



NTP

National Toxicology Program

2021

Testing and Toxicology Studies in FY 2021

APPENDIX II

The NTP testing program evaluates substances for a variety of health-related effects, generally using rodent models. For each test article, a study team develops an appropriate testing strategy to address the identified research needs. Reports and summaries of NTP toxicity studies, including carcinogenicity and effects on development and reproduction, are available on the NTP website. Studies initiated, ongoing, or completed in 2021 are listed in this appendix.

Disposition, Metabolism, and Toxicokinetic Studies

Complete dosimetry of a chemical or physical agent describes its absorption, distribution, metabolism, and excretion in the body of both humans and test animals at differing levels of exposure, of all ages, via several routes of exposure, and under varying genetic backgrounds. Substances evaluated during FY 2021 are listed below.

Disposition, Metabolism, and Toxicokinetic Studies in FY 2021

Test Article	CASRN*	Species	Route	Status	Study Scientist
Microcystin LR	101043-37-2	Rats, Mice	Gavage, intravenous	Ongoing	Suramya Waidyanatha
NTP systematic evaluation of the application of zebrafish in toxicology	N/A	Fish	N/A	Ongoing	Kristen Ryan
Phenolic benzotriazoles (2-(2H-benzotriazol-2-yl)-4,6-bis(1-methyl-1-phenylethyl)phenol)	70321-86-7	Rats	Gavage, intravenous	Ongoing	Suramya Waidyanatha
Phenolic benzotriazoles (2-(2H-benzotriazol-2-yl)-4,6-bis(1,1-dimethylpropyl)phenol)	25973-55-1	Rats	Gavage, intravenous	Ongoing	Suramya Waidyanatha
Phenolic benzotriazoles (2-(2H-benzotriazol-2-yl)-4-tert-butylphenol)	3147-76-0	Rats	Gavage, intravenous	Ongoing	Suramya Waidyanatha
Phenolic benzotriazoles (2-(2H-benzotriazol-2-yl)phenol)	10096-91-0	Rats	Gavage, intravenous	Ongoing	Suramya Waidyanatha
Phenolic benzotriazoles (2-(5-chloro-2H-benzotriazol-2-yl)-4,6-bis(1,1-dimethylethyl)phenol)	3864-99-1	Rats	Gavage, intravenous	Ongoing	Suramya Waidyanatha
Phenolic benzotriazoles (3-(2H-benzotriazol-2-yl)-5-(1,1-dimethylethyl)-4-hydroxybenzenepropanoic acid, octyl ester)	84268-23-5	Rats	Gavage, intravenous	Ongoing	Suramya Waidyanatha
Phenolic benzotriazoles (Bumetrizole)	3896-11-5	Rats	Gavage, intravenous	Ongoing	Suramya Waidyanatha
Phenolic benzotriazoles (Drometrizole)	2440-22-4	Rats	Gavage, intravenous	Ongoing	Suramya Waidyanatha
Phenolic benzotriazoles (Octrizole)	3147-75-9	Rats	Gavage, intravenous	Ongoing	Suramya Waidyanatha
Polyethylene glycol monomethyl ether	9004-74-4	Rats	Subcutaneous injection	Ongoing	Jia-Long Fang
		Mice	Dosed-water	Ongoing	Daniel Doerge
		Monkeys	Dosed-feed	Ongoing	Daniel Doerge
Sodium arsenite	7784-46-5	Rats	Gavage	Ongoing	Daniel Doerge

*CASRN = Chemical Abstracts Service Registry Number.

Genetic Toxicity Studies

Genetic toxicity test results are used to help interpret general toxicity, carcinogenicity, or other in vivo test results and to provide a database for use in structure-activity relationship analysis.

Substances evaluated during FY 2021 are listed below.

