COMPARISON OF THE TEST METHOD SENSITIVITIES USED BY EPA AND THE LEVELS RELATED TO HEALTH RISKS FOR KEY TOXIC SUBSTANCES RELATED TO THE COLLAPSE OF WORLD TRADE CENTER

-----2/11/02 DRAFT-----

The following draft tables were compiled by Cate Jenkins, Ph.D., Environmental Scientist, Hazardous Waste Identification Division, U.S. Environmental Protection Agency, jenkins.cate@epa.gov with ad hoc assistance from other scientists. This document has not been reviewed by EPA, and any opinions or views are that of the author and do not necessarily represent those of the EPA.

The tables list the detection limits, or the sensitivities, that the EPA and other governmental bodies achieved when testing key toxic materials from the collapse of the World Trade Center (WTC). Not all of this information is available, and the actual test methods used are unknown in most instances. The EPA/other government detection limits are compared to the levels that are related to health risks. The testing sensitivities (detection limits) that are required to test to the levels related to health risks are projected.

asbestos

fiberglass and other manmade glass-like and vitreous fibers

fine particulate matter

chlorinated dibenzo-p-dioxins and furans

polychlorinated biphenyls (PCB's)

benzene

mercury

lead

chromium

No test results are acceptable which purport to claim that these substances are not present ("not detected" or "below 70 structures per square millimeter") unless the method can quantify levels at or below the lowest health risk levels. If concentrations of hazardous substances are high and can be tested with less sensitive methods, then this is acceptable.

For carcinogens, the detection limit should be at or lower than the cancer risk at the 10^{-6} ("ten to the minus six") risk level. This corresponds to those levels found by EPA to be associated with a cancer risk of 1 in a million. It is EPA policy to evaluate human exposures to carcinogens at this level as "the point of departure" for any formal decision process for remediation that might justify exposing citizens to higher cancer risks, such as the 1 in 100,000 risk level (10^{-5} risk level); or the 1 in 10,000 risk level (10^{-4} risk level).[1] At this point in time, the EPA has established no basis for justifying any higher risk level than the 1 in a million, or 10^{-6} risk level. Testing at this low level provides a greater degree of assurance that the substance is not present at levels where there would be health concerns. Furthermore, because several carcinogens are potentially present at levels of concern, it would not be sufficiently protective to test each carcinogen at the 1 in 10,000 risk level (10^{-4} risk level). This is because the carcinogenic risks of the all of the carcinogens could add up. If each is only tested 10^{-4} risk level, then the aggregate risk could be much higher than 1 in 10,000, which is always EPA's action level. For other hazardous substances, which are not carcinogens, the detection limit must be at or below the established EPA reference dose for humans (RfD), or the lowest observed effect level (LOEL) in any animal study divided by a safety factor of 10,000.

AIR, INTERIOR AND EXTERIOR

For inside air, all hazardous substances which may be associated with particulates (asbestos, fine particulates, fiberglass, metals, dioxins and furans, PCB's) must be tested using EPA's aggressive inside air testing protocols, which simulate human activities which disturb dusts. This testing protocol is paramount to simulating the actual breathing zone of a small children who may jump on a couch or roll or run around a carpet. This testing may be found in EPA's regulation for conducting the asbestos clearance test at Title 40 of the Code of Federal Regulations, Part 763, Appendix A, Unit III.B.7. This testing requires the use of a one-horsepower minimum leaf blower directed at all surfaces followed by fans to keep particulates suspended.

This type of aggressive air testing should not be carried out in currently occupied spaces, as it could serve to re-distribute contamination as well as displace small objects. However, there are many vacant apartments containing contaminated carpeting in Lower Manhattan, and plenty of contaminated upholstered furniture which could be placed in these apartments for aggressive air testing. EPA should gain access to conduct the necessary testing. For outside air, monitors should be placed close to the ground to simulate the breathing zone of a small child.

