M30															191	22				
IL6															191	22				
Leptin															191	22				
IL8															191	22				
MCP1															191	22				
TNFa															128	14				
IL1B															191	22				
Adiponectin															191	22				
Resistin															190	22				
PAI1															189	22				
Metals																				
Magnesium													413	0						
Aluminum													413	0						
Calcium													413	0						
Vanadium													413	0						
Chromium													413	0						
Manganese													413	0						
Iron													413	0						
Cobalt													413	0						
Nickel													413	0						
Copper													413	0						
Zinc													413	0						
Arsenic													413	0						
Selenium													413	0						
Molybdenum													413	0						
Cadmium													413	0						
Antimony													413	0						
Mercury													413	0						
Lead													413	0						
DNA Methylation																				
EPIC BeadChip Array (Illumina, Inc., 850K)																	1,531	0		
Global Screening Array (Illumina, Inc.)																	1,531	0		
Proteomics																				
SOMAScan 11K Assay																			1,215	0

As of February 6, 2026

GuLF Study Blood Metals/VOCs

whole blood

Availability of measured metals and VOCs in workers and non-workers in the GuLF STUDY Biomonitoring Exposure Substudy

Metal/VOC	BTEX (N=1,061)	
	Workers (N=904)	Non-Workers (N=157)
Blood Metals		
Cadmium	897	155
Lead	901	157
Mercury	901	157
Manganese	901	157
Selenium	901	157
Volatile Organic Compounds		
Benzene	869	154
Toluene	878	155
Ethylbenzene	653	108
m/p-Xylene	876	155
o-Xylene	850	151
Hexane	819	147
1,2 Dichlorobenzene	850	148
1,4 Dichlorobenzene	849	147
1,3 Dichlorobenzene	881	153
Chloroform	865	153
Styrene	845	150
Octane	787	137
1,1 Dichloroethane	870	154
1,2 Dichloroethane	868	153
1,1 Dicholoroethylene	871	146
2-5 Dimethylfuran	832	147
Heptane	810	140
cis-1,2 Dichloroethylene	874	154
1,1,2-Trichloroethane	876	154
trans 1,2 Dichloroethylene	874	153
1,1,1,2 Tetrachloroethane	880	154
Tetrachloroethylene	793	141
1,1,2,2 Tetrachloroethane	878	154
Bromoform	881	152
Bromodichloromethane	876	153
1-Bromopropane	877	154
Chlorobenzene	878	154
Chloroethane	867	151
Dibromochloromethane	876	154
Carbon Tetrachloride	871	153
Ethyl Ether	812	138
1,2 Dibromoethane	883	154

GuLF Study Blood Metals/VOCs Cont.

whole blood

Availability of measured metals and VOCs in workers and non-workers in the GuLF STUDY Biomonitoring Exposure Substudy

Metal/VOC	BTEX (N=1,061)	
	Workers (N=904)	Non-Workers (N=157)
Dibromoethane	870	152
1,2 Dichloropropane	707	120
Furan	796	136
Hexachloroethane	877	154
Isopropylbenzene	848	152
Methyl-Tert-Butyl	810	140
4-Methyl-2-Pentanone	872	155
Nitrobenzene	875	154
Trichloroethylene	834	143
1,1,1 Trichloroethane	871	154
a,a,a Trifluorotoluene	875	155
Tetrahydrofuran	754	137
1,2,3 Trichloropropane	881	154
Vinyl Bromide	872	154
Acetone	121	26
Butyl Acetate	9	4
1-Butanol	42	12
Cyclohexanone	1	1
Ethyl Acetate	119	25
Ethyl Alcohol	130	27
Isopropyl Alcohol	127	27
Methylene Chloride	1	0
Methyl Ethyl Ketone	95	22
Methyl Isobutyl Ketone	22	2
Methyl Methacrylate	1	1
Phenyl Cyclohexene	3	0
Perchloroethylene	9	4