Genetic Toxicity Studies in FY 2021

Test Article	CASRN*	Species/Cell Line	Testing Battery	Status	Study Scientist
1,2-bis(2,4,6-tribromophenoxy)ethane	37853-59-1	TK6 cells	Comet assay	Ongoing	Stephanie Smith-Roe
1,2-bis(pentabromophenyl)ethane	84852-53-9	TK6 cells	Comet assay	Ongoing	Stephanie Smith-Roe
1,3,5,7,9,11-hexabromocyclododecane	25637-99-4	TK6 cells	Comet assay	Ongoing	Stephanie Smith-Roe
2,2',4,4'-tetrabromodiphenyl Ether	5436-43-1	TK6 cells	Comet assay	Ongoing	Stephanie Smith-Roe
2-ethylhexyl-2,3,4,5-tetrabromobenzoate	183658-27-7	TK6 cells	Comet assay	Ongoing	Stephanie Smith-Roe
Aspergillus versicolor mold	N/A	Mice	Micronucleus	Ongoing	Stephanie Smith-Roe
Benzo(a)pyrene	50-32-8	Rats	Comet assay, pig-a gene mutation	Ongoing	Stephanie Smith-Roe
Cell phone radiation: code-division multiple access (CDMA)	N/A	Mice	Comet assay	Ongoing	Stephanie Smith-Roe
Decabromodiphenyl ether	1163-19-5	TK6 cells	Comet assay	Ongoing	Stephanie Smith-Roe
Deionized water	N/A	Mice	Micronucleus	Ongoing	Stephanie Smith-Roe
Ethyl methanesulfonate	62-50-0	TK6 cells	Micronucleus	Ongoing	Stephanie Smith-Roe
Hexachlorocyclopentadienyl-dibromocyclooctane	51936-55-1	TK6 cells	Comet assay	Ongoing	Stephanie Smith-Roe
Isopropylated phenol phosphate	68937-41-7	Rats	Micronucleus	Ongoing	Stephanie Smith-Roe
Mesotrione	104206-82-8	TK6 cells	Micronucleus	Completed	Stephanie Smith-Roe
Methylcellulose	9004-67-5	Mice	Micronucleus	Ongoing	Stephanie Smith-Roe
N-Ethyl-N-nitrosourea	759-73-9	Rats	Comet assay	Ongoing	Stephanie Smith-Roe
Sodium metavanadate	13718-26-8	Rats, mice	Comet Assay, micronucleus	Ongoing	Stephanie Smith-Roe
Sodium tungstate dihydrate	10213-10-2	Rats, mice	Comet assay	Completed	Stephanie Smith-Roe
Tetrabromobisphenol A-bis(2,3-dibromopropyl ether)	21850-44-2	TK6 cells	Comet assay	Ongoing	Stephanie Smith-Roe
Thallium (I) sulfate	7446-18-6	Rats, mice	Micronucleus, pig-	Ongoing	Stephanie

Test Article	CASRN*	Species/Cell Line	Testing Battery	Status	Study Scientist
			a gene mutation		Smith-Roe
Tricombination ABC:DTG:3TC	N/A	Rats	Micronucleus, pig-a gene mutation	Ongoing	Stephanie Smith-Roe
Triphenyl phosphate	115-86-6	Rats	Micronucleus	Initiated	Stephanie Smith-Roe
Vanadyl sulfate	27774-13-6	Rats, mice	Comet assay, micronucleus	Ongoing	Stephanie Smith-Roe

*CASRN = Chemical Abstracts Service Registry Number.

Organ Systems Toxicity Studies

NTP studies toxicity of environmental substances on development, reproduction, and on the nervous and immune systems. Organ systems toxicity studies conducted during FY 2021 are listed below

Neurotoxicity, Developmental Toxicity, and Reproductive Toxicity Studies in FY 2021

Test Article	CASRN*	Species	Testing Battery	Length	Route	Status	Study Scientist
1020 long multiwalled carbon nanotube	N/A	Mice	Immunotoxicity	30 days, 90 days	Inhalation	Ongoing	Dori Germolec
		Rats	Immunotoxicity	30 days	Inhalation	Ongoing	Dori Germolec
2-((1-(4-phenoxyphenoxy)propan-2-yl)oxy)pyridine	95737-68-1	Rats	Conventional Teratology	GD 6 to GD 21	Gavage	Ongoing	Barry McIntyre
		Rats	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec
		Rabbits	Teratology pilot studies, conventional teratology	GD 7 to GD 28	Gavage	Ongoing	Barry McIntyre
		Rabbits	Preliminary toxicokinetic study, toxicokinetic study	GD 7 to GD 28, GD 6 to GD 18	Gavage	Ongoing	Barry McIntyre
4-methylcyclohexanemethanol (MCHM)	34885-03-5	Rats	Continuous breeding	M: 10 weeks prior to cohabitation; F: 2 weeks prior to cohabitation; M&F: during cohabitation; F: during gestation, delivery and up to PND4	Dosed-feed	Ongoing	Mamta Behl
4-Methylimidazole	822-36-6	Rats	Continuous breeding	Continuous	Dosed-feed	Ongoing	Mamta Behl
Acenaphthenequinone	82-86-0	Mice	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec
Arsenic	7440-38-2	Rats	Developmental toxicity	Pregnant dams through PND21, 6 months in-life	Gavage & dosed-water	Ongoing	Andrew Shen
Benz(j)aceanthrylene	202-33-5	Mice	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec
Benzo(a)pyrene	50-32-8	Mice	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec
Benzo(b)fluoranthene	205-99-2	Mice	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec
Benzo(c)fluorene	205-12-9	Mice	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec
Benzo(k)fluoranthene	207-08-9	Mice	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec

Test Article	CASRN*	Species	Testing Battery	Length	Route	Status	Study Scientist
Bisphenol AF	1478-61-1	Rats	Developmental immunotoxicity	GD 6 to PND 96	Dosed-feed	Ongoing	Dori Germolec
Black cohosh	84776-26-1	Rats	Continuous breeding	N/A	Gavage	Ongoing	Minerva Mercado-Feliciano
		Mice	Immunotoxicity	28 days	Gavage	Ongoing	Chad Blystone
Chrysene	218-01-9	Mice	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec
Dibenz(a,h)anthracene	53-70-3	Mice	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec
dibenzo(a,l)pyrene	191-30-0	Mice	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec
Dibenzothiophene	132-65-0	Mice	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec
Diisobutyl phthalate	84-69-5	Rats	Continuous breeding	Continuous	Dosed-feed	Ongoing	Chad Blystone
Echinacea purpurea root extract	90028-20-9	Rats	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec
Effective dose producing 10% response PAC mixture	N/A	Mice	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec
Effective dose producing 50% response PAC mixture	N/A	Mice	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec
Equimolar PAC mixture	N/A	Mice	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec
Indeno(1,2,3-cd)pyrene	193-39-5	Mice	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec
N-butylbenzenesulfonamide	3622-84-2	Rats	Developmental immunotoxicity	GD 6 to PND 42	Dosed-feed	Ongoing	Dori Germolec
		Mice	Immunotoxicity	28 days	Dosed-feed	Ongoing	Dori Germolec
Phenanthrene	85-01-8	Mice	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec
Pyrene	129-00-0	Mice	Immunotoxicity	28 days	Gavage	Ongoing	Dori Germolec
Resveratrol	501-36-0	Mice	Immunotoxicity	28 days, 180 days	Gavage	Ongoing	Dori Germolec
Sodium metavanadate	13718-26-8	Mice	Immunotoxicity	28 days	Dosed-water	Ongoing	Georgia Roberts
Sodium tungstate dihydrate	10213-10-2	Mice	Immunotoxicity	28 days	Dosed-water	Ongoing	Dori Germolec
Sulfolane	126-33-0	Rats, mice	Immunotoxicity	13 weeks	Gavage	Ongoing	Dori Germolec
Tenofovir disoproxil fumarate (TDF)	202138-50-9	Mice	Teratology pilot studies	GD 5 to PND 21	Gavage	Ongoing	Vicki Sutherland
Tricombination FTC:TDF:EFV (1:1.5:3)	N/A	Mice	Maternal transfer	GD 5 to GD 15	Gavage	Ongoing	Vicki Sutherland
		Mice	Teratology pilot studies	GD 5 to GD 18	Gavage	Ongoing	Vicki Sutherland
Tris(chloropropyl) phosphate (TCPP)	13674-84-5	Rats	Developmental immunotoxicity	GD 6 to PND 127	Dosed-feed	Ongoing	Dori Germolec

*CASRN = Chemical Abstracts Service Registry Number.

Modified One-Generation Reproductive Studies

NTP modified one-generation study design emphasizes a full evaluation of the first-generation offspring of animals and uses fewer animals than the classical multigenerational study design. These studies generate information on the effects of substances on prenatal development, postnatal development, and reproduction. Ongoing and completed modified one-generation studies are listed below.