AIR, INTERIOR AND EXTERIOR **REQUIRED DETECTION LIMITS**		**HEALTH-BASED STANDARDS**		**EPA's WTC TESTING DETECTION LIMITS AND/OR OTHER TEST METHOD DETECTION LIMITS**	
UNITS FOR ASBESTOS AND FIBERGLASS IN AIR s/mL = structures per milliliter = s/cc = structures per cubic centimeter structures = asbestos fibers plus bundles of fibers s/mm^2 = structures per square millimeter, a given area of filter through which air is drawn There is no direct way to convert s/cc to s/mm^2 without knowing the volume of air sampled.			**UNITS FOR OTHER AIR SUBSTANCES** pg/m3 = picogram per cubic meter; ng/m3 = nanogram per cubic meter, ug/m3 = micrograms/m3; mg/m3 = milligrams/m3 1 ug = 1000 ng, 1 mg = 1000 ug ppm = part per million; ppb = part per billion; ppt = part per trillion, ppq = part per quadrillion 1 ppt = 1000 ppq, 1 ppb = 1000 ppt, 1 ppm = 1000 ppb		
ASBESTOS (air)					
0.000004 s/mL for the PLM fraction, also with all structures quantified	Based on health risk level. Inside buildings, test under aggressive conditions, using EPA's regulations at 40 CFR § 763 App. A, Unit III.B.7	0.000004 f/mL	10^{-6} cancer risk level, from EPA's Integrated Risk Information System (IRIS)	detection limit: < 0.0048 s/m3 = < 8.89 s/mm^2	EPA's detection limit for outside air, outside air, WTC evaluation
				detection limit: 0.02 s/mL = 70 s/mm^2	The AHERA "clearance test" level, which is not a standard, but instead a method detection limit. This test misused by EPA and NYC DOH since samples taken under passive conditions and in lieu of abatement. Level is also grossly unprotective even if samples were taken under aggressive conditions.

				detection limit: 0.00197 s/mL for less contaminated building, could be pushed much lower	Ground Zero Task Force, Independent study of apartments in Lower Manhattan, WTC evaluation[2]
				detection limit: 0.007 s/mL for direct prep 0.158 s/mL for indirect prep (detection limit can be pushed lower by this research group)	HP environmental study, highly contaminated buildings, using indirect preparation technique, WTC evaluation
				variable, as desired	EPA 1990 Superfund method for the determination of asbestos in ambient air
FIBERGLASS (air)					
Quantify at lowest levels achievable with the same sampling and analysis for asbestos. The TEM measurement for asbestos will also determine fiberglass. Inside buildings, test under aggressive conditions, using EPA's regulations at 40 CFR § 763 App. A, Unit III.B.7		No health standard based on carcinogenicity developed by EPA. International Agency for Research on Cancer classifies fiberglass as a probable human carcinogen OSHA voluntary standard of 1 f/mL not likely to be protective. ACGIH recommended TLV of 0.1 f/mL.		EPA has not tested air samples for fiberglass in WTC evaluation. OSHA, although having a voluntary standard, also apparently has not tested for fiberglass.	
FINE PARTICULATES (air)		PM 2.5 are particles less than 2.5 micrometers in diameter, PM 10 are particles less than 10 micrometers in diameter and are a combination of fine and coarse particulates			
0.01 ug/m^3 for PM 2.5 based on EPA's ability to easily detect these levels	Inside buildings, test under aggressive conditions, using EPA's regulations at 40 CFR § 763 App. A, Unit III.B.7	40 ug/m^3 for PM 2.5	EPA's 24-hour average exposure, protection of elderly and persons with heart or lung disease	detection limit: 0.01 ug/m^3 for PM 2.5	EPA's data for outside air, WTC evaluation
CHLORINATED DIOXINS AND FURANS (air)					
0.0000231 ng/m3 for 2,3,7,8-tetrachlorodibenzodioxin, with applicable detection limits for other congeners using the same method with complete congener information	10^{-6} risk level for 70 year lifetime exposure, using EPA Region 2 logic. Inside buildings, test air for dioxins under aggressive conditions, using EPA's regulations at 40 CFR § 763 App. A, Unit III.B.7	0.0000231 ng/m3 = 0.0231 pg/m3	10^{-6} risk level for 70 year lifetime exposure, using EPA Region 2 logic, for cancer risk only.	detection limit: lower than 0.0054 ng/m3 = 5.4 pg/m3 [detection limit]	EPA Region 2 claimed that air did not exceed this 10^{-4} risk level for 30 years in the special EPA ORD dioxin tests done at the end of October, early November. Thus, their detection limit was at least this good. WTC evaluation
		0.00162 ng/m3 = 1.62 pg/m3	10^{-6} risk level for 1 year, using EPA Region 2 logic	detection limit: 0.0021 - 0.067 ng/m3	EPA tests on 9/23/01, WTC evaluation
		0.162 ng/m3	10^{-4} risk level for 1 year exposure, derived by EPA Region 2 without EPA ORD approval, for evaluating WTC air. 12/05/01 WTC daily summary said air exceeded this amount	detection limit: 1 - 5 pg/m3	EPA method, high resolution, 325 m3 of air per sample

