Potential Environmental Exposures of Interest

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Exposures	Exposure Sources	Examples of Specific Analytes	Potential Examples of Outcomes of Interest	Considerations	Proposed Study Visit Measure	NCS Proposed Approach	Other Potential Options to Evaluate				
General (All Participants)							Biomarker	Environmental Sample	Extant Data	Questionnaire	Direct observation
Nicotine and hydrocarbons	Tobacco smoke	Cotinine	Addiction, neurochemical changes, malignancy, respiratory effects, lung function decrements	Limited to ~ prior 72 hours exposure, better quantification in serum, higher concentrations in urine, questionnaires generally unreliable, serum collection generally feasible in children 24 months or older	Questionnaire plus Blood (serum)	Biomarker	Urine	Air - particulate matter	Gallup Poll - Smoking in the USA	Smoking history	Smoking materials in home
Polyfluoroalkyl Compounds	Industrial polymers found in textiles and carpets; consumer products including adhesives, lubricants, package coatings, stains, soil repellents, insecticides, specialty papers, and pharmaceuticals	2-(N-Ethyl-perfluorooctane sulfonamido) acetic acid (Et-PFOSA-AcOH), 2-(N-Methyl-perfluorooctane sulfonamido) acetic acid (Me-PFOSA-AcOH), Perfluorodecanoic acid (PFDeA), Perfluorohexane sulfonic acid (PFHxS), Perfluorononanoic acid (PFNA), Perfluorooctanoic acid (PFOA), Perfluorooctane sulfonic acid (PFOS), Perfluorooctane sulfonamide (PFOSA)	Disrupted lipid metabolism and weight regulation	Limited to exposures less than 3-4 days prior to sampling	Urine	Biomarker	Blood (serum)	Dust	Whole Foods Survey consumer packaging preferences	Carpet, furniture, clothing stain repellants	New carpeting and furniture, food storage containers
Metals	contaminants in drinking water and dietary sources	Barium, Beryllium, Cadmium, Cobalt, Cesium, Manganese, Mercury, Molybdenum, Lead, Platinum, Antimony, Selenium, Tin, Thallium, Tungsten, Uranium	Cadmium - bone and kidney effects, lead and mercury-neurological deficits, manganese - CNS effects, selenium - immune regulation	Long half life in weeks to months, could be assessed in bone and soft tissue	urine	Biomarker	Blood (serum)	Tap water	Water supplier monitoring reports, state household water satisfaction surveys	Source of drinking water	Age, condition, discoloration of water pipes and taps
Arsenic (speciated)	drinking water and dietary sources of exposure	Arsenobetaine, Aresenocholine, trimethylarsine, Monomethylarsonic acid, Dimethylarsinic acid, Arsenous (III) acid, Aresenic (V) acid	Interference with intermediary metabolism leading to malignancy, inflammation, cardiovascular disease; diabetes;	Limited to exposures less than 30 hours prior to sampling	urine	Biomarker	Blood (serum)	tap water	Water supplier monitoring reports, state household water satisfaction surveys	source of drinking water	age, condition, discoloration of water pipes and taps
Dialkyl phosphate metabolites of organophosphorus pesticides and Pyrethroid insecticide metabolites	Pesticide residues from diet	Standard organophosphate Screening Method	Neurological effects	Limited to exposures less than a few hours for non-fat soluble and a few days for fat soluble	Urine	Biomarker	Blood (serum)	dust	pesticide use surveys, product sale data	diet survey, pesticide applications	pesticide products
Phthalate metabolites	Chemical emissions from fixtures and furnishings	MCPP (MONO[CARBOXYNONYL]), MMP (MONO-METHYL), MCHP (MONO-CYCLOHEXYL), MOP (MONO-N-OCTYL) + others	Reproductive and endocrine effects	Limited to exposures less than 24 hours prior to sampling	Urine	Biomarker	Blood (serum)	Dust, surface wipes	Whole Foods Survey consumer packaging preferences	Medical device use	plastic food containers and toys, medical devices
Polycyclic aromatic hydrocarbon metabolites (PAHs)	Combustion products from smoking, particulate matter sources, and dietary sources	1-naphthol (1-NAP), 2-naphthol (2-NAP), 3-hydroxyfluorene (3-FLU), 9-hydroxyfluorene (9-FLU), 1-hydroxyphenanthrene (1-PHE), 2-hydroxyphenanthrene (2-PHE), 3-hydroxyphenanthrene (3-PHE), 1-hydroxypyrene (1-PYR), 2-hydroxyfluorene (2-FLU)	Fetal development, pre-mature birth, congenital defects	Limited to exposures less than7 days prior to sampling	Urine	Biomarker	Blood (serum)	Air - particulate matter	American Housing Survey	Smoking, heating appliances	Smoking materials in home, fireplace, woodstove