Modified One-Generation Studies in FY 2021

Test Article	CASRN*	Species	Testing Battery	Status	Study Scientist
2,2'-Dimorpholinodiethyl ether	6425-39-4	Rats	Dose range finding	Ongoing	Georgia Roberts
2-Ethylhexyl p-methoxycinnamate	5466-77-3	Rats	Dose range finding; developmental toxicity, F0 generation, fertility assessment, subchronic	Ongoing	Barry McIntyre
2-Hydroxy-4-methoxybenzophenone	131-57-7	Rats	Dose range finding; developmental toxicity, F0 generation, fertility assessment	Ongoing	Barry McIntyre
Bisphenol AF	1478-61-1	Rats	Dose range finding, developmental toxicity, F0 generation, fertility assessment, maternal transfer, subchronic	Ongoing	Vicki Sutherland
Boric acid	10043-35-3	Rats	F0 generation	Ongoing	Shannah Witchey
Deoxynivalenol	51481-10-8	Rats	Dose range finding	Ongoing	Dori Germolec
Echinacea purpurea root extract	90028-20-9	Rats	Dose range finding; conventional teratology, fertility assessment, subchronic	Ongoing	Kristen Ryan
Isopropylated phenol phosphate	68937-41-7	Rats	Dose range finding	Ongoing	Shannah Witchey
N-Butylbenzenesulfonamide	3622-84-2	Rats	Developmental toxicity, F0 generation, fertility assessment; maternal transfer; neurotoxicology assessment; subchronic	Ongoing	Cynthia Rider
Resveratrol	501-36-0	Rats	Developmental toxicity, F0 generation, fertility assessment	Ongoing	Mimi Huang
Triclosan	3380-34-5	Rats	Dose range finding	Ongoing	Vicki Sutherland
Tricombination FTC:TDF:EFV (1:1.5:3)	N/A	Mice	F0 generation; maternal transfer; subchronic	Ongoing	Vicki Sutherland
Tricombination ABC:DTG:3TC	N/A	Rats	Dose range finding	Ongoing	Vicki Sutherland
		Rats	Maternal transfer; neurotoxicology assessment; subchronic	Initiated	Vicki Sutherland

Test Article	CASRN*	Species	Testing Battery	Status	Study Scientist
Triphenyl phosphate	115-86-6	Rats	Dose range finding	Ongoing	Shannah Witchey
Tris(4-chlorophenyl)methane	27575-78-6	Rats	Dose range finding	Ongoing	Nigel Walker
Valerian (Valeriana officinalis L.) root extract	8057-49-6	Rats	Dose range finding	Ongoing	Georgia Roberts

*CASRN = Chemical Abstracts Service Registry Number.

Toxicity and Carcinogenicity Studies

NTP performs toxicity studies to provide dose-setting information for chronic studies and to address specific deficiencies in the toxicology database for the chemical. Toxicology and carcinogenicity studies fall into two categories: prechronic toxicity studies and chronic two-year toxicology and carcinogenicity studies. Studies are generally conducted in rats and mice.

Each study type is performed according to the Specifications for the Conduct of Studies to Evaluate the Reproductive and Developmental Toxicity of Chemical, Biological, and Physical Agents in Laboratory Animals for the National Toxicology Program (NTP) (May 2011). Prechronic and chronic toxicity studies and carcinogenicity studies that were initiated, ongoing, or completed during FY 2021 are listed below.

Prechronic Toxicity and Carcinogenicity Studies in FY 2021

Test Article	CASRN*	Species	Length	Route	Status	Study Scientist
3,3',4,4'-Tetrachloroazobenzene	14047-09-7	Rats	5 days	Gavage	Completed	William Gwinn
Acefoin	513-86-0	Rats, mice	14 days, 90 days	Inhalation	Ongoing	Nigel Walker
Acrylamide	79-06-1	Rats	5 days	Gavage	Completed	William Gwinn
Aging cohort study: 12951/SvlmJ mouse	N/A	Mice	2 years	N/A	Ongoing	June Dunnick
Aging cohort study: A/J mouse	N/A	Mice	2 years	N/A	Ongoing	June Dunnick
Aging cohort study: B6C3F1J mouse	N/A	Mice	2 years	N/A	Ongoing	June Dunnick
Aging cohort study: C3H/HeJ mouse	N/A	Mice	2 years	N/A	Ongoing	June Dunnick
Aging cohort study: C57/BL/6J mouse	N/A	Mice	2 years	N/A	Ongoing	June Dunnick
Aging cohort study: CAST/EiJ mouse	N/A	Mice	2 years	N/A	Ongoing	June Dunnick
Aging cohort study: NOD. B10Sn-H2(b)/J	N/A	Mice	2 years	N/A	Ongoing	June Dunnick
Aging cohort study: NZO/HILtJ mouse	N/A	Mice	2 years	N/A	Ongoing	June Dunnick
Aging cohort study: PWK/PhJ mouse	N/A	Mice	2 years	N/A	Ongoing	June Dunnick
Aging cohort study: WSB/EiJ mouse	N/A	Mice	2 years	N/A	Ongoing	June Dunnick
alpha/beta Thujone mixture	76231-76-0	Rats	5 days	Gavage	Completed	William Gwinn