		0.0054 ng/m3 = 5.4 pg/m3	10^{-4} risk level for 30 year exposure, EPA Region 2 unapproved number	detection limit: 0.01 - 0.05 pg/m3	EI high resolution method
POLYCHLORINATED BIPHENYLS (PCB'S) (air)					
0.01 ug/m3 may be revised with complete congener information	EPA 10^{-6} risk level Inside buildings, test under aggressive conditions, using EPA's regulations at 40 CFR § 763 App. A, Unit III.B.7	0.01 ug/m3 = 0.00001 mg/m3 = 10 ng/m3	10^{-6} cancer risk level, EPA IRIS database	detection limit: 1.06 - 3.34 ng/m3	EPA tests on 9/23/01, WTC evaluation
		730 ng/m3 = 0.73 ug/m3	EPA Region 2 calculated a 10^{-4} risk level for non-cancer effects, apparently converting the IRIS oral reference dose for Arochlor 1254 to inhalation for one day, then multiplying by 10.	detection limit: 20 ng/m3	NIOSH method 5503, personal air monitor
		1 ug/m3	OSHA PEL	detection limit: 1 ng/m3	EPA method TO4, if high air volume used
BENZENE (air)		1 ppm benzene = 3.25 mg/m3 benzene			
0.01 ppb	10 times lower than the EPA 10^{-6} risk level	0.00045 mg/m^3 = 0.45 ug/m3 = 0.138 ppb	10^{-6} risk level, EPA's Integrated Risk Management Information System	detection limit: 20 parts per billion (ppb)	EPA WTC evaluation
		1 ppm	OSHA PEL	detection limit: 0.03 ppb	EPA method using GC/FID
				1 ppt = 0.001 ppb	GC/PID/FID method
MERCURY (air)					
1 ng/m3 = 0.001 ug/m3 = 0.000001 mg/m3	based on availability of analytical method to detect at this level and the critical need to determine the source of mercury causing the elevated blood mercury levels in personnel near Ground Zero. OSHA tested at the apparent 0.00001detection limit and was unable to detect the problem.	0.3 ug/m3	EPA, IRIS elemental mercury	EPA apparently has not tested mercury in air at WTC	