GuLF Study Biospecimen Counts

HV Participant N=11,038	Biomonitoring Substudy (N=1,061)	CE Participant (N=3,400)	Univ. of Minnesota (N=3,062)	Liver/Kidney Injury (N=924)	Toenail Metals (N=413)	Cytokeratin (CK18) (N=213)	DNA Methylation (N=1,531)	Proteomics (N=1,215)	Workers	Non-Workers	Total
x	.	.	.	.	.	.	.	.	5,198	1,546	6,744
x	.	x	x	.	.	.	.	.	1,091	427	1,518
x	x	.	.	.	.	.	.	.	455	102	557
x	.	x	x	.	.	.	x	x	471	0	471
x	.	x	.	.	.	.	.	.	222	57	279
x	.	x	x	x	.	.	x	x	254	0	254
x	.	x	x	x	x	.	x	x	241	0	241
x	x	x	x	.	.	.	.	.	136	29	165
x	.	.	.	.	.	.	x	.	115	0	115
x	x	.	.	.	.	x	.	.	84	15	99
x	.	.	.	x	.	.	x	x	65	0	65
x	.	x	x	.	.	.	x	.	49	0	49
x	.	x	x	x	.	.	x	.	49	0	49
x	x	x	x	x	x	x	x	x	46	0	46
x	.	x	x	x	x	.	x	.	41	0	41
x	.	x	x	x	x	.	.	.	38	0	38
x	.	x	x	x	.	.	.	.	34	0	34
x	x	x	x	x	.	.	x	x	30	0	30
x	.	.	.	.	.	.	x	x	24	0	24
x	.	.	.	x	.	.	.	.	23	0	23
x	x	x	x	x	x	.	x	x	23	0	23
.	.	x	.	.	.	.	.	.	14	5	19
x	x	x	x	.	.	x	.	.	12	6	18
x	x	x	.	.	.	.	.	.	12	3	15
x	x	.	.	.	.	.	x	.	13	0	13
x	x	x	x	.	.	.	x	x	12	0	12
x	x	x	x	x	.	x	x	x	11	0	11
x	.	x	.	.	.	.	x	.	9	0	9
x	x	x	x	x	x	x	x	.	9	0	9
x	.	.	.	x	.	.	x	.	7	0	7
x	x	.	.	x	.	.	x	x	6	0	6
x	x	x	x	.	.	.	x	.	6	0	6
x	x	x	x	.	.	x	x	x	6	0	6
x	x	x	x	x	.	.	x	.	6	0	6
.	.	x	x	.	.	.	.	.	5	0	5
x	.	x	.	.	.	.	x	x	5	0	5
x	x	.	.	x	.	x	x	x	5	0	5
x	x	x	x	x	.	.	.	.	5	0	5
x	.	x	x	.	.	.	.	x	4	0	4
x	x	x	x	x	.	x	x	.	4	0	4

GuLF Study Biospecimen Counts Cont.

HV Participant N=11,038	Biomonitoring Substudy (N=1,061)	CE Participant (N=3,400)	Univ. of Minnesota (N=3,062)	Liver/Kidney Injury (N=924)	Toenail Metals (N=413)	Cytokeratin (CK18) (N=213)	DNA Methylation (N=1,531)	Proteomics (N=1,215)	Workers	Non-Workers	Total
x	x	x	x	x	x	x	.	.	4	0	4
.	x	.	.	.	.	.	.	.	2	1	3
x	.	x	.	x	.	.	x	x	3	0	3
x	x	.	.	.	.	x	x	.	3	0	3
x	x	.	.	x	.	x	x	.	3	0	3
x	x	x	x	x	x	.	x	.	3	0	3
x	.	x	.	x	x	.	x	.	2	0	2
x	.	x	.	x	x	.	x	x	2	0	2
.	.	x	x	.	.	.	x	.	1	0	1
.	.	x	x	.	.	.	x	x	1	0	1
.	.	x	x	x	x	.	x	x	1	0	1
.	x	.	.	.	.	.	x	.	1	0	1
.	x	.	.	.	.	x	.	.	0	1	1
x	.	.	.	.	.	.	.	x	1	0	1
x	.	x	.	x	.	.	.	.	1	0	1
x	.	x	.	x	.	.	x	.	1	0	1
x	.	x	x	x	.	.	.	x	1	0	1
x	.	x	x	x	x	.	.	x	1	0	1
x	x	x	.	.	.	.	x	.	1	0	1
x	x	x	.	x	.	x	x	.	1	0	1
x	x	x	x	.	.	x	x	.	1	0	1
x	x	x	x	x	.	.	.	x	1	0	1
x	x	x	x	x	.	x	.	.	1	0	1
x	x	x	x	x	x	.	.	.	1	0	1
x	x	x	x	x	x	x	.	x	1	0	1

GuLF Study Biospecimen Counts: Liver/Kidney and DNA Methylation