Test Article	CASRN*	Species	Length	Route	Status	Study Scientist
Alpha-pinene	80-56-8	Rats, mice	7 days, 2 years	Inhalation	Ongoing	Cynthia Rider
		Rats	90 days	Inhalation	Ongoing	Cynthia Rider
		Rats, mice	7 days	Inhalation	Ongoing	Cynthia Rider
Aqueous film forming foams	N/A	Rats	14 days	Gavage	Ongoing	Mimi Huang
Aspergillus fumigatus mold	N/A	Mice	13 weeks	Inhalation	Completed	Dori Germolec
Aspergillus versicolor mold	N/A	Mice	90 days	Inhalation	Initiated	Dori Germolec
Bis(2-ethylhexyl) tetrabromophthalate	26040-51-7	Rats	5 days	Gavage	Ongoing	June Dunnick
Bisphenol AF	1478-61-1	Rats	5 days	Gavage	Ongoing	Vicki Sutherland
Bisphenol S	80-09-1	Mice	14 days	Dosed-feed	Ongoing	Vicki Sutherland
Black cohosh	84776-26-1	Rats, mice	2 years	Gavage	Ongoing	Chad Blystone
		Rats	14 days	Gavage	Ongoing	Chad Blystone
Brominated vegetable Oil	8016-94-2	Rats	90 days	Dosed-feed	Ongoing	Goncalo Gamboa da Costa
Cell phone radiation: CDMA	N/A	Mice	5 days	Whole body exposure	Ongoing	Michael Wyde
Coumarin	91-64-5	Rats	5 days	Gavage	Completed	June Dunnick
Decabromodiphenyl ether	1163-19-5	Rats	5 days	Gavage	Ongoing	June Dunnick
Di(2-ethylhexyl) phthalate	117-81-7	Rats	Perinatal + 2 years, 2 years	Dosed-feed	Ongoing	Rachel Dee
		Rats	5 days	Gavage	Ongoing	Rachel Dee
Dibutyl phthalate	84-74-2	Rats, mice	2 years	Dosed-feed	Ongoing	Mimi Huang
Dimethylamine borane	74-94-2	Rats, mice	2 weeks	Dermal	Ongoing	Rachel Frawley
Ethinyl estradiol	57-63-6	Rats	5 days	Gavage	Completed	William Gwinn
Fenofibrate	49562-28-9	Rats	5 days	Gavage	Completed	William Gwinn
Furan	110-00-9	Rats	5 days	Gavage	Completed	William Gwinn
Garcinia Cambogia Extract	90045-23-1	Rats, mice	14 days, 13 weeks	Dosed-feed	Ongoing	Rachel Dee
Ginkgo biloba extract	90045-36-6	Rats	5 days	Gavage	Ongoing	Cynthia Rider
Ginseng	50647-08-0	Rats	5 days	Gavage	Completed	William Gwinn
Goldenseal extract	84603-60-1	Rats	5 days	Gavage	Ongoing	Scott Auerbach
Green tea extract	N/A	Rats	5 days	Gavage	Ongoing	Scott Auerbach
Hexachlorobenzene	118-74-1	Rats	5 days	Gavage	Completed	William Gwinn