		0.1 mg/m3 = 100 ug/m3	OSHA PEL	detection limit: 0.00004 mg/m3 = 0.04 ug/m3	OSHA testing, WTC evaluation, apparent detection limit, since area samples reported as "0.0000 mg/m3 mercury"
				detection limit: 3 ug/m3	NIOSH method 1994
				detection limit: 1 ng/m3	CVAFS method
LEAD (air)					
0.0001 ug/m3 = 0.1 ng/m3	based on Florida standard for lead in the city of Pinella, and available method for detection at this level Inside buildings, test under aggressive conditions, using EPA's regulations at 40 CFR § 763 App. A, Unit III.B.7	1.5 ug/m3	EPA, NAAQS, 40 CFR 50.12	detection limit: 0.033 - 0.24 ug/m3	EPA WTC evaluation
		0.03 ug/m3	New York 1-year ambient air standard for lead acetate	detection limit: 0.1 ng/m3	IDMS method
		0.07 ug/m3	annual standard for Vermont, and 8-hr. standard for Nevada, for lead powder		
		0.0001 ug/m3	Pinella, Florida one-year standard for tetraethyl lead		
		50 ug/m3	OSHA PEL, 29 CFR 1910.1025		
CHROMIUM (air)					
0.000001 ug/m = 0.001 ng/m3	lower than 10^{-6} risk level and achievable by analytical methods Inside buildings, test under aggressive conditions, using EPA's regulations at 40 CFR § 763 App. A, Unit III.B.7	= 0.08 pg/m3 = 0.00008 ug/m3 = 0.00000008 mg/m3	EPA IRIS 10^{-6} risk level	detection limit: 0.083 - 0.17 ug/L	EPA WTC evaluation
		0.001 mg/m3 = 1 ug/m3	NIOSH recommended workplace standard for chromium (VI)	detection limit: 0.001 ng/m3 = 0.000001 ug/m3	achievable by ion chromatography/coulometric

INTERIOR SURFACES

Wipe samples should be taken of smooth, non-porous surfaces. Wipe samples were used earlier in a study of apartments in Lower Manhattan contaminated by WTC fallout to test for a number of hazardous substances,[3] and is a technique that recovers a greater quantity of substances from surfaces than a similar technique using a small micro-vacuum. Wipe sampling has a further advantage in that it is available to a larger number of investigators because it does not require highly specialized equipment. Wipe sampling for asbestos is also compatible with established wipe sampling methods for dioxins and PCB's, which cannot be sampled with microvacuum methods.

For porous surfaces, EPA should use ultrasonication extraction laboratory methods [4] to efficiently remove particulates from these surfaces so they can be tested. The carpeting and upholstery materials should be subjected to the ultrasonication extraction method, where actual pieces of carpet or upholstery are immersed in solutions to extract particulates. In a study where carpeting had been in use for several years after asbestos contamination, the ultrasonication extraction technique was able to measure 100 times more asbestos than using a micro-vacuum sampling technique for the asbestos. Because this technique destroys the objects being tested, EPA will need to purchase and/or replace items it tests.

EPA should test upholstered furniture and carpeting which has been professionally cleaned with either dry or wet extraction techniques, as well as such items that have been cleaned by homeowners with standard vacuum cleaners. EPA should test furniture and carpeting that has been in use for several months where any contaminants has had an opportunity to work their way deep into the materials.

INTERIOR SURFACES **REQUIRED DETECTION LIMITS**		**HEALTH-BASED STANDARDS**	**EPA's WTC TESTING DETECTION LIMITS AND/OR OTHER TEST METHOD DETECTION LIMITS**	
UNITS FOR INTERIOR SURFACES ug/m2 = micrograms per square meter; ng/m2 = nanograms per square meter; ug/ft2 = micrograms per square foot; s/cm2 = asbestos structures per square centimeter				
ASBESTOS (interior surfaces)				
detection limit low enough to ascertain from one sample any statistically significant deviation from background	TEM testing by wipe sampling of hard smooth surfaces, and ultrasonication extraction of porous/woven surfaces	over background	no testing of interior surfaces by EPA in WTC evaluation	
			detection limit: 165 - 4320 s/cm2	Ground Zero Task Force, Independent study of apartments in Lower Manhattan, WTC evaluation[5]
FIBERGLASS (interior surfaces)				
detection limit low enough to ascertain from one sample any statistically significant deviation from background	testing by wipe sampling of hard smooth surfaces, and ultrasonication extraction of porous/woven surfaces. Analyze along with asbestos by TEM.	over background	no testing of interior surfaces by EPA in WTC evaluation	