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Phytoestrogens and metabolites	Ingested plant material	Isoflavonoids, the lignans or the coumestans.		Limited to exposures less than 1 day prior to sampling	Urine	Biomarker	Blood (serum)		Survey of estrogen therapies, medical supplement use	Diet survey, pharmaceutical use, medical supplement use, baby formula	Baby formula
Phenols	Chemicals in consumer products	2,4-Dichlorophenol (24 DCP), 2,5-dichlorophenol (25 DCP), Butyl paraben (B-PB), Methyl paraben (M-PB). n-Propyl paraben (P-PB), Benzophenone-3 (2-Hydroxy-4-methoxybenzophenone) (BP3), Bisphenol A (2,2-bis[4-Hydroxyphenyl] propane) (BPA), Triclosan (2,4,4'-Trichloro-2'-hydroxyphenyl ether) (TCS)	Endocrine disruption, epigenetic modification, cytokine release, and oxidative stress. reproductive disorders and increased risk of breast, prostate or testicular cancer in offspring	Limited to exposures less than a few (5-14) hours prior to sampling	Urine	Biomarker	Blood (serum)	surface wipe	Consumer product surveys	Consumer product use	Consumer product inventory
Phenols	Chemical residue in consumer products	Bisphenol A, (2,2-bis[4-Hydroxyphenyl] propane)	Reproductive effects, endocrine effects	Higher concentrations in breast milk than serum or urine, limited to exposures less than a few hours	Breast milk	Biomarker	Blood (serum)	Dust	Consumer product surveys	Use of plastic ware containers and products	Plastic water and food containers and toys
Organochlorines	Pesticide residues from diet	Organochlorines	Neurological effects, reproductive effects	Strongly lipid soluble, can sequester in body tissues with high lipid content for days - months	breast milk	Biomarker	Blood (serum)	dust	pesticide use surveys, product sale data	diet survey, pesticide applications, pet care	pesticide products, pets
Polyhalogenated compounds	Chemical residue in building materials, furnishings, and consumer products	PBDEs/PCBs	Endocrine disruption, neurolog	Strongly lipid soluble, can bio accumulate, half life of several weeks for PBDE, months for PCBs	breast milk	Biomarker	Blood (serum)	dust	Housing characteristics surveys	new or recent household furnishings	new household furnishings
Pesticide residues, metals, semi-volatile organic compounds, polyhalogenated organic compounds	Diet may be a source of exposure to chemical contaminates	Cadmium, mercury, PBDEs/PCBs,	Endocrine disruption, epigenetic modification, cytokine release, reproductive disorders, neurological disorders, and malignancies	broad variable half life spanning hours-days	diet survey	Participant responses	Blood or urine	Food samples	Market basket surveys	Diet survey	Duplicate diet survey, videography
Noise	Noise outside and inside the dwelling	Traffic, construction	Sensory loss, stress, irritability	Variable duration and intensity depending on source	Questionnaire, inverviewer impression and spot sound pressure	Participant response, inverviewer impression and direct measure		Noise measurement	Community noise surveys	Noise questionnaire	Community observation of noise emitting sources
Volatile organic compounds, semi-volatile organic compounds	Emissions from fixtures, furnishings and consumer products, cleaners	Toluene, xylene, carbonyls (aldehydes, ketones)	Respiratory effects, cancer	Limited half-life in air of a few hours	Questionnaire	Participant responses		Air trap samplers	Consumer product surveys	Consumer product use	Inventory of consumer products
Selective (not all participants)											
Particulate matter (PM), Nitrogen dioxide	Smokers in the home, gas appliances, wood burning stove, fireplace	PM 2.5, $N0_2$	Respiratory effects	Resource intensive and requires cooperation of participant family	Air sample	Air trap samplers	Blood for PM	Air trap samples, surface wipes, dust	American Housing Survey	Smoking history, appliance use	Smoking materials in home, fireplace, woodstove
Disinfection by products, pesticides, pharmaceuticals	Contaminants in personal wells or public water supply source	Trihalomethanes, Haloacetic Acids	Low birth weight, preterm delivery, birth defects, reproductive effects	NCS staff trained to collect sample properly	Drinking water sample	Drinking water sample collection	Blood, urine	Drinking water sample	Water supplier monitoring reports, state household water satisfaction surveys	Source of drinking water	Age, condition, discoloration of water pipes and taps
Noise	Noise outside and inside the dwelling	Traffic, construction	Sensory loss, stress, irritability	Variable duration and intensity depending on source	Sound recording with frequency analysis	Direct measure	Hearing acuity test	Noise measurement	Community noise surveys	Noise questionnaire	Community observation of noise emitting sources