Test Article	CASRN*	Species	Length	Route	Status	Study Scientist
		Rats	13 weeks	Gavage	Completed	Michelle Hooth
Hexachlorocyclopentadienyl-dibromocyclooctane	51936-55-1	Rats	5 days	Gavage	Ongoing	June Dunnick
Ionic liquid: 1-butyl-1-methylpyrrolidinium chloride	479500-35-1	Rats, mice	90 days	Dosed-water	Ongoing	Rachel Dee
Ionic liquid: 1-butyl-3-methylimidazolium chloride	79917-90-1	Rats, mice	90 days	Dosed-water	Ongoing	Rachel Dee
Ionic liquid: 1-Ethyl-3-methylimidazolium chloride	65039-09-0	Rats, mice	90 days	Dosed-water	Ongoing	Rachel Dee
Ionic Liquid: N-butylpyridinium Chloride	1124-64-7	Rats, mice	90 days	Dosed-water	Ongoing	Kristen Ryan
Isopropylated phenol phosphate	68937-41-7	Rats	13 weeks	Dosed-feed	Ongoing	Shannah Witchey
Libby amphibole 2007	N/A	Rats	2 years	Inhalation	Initiated	Georgia Roberts
		Rats	7 months	Inhalation	Ongoing	Matt Stout
Melamine + cyanuric acid combination	N/A	Rats	90 days, 90 days + recovery	Gavage	Ongoing	Goncalo Gamboa da Costa
		Rats	90 day	Gavage	Ongoing	Luísa Camacho
Methyleugenol	93-15-2	Rats	5 days	Gavage	Completed	William Gwinn
Microbiome	N/A	N/A	N/A	N/A	Ongoing	Sangeeta Khare
Milk thistle extract	84604-20-6	Rats	5 days	Gavage	Completed	William Gwinn
Mixed xylenes	N/A	Rats, mice	2 years	Inhalation	Initiated	Kristen Ryan
		Rats, mice	30 days	Inhalation	Ongoing	Kristen Ryan
Nattokinase and lumbrokinase	N/A	Rats	28 days	Gavage	Ongoing	Luísa Camacho
N-Butylbenzenesulfonamide	3622-84-2	Mice	14 days	Dosed-feed	Ongoing	Cynthia Rider
		Rats, mice	13 weeks	Dosed-feed	Ongoing	Cynthia Rider
Pentabromodiphenyl ether mixture [DE-71 (technical grade)]	32534-81-9	Rats	5 days	Gavage	Completed	William Gwinn
Perfluorohexanesulfonamide	41997-13-1	Rats	5 days	Gavage	Ongoing	Scott Auerbach
Perfluorooctanoic acid (PFOA)	335-67-1	Rats	5 days	Gavage	Completed	William Gwinn
Phenolic benzotriazoles (2-(2H-benzotriazol-2-yl)-4,6-bis(1-methyl-1-phenylethyl)phenol)	70321-86-7	Rats	14 days	Gavage	Ongoing	Rachel Dee
Phenolic benzotriazoles (2-(2H-benzotriazol-2-yl)-4,6-bis(1,1-dimethylpropyl)phenol)	25973-55-1	Rats	14 days	Gavage	Ongoing	Rachel Dee
Phenolic benzotriazoles (2-(2H-Benzotriazol-2-yl)-4-tert-butylphenol)	3147-76-0	Rats	14 days	Gavage	Ongoing	Rachel Dee