CHLORINATED DIOXINS AND FURANS (interior surfaces)				
detection limit low enough to ascertain from one sample any statistically significant deviation from background	testing by wipe sampling of hard smooth surfaces, and ultrasonication extraction of porous/woven surfaces.	over background	no testing of interior surfaces by EPA in WTC evaluation	
		background level in office buildings: 0.0012 - 0.088 ng/m2	Ground Zero Task Force, Independent study of apartments in Lower Manhattan, WTC evaluation	
POLYCHLORINATED BIPHENYLS (PCB'S) (interior surfaces)				
detection limit low enough to ascertain from one sample any statistically significant deviation from background	testing by wipe sampling of hard smooth surfaces, and ultrasonication extraction of porous/woven surfaces.	over background	no testing of interior surfaces by EPA in WTC evaluation	
		detection limit: 0.10 ug/m2	Ground Zero Task Force, Independent study of apartments in Lower Manhattan, WTC evaluation	
MERCURY (interior surfaces)				
detection limit low enough to ascertain from one sample any statistically significant deviation from background	testing by wipe sampling of hard smooth surfaces, and ultrasonication extraction of porous/woven surfaces.	over background	no testing of interior surfaces by EPA in WTC evaluation	
		detection limit: not stated, but less than 0.02 ug/ft2	Ground Zero Task Force, Independent study of apartments in Lower Manhattan, WTC evaluation	
LEAD (interior surfaces)				
detection limit low enough to ascertain from one sample any statistically significant deviation from background	testing by wipe sampling of hard smooth surfaces, and ultrasonication extraction of porous/woven surfaces.	over background	no testing of interior surfaces by EPA in WTC evaluation	
		detection limit: not stated, but less than 14 ug/ft2	Ground Zero Task Force, Independent study of apartments in Lower Manhattan, WTC evaluation	
CHROMIUM (interior surfaces)				
detection limit low enough to ascertain from one sample any statistically significant deviation from background	testing by wipe sampling of hard smooth surfaces, and ultrasonication extraction of porous/woven surfaces.	over background	no testing of interior surfaces by EPA in WTC evaluation	
		detection limit: not stated, but less than 3 ug/ft2	Ground Zero Task Force, Independent study of apartments in Lower Manhattan, WTC evaluation	

OUTDOOR SOIL AND DEBRIS

OUTDOOR SOIL AND DEBRIS **REQUIRED DETECTION LIMITS**	**HEALTH-BASED STANDARDS**	**EPA's WTC TESTING DETECTION LIMITS AND/OR OTHER TEST METHOD DETECTION LIMITS**	
ASBESTOS (outdoor soil and debris)			
Less than 0.0001 % can probably be detected by Transmission Electron Microscopy (TEM) or Scanning Electron Microscopy (SEM). PLM is never acceptable unless the levels are over 10%, a situation which has not been found in WTC fallout.	Soils containing only 0.001% asbestos were still capable of producing measurable airborne asbestos concentrations greater than 0.01 fibers per milliliter in air.[6] An air level of 0.01 f/L is many times higher than 0.000004 f/mL , the level associated with a 10^{-6} cancer risk level, from EPA's Integrated Risk Information System	detection limit: reliably only to 1%	EPA analyses of bulk dust for asbestos using polarized light microscopy (PLM) measurements, WTC evaluation
FIBERGLASS (outdoor soil and debris)			
Analyze at the same time as asbestos using TEM or SEM.			
CHLORINATED DIOXINS AND FURANS (outdoor soil and debris)			
0.5 - 0.3 ng/kg for 2,3,7,8-tetrachlorodibenzodioxin, with applicable detection limits for other congeners using the same method with complete congener information based on EPA's demonstrated ability to detect at this level in sediments	health levels associated with chlorinated dioxins and furans in outdoor soils not calculated at this time	detection limit: 0.66 - 0.8 ng/kg = 0.66 - 0.8 parts per trillion (ppt) for 2,3,7,8 tetrachlorodioxins and furans	EPA analysis of sediment, sampling on 9/15/01, reported 9/24/01, WTC evaluation
		detection limit: 3.5 - 4.1 ng/kg = 3.5 - 4.1 ppt for penta, hexa, and hepta-chlorinated dioxins and furans	EPA analysis of sediment, sampling on 9/15/01, reported 9/24/01, WTC evaluation
		detection limit: 1 ppt	EPA method 8290, solids
		detection limit: 10 ppt	EPA method 8280, solids

POLYCHLORINATED BIPHENYLS (PCB'S) (outdoor soil and debris)				
11 - 19 ng/kg with complete congener information	based on EPA's ability to test at this level with their own method 1668	safe levels in soils yet to be calculated or assessed from literature	no data found where EPA analyzed soils or bulk WTC dusts for PCB's	
			detection limit: 11 - 19 ng/kg = 11 - 19 ppt	EPA method 1668 estimated detection limits for soil, tissue, and mixed phase systems
MERCURY (outdoor soil and debris)				
0.09 ug/kg	based on analytical capability at this level and need due to increased mercury levels in personnel near Ground Zero	safe levels in soils yet to be calculated or assessed from literature	detection limit: 0.04 - 0.06 mg/kg	EPA analyses of bulk WTC dust
			detection limit: 0.1 mg/kg	EPA method 7471A for soil, sediment, sludge
			detection limit: 0.09 ug/kg	CV-AFS method for all solid samples
LEAD (outdoor soil and debris)				
12 ug/kg	based on availability of analytical method for this level	safe levels in soils yet to be calculated or assessed from literature	detection limit: 3.8 - 19 mg/kg	EPA analyses of bulk WTC dust
			detection limit: 0.1 mg/kg	EPA method 7420 for soil, wastes, and groundwater
			detection limit: 12 ug/kg = 0.012 mg/kg	AAS method for soil, dust, and paint
CHROMIUM (outdoor soil and debris)				
		safe levels in soils yet to be calculated or assessed from literature	detection limit: 0.48 - 0.76 mg/kg	EPA analyses of bulk WTC dust

DRINKING WATER AND OUTDOOR SURFACE WATERS (rivers, ponds, lakes, etc.)

ALL WATER SAMPLES **REQUIRED DETECTION LIMITS**	**HEALTH-BASED STANDARDS**	**EPA's WTC TESTING DETECTION LIMITS AND/OR OTHER TEST METHOD DETECTION LIMITS**
UNITS FOR WATER MEASUREMENTS mg/L = milligrams per liter; ug/L = micrograms/L, ng/L = nanograms/L; pg/L = picograms/L 1000 pg = 1 ng, 1000 ng = 1 ug, 1000 ug = 1 mg	ppm = part per million = mg/L; ppb = part per billion = ug/L; ppt = part per trillion = ng/L; ppq = part per quadrillion = pg/L	
ASBESTOS (all waters)		
70,000 fibers/liter based on 10^{-6} risk level and availability of method	70,000 fibers/liter cancer risk at 10^{-6} cancer level, extrapolated from the MCL (below) at the cancer risk level of 10^{-4}	no testing of drinking water reported by EPA in WTC evaluation, as per web site which showed analysis of drinking water on 9/15/01 only
	7 million fibers/liter EPA maximum contaminant limit (MCL) at cancer risk of 10^{-4}	detection limit: TEM method at 20,000X 10,000 fibers/liter
FIBERGLASS (all waters)		
test at same time as asbestos in water with same method	no drinking water standard available	no testing of drinking water reported by EPA in WTC evaluation, as per web site which showed analysis of drinking water on 9/15/01 only
CHLORINATED DIOXINS AND FURANS (all waters)		
0.01 ppq = 0.01 pg/L for 2,3,7,8-tetrachlorodibenzodioxin, with applicable detection limits for other congeners using the same method required to meet new but as yet unquantified health risk numbers, based on knowledge of research methods using large volumes of water with complete congener information	a new drinking water standard has not yet been developed to reflect EPA's recent dioxin risk reassessment, which found that the range of chlorinated dioxins and furans had higher health risks	no testing of drinking water reported by EPA in WTC evaluation, as per web site which showed analysis of drinking water on 9/15/01 only, although PCB's were tested
	0.00000003 mg/L = 0.00003 ug/L = 0.03 ng/L EPA 1994 maximum contaminant limit (MCL) for drinking water - this is outdated and not protective	detection limit: EPA method 8290 10 ppq = 10 pg/L = 0.01 ng/L
		detection limit: high resolution SIM method 0.5 - 1.1 ppq = 0.5 - 1.1 pg/L