Test Article	CASRN*	Species	Length	Route	Status	Study Scientist
Phenolic benzotriazoles (2-(2H-Benzotriazol-2-yl)phenol)	10096-91-0	Rats	14 days	Gavage	Ongoing	Rachel Dee
Phenolic benzotriazoles (2-(5-Chloro-2H-benzotriazol-2-yl)-4,6-bis(1,1-dimethylethyl)phenol)	3864-99-1	Rats	14 days	Gavage	Ongoing	Rachel Dee
Phenolic benzotriazoles (3-(2H-benzotriazol-2-yl)-5-(1,1-dimethylethyl)-4-hydroxybenzenepropanoic acid, octyl ester)	84268-23-5	Rats	14 days	Gavage	Ongoing	Rachel Dee
Phenolic benzotriazoles (Bumetizole)	3896-11-5	Rats	14 days	Gavage	Ongoing	Rachel Dee
Phenolic benzotriazoles (Drometizole)	2440-22-4	Rats	14 days	Gavage	Ongoing	Rachel Dee
Phenolic benzotriazoles (Octrizole)	3147-75-9	Rats	14 days	Gavage	Ongoing	Rachel Dee
Pulegone	89-82-7	Rats	5 days	Gavage	Completed	William Gwinn
Resveratrol	501-36-0	Rats, mice	2 weeks, 13 weeks, 2 years	Gavage	Ongoing	Mimi Huang
Sodium metavanadate	13718-26-8	Rats, mice	90 days	Dosed-water	Ongoing	Georgia Roberts
Sodium tungstate dihydrate	10213-10-2	Rats, mice	13 weeks, 2 years	Dosed-water	Ongoing	Mamta Behl
Stachybotrys chartarum	67892-26-6	Mice	13 weeks	Inhalation	Ongoing	Dori Germolec
Stachybotrys chartarum strain 1 mold (macrocyclic trichothecene chemotype)	N/A	Mice	90 days	Inhalation	Ongoing	Dori Germolec
Sulfolane	126-33-0	Rats, mice	2 years	Dosed-water	Ongoing	Shannah Witchey
		Rats, mice, guinea pigs	28 days	Gavage	Ongoing	Shannah Witchey
Tetrabromobisphenol A	79-94-7	Rats	5 days	Gavage	Completed	William Gwinn
Tetrabromobisphenol A-bis(2,3-dibromopropyl ether)	21850-44-2	Rats	N/A	Gavage	Ongoing	June Dunnick
Thallium (I) sulfate	7446-18-6	Mice	2 weeks, 90 days	Dosed-water	Ongoing	Kelly Shipkowski
		Rats	GD 6 to PND 28, 90 days	Dosed-water	Ongoing	Kelly Shipkowski
Triclosan	3380-34-5	Rats	5 days	Gavage	Ongoing	William Gwinn
Tricombination ABC:DTG:3TC	N/A	Rats	3 months Subchronic	Gavage	Initiated	Vicki Sutherland
Trimethylsilyldiazomethane (TMSD)	18107-18-1	Rats, mice	1 or 5 days	Inhalation	Completed	William Gwinn
Triphenyl phosphate	115-86-6	Mice	2 weeks	Dosed-feed	Ongoing	Shannah Witchey
		Rats	3 months Subchronic	Dosed-feed	Initiated	Shannah Witchey
Tris(chloropropyl) phosphate (TCPP)	13674-84-5	Rats	5 days	Gavage	Completed	Kristen Ryan
		Rats, mice	90 days, 2 years	Dosed-feed	Ongoing	Kristen Ryan

Test Article	CASRN*	Species	Length	Route	Status	Study Scientist
Valerian (Valeriana officinalis L.) root extract	8057-49-6	Mice	90 days	Gavage	Ongoing	Nigel Walker
Vanadyl sulfate	27774-13-6	Rats, mice	90 days	Dosed-water	Ongoing	Georgia Roberts
Water disinfection byproducts (Bromodichloroacetic Acid)	71133-14-7	Rats	5 days	Gavage	Completed	William Gwinn

*CASRN = Chemical Abstracts Service Registry Number.

Toxicogenomic Studies

NTP is incorporating the latest toxicogenomic technologies, including nextgeneration (NextGen) sequencing, microarrays, and metabolomic analyses, into its testing program to gain further insights into the toxicity of environmental substances.

Toxicogenomics examines how the entire genetic structure, or genome, influences an organism's response to environmental toxicants.

Toxicogenomic Studies Ongoing in FY 2021

Test Article	CASRN*	Species/Cell Line	Route	Duration	Test Type (Platform)	Study Scientist
10:2 Fluorotelomer alcohol	865-86-10	Rat liver	Gavage	5 days	\$1500+ NextGen sequencing	Scott Auerbach
1-Methylfluorene	1730-37-6	Human hepatocyte cell line	In vitro	2 days	Cytotoxicity and gene expression by quantitative polymerase chain reaction	Cynthia Rider, Erik Tokar
2,3-Benzofluorene	243-17-4	Rat liver	Gavage	5 days	\$1500+ NextGen sequencing	Scott Auerbach
20-environmental NTP chemical compound test set	N/A	Rat plasma	Gavage	5 days	Metabolomics	David Crizer
2-Ethylhexyl diphenyl phosphate	1241-94-7	Rat liver	Gavage	5 days	Microarray (Affymetrix), metabolomics	Scott Auerbach, Mamta Behl
315-chemical compound test set (pharmaceuticals and environmental compounds)	N/A	Human hepatocyte HepaRG	In vitro	2 days	\$1500+ NextGen sequencing	Stephen Ferguson, Sreenivasa Ramaiahgari
6:1 Fluorotelomer alcohol	375-82-6	Rat liver	Gavage	5 days	\$1500+ NextGen sequencing	Scott Auerbach
9-Methylanthracene	779-02-2	Human hepatocyte cell line	In vitro	2 days	Cytotoxicity and gene expression by quantitative polymerase chain reaction	Cynthia Rider, Erik Tokar
Acenaphthenequinone	82-86-0	Human hepatocyte cell line	In vitro	2 days	Cytotoxicity and gene expression by quantitative polymerase chain reaction	Cynthia Rider, Erik Tokar
Aqueous Firefighting Foams	N/A	3D human HepaRG spheroids	In vitro	2 days	\$1500+ NextGen sequencing	Stephen Ferguson, Sreenivasa Ramaiahgari
Aflatoxin B1	1162-65-80	Rat liver	Oral	14-150 days	Exome-Seq	Julie Foley, Alex Merrick
		Mouse kidney cells	In vitro	4 days	RNA-Seq	Alex Merrick
Benzo(a)pyrene	50-32-8	Human hepatocyte cell line	In vitro	2 days	Cytotoxicity and gene expression by quantitative polymerase chain reaction	Cynthia Rider, Erik Tokar
Benzo[b]fluoranthene	205-99-2	Human hepatocyte cell line	In vitro	2 days	Cytotoxicity and gene expression by quantitative polymerase chain reaction	Cynthia Rider, Erik Tokar