				detection limit: 0.01 ng/L	EPA method 1613
				detection limit: 0.01 ppq = 0.01 pg/L	based on knowledge of research methods using large volumes of water
POLYCHLORINATED BIPHENYLS (PCB'S) (all waters)					
109 - 169 pg/L with complete congener information	based on EPA ability to test at this level using their own method 1668, and fact that Colorado water standard much lower than EPA's	0.0001 mg/L = 0.1 ug/L = 100 ng/L	10^{-6} risk level, EPA IRIS.	detection limit: 0.16 - 0.38 ug/L = 0.16 - 0.38 parts per billion	EPA Region 2 data, 9/15/01, NYC drinking water supply, all PCB's measured, WTC evaluation
		0.0005 mg/L = 0.5 ug/L = 500 ng/L	EPA maximum contaminant limit (MCL) for drinking water	detection limit: 109 - 169 pg/L = 109 - 169 parts per quadrillion	EPA method 1668
		0.005 ug/L = 5 ng/L = 0.000005 mg/L	Colorado drinking and groundwater standard	detection limit: 0.042 ng/L for Aroclor 1242	EPA method 508 or 508A
		0.02 ug/L	New Jersey groundwater standard		
		0.02 mg/kg/day	ATSDR MRL, chronic oral, based on immunological effects		
		1 mg/m3	OSHA PEL		
BENZENE (all waters)					
0.009 ug/L	easily achieved with EPA method 8021A, and lower than the EPA 10^{-6} risk level 10 times	0.001 mg/L = 1.0 ug/L	10^{-6} risk level, lower range, EPA IRIS	detection limit: Assume 0.005 mg/L detection limit. EPA does not give actual data for drinking water after the WTC disaster, saying only that concentrations were below the MCL of 0.005 mg/L.	
		0.005 mg/L	EPA's maximum contaminant limit (MCL) for water	detection limit: 0.009 ug/L	EPA method 8021A

MERCURY (all waters)					
		0.002 mg/L	EPA drinking water regulations	detection limit: EPA does not give actual data for drinking water after the WTC disaster, saying only that concentrations were below drinking water standards.	
		0.025 ug/L	EPA Ambient Water Quality Criteria for phenylmercuric acetate for marine organisms	detection limit: 0.1 mg/L	EPA method 7470A
				detection limit: 30 - 40 ng/L	DIN-ICPMS, PN-ICPMS methods
LEAD (all waters)					
1 ug/L	based on ability to test by EPA method 239.2 at this level, and even lower by other method	0.0	EPA maximum contaminant level goal (MCLG) in drinking water	EPA does not give actual data for drinking water after the WTC disaster, saying only that concentrations were below drinking water standards.	
		10^{-6} risk level for cancer effects of lead not available from EPA IRIS	EPA IRIS classification of lead as a carcinogen	detection limit: 1 ug/L	EPA method 239.2
		0.015 mg/L	EPA action level in drinking water	detection limit 0.14 ug/L	ETAAS method for water
		3.2 ug/L = 0.0032 mg/L	EPA ambient water quality criteria for freshwater species		
CHROMIUM (all waters)					
0.3 ug/L	easily achieved with EPA method, and lower than EPA's MCL		EPA IRIS RfD, oral, of 0.003 mg/kg-day needs to be converted to approximate drinking water level	EPA does not give actual data for drinking water after the WTC disaster, saying only that concentrations were below drinking water standards.	
		0.1 mg/L	EPA maximum contaminant limit (MCL) in water	detection limit: 0.3 ug/L	EPA method 7199
		11 ug/L = 0.011 mg/L	EPA water quality criteria for chromium, freshwater fish		

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