Test Article	CASRN*	Species/Cell Line	Route	Duration	Test Type (Platform)	Study Scientist
Cisplatin	15663-27-1	Mouse kidney cells	In Vitro	4 days	RNA-seq	Alex Merrick
Developmental neurotoxicant library (~94 chemicals)	N/A	Human embryoid bodies, induced pluripotent stem cells	N/A	N/A	RNA-Seq	Erik Tokar
Dibenz[a,h]anthracene	53-70-3	Human hepatocyte cell line	In vitro	2 days	Cytotoxicity and gene expression by quantitative polymerase chain reaction	Cynthia Rider, Erik Tokar
Ginkgo biloba extract	90045-36-6	Rat	Gavage	5 days	Microarray (Affymetrix)	Cynthia Rider, Scott Auerbach
Hexafluoropropylene oxide (HFPO) dimer acid and its ammonium salt (referred to as GenX chemicals)	13252-13-6, 62037-80-3	Mouse liver, placenta	Gavage	E17.5 gestational exposure	Microarray	Sue Fenton
Isodecyl diphenyl phosphate	29761-21-5	Rat liver	Gavage	5 days	Microarray (Affymetrix), metabolomics	Scott Auerbach
Isopropylated phenol phosphate	68937-41-7	Rat liver	Gavage	5 days	Microarray (Affymetrix), metabolomics	Scott Auerbach
Time course	N/A	HepaRG	In vitro	1–21 days	\$1500+ NextGen sequencing	Steve Ferguson
N-ethyl-N-nitrosourea	759-73-9	Harlan Sprague Dawley rat	Tail vein, intravenous	Single injection; brain tumor model	RNA-Seq; miRNA-Seq; Exome-Seq	Arun Pandiri
PCB-11	2050-67-1	Rat hepatocytes, human hepatocyte HepaRG cells	In vitro	1 day	\$1500+ NextGen sequencing	Steve Ferguson
Perfluorohexanesulfonamide	41997-13-1	Rat liver	Gavage	5 days	\$1500+ NextGen sequencing	Scott Auerbach
Perinaphthenone	548-39-0	Human hepatocyte cell line	In vitro	2 days	Cytotoxicity and gene expression by quantitative polymerase chain reaction	Cynthia Rider, Erik Tokar
PFAS library (120 compounds)	N/A	Human HepaRG spheroids	In vitro	3 days	\$1500+ NextGen sequencing	Stephen Ferguson, Sreenivasa Ramaiahgari
PFOA	335-67-1	Mouse liver, placenta	Gavage	E17.5 gestational exposure	Microarray	Sue Fenton
Phenanthrene	85-01-8	Human hepatocyte cell line	In vitro	2 days	Cytotoxicity and gene expression by quantitative polymerase chain reaction	Cynthia Rider, Erik Tokar
Phenol, isopropylated, phosphate (3:1)	68937-41-7	DO mouse iPSC neuro-progenitor cells	In vitro	24 hours	RNA-Seq	Scott Auerbach
Pyrene	129-00-0	Human hepatocyte cell line	In vitro	2 days	Cytotoxicity and gene expression by quantitative polymerase chain reaction	Cynthia Rider, Erik Tokar
Tert-Butylphenyl diphenyl phosphate	56803-37-3	Rat liver	Gavage	5 days	Microarray (Affymetrix), metabolomics	Scott Auerbach

*CASRN = Chemical Abstracts Service Registry Number.