

Experiment Number: 20725 - 03
Test Type: CHRONIC
Route: RESPIRATORY EXPOSURE WHOLE BODY
Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
2,3-Butanedione
CAS Number: 431-03-8

Date Report Requested: 04/12/2016
Time Report Requested: 16:27:54
First Dose M/F: 08/17/09 / 08/17/09
Lab: BNW

F1_RE

NTP Study Number: C20725
Lock Date: 10/11/2012
Cage Range: ALL
Date Range: ALL
Reasons For Removal: ALL
Removal Date Range: ALL
Treatment Groups: Include ALL
Study Gender: Both
TDMSE Version: 3.0.2.3_002
PWG Approval Date: 01/15/2016

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**FOR ALL DOSES THE TUMOR RATES IN THE FOLLOWING TISSUES/ORGANS ARE BASED ON NUMBER OF TISSUES EXAMINED.
IN OTHER TISSUES/ORGANS RATES ARE BASED ON THE NUMBER OF ANIMALS NECROPSIED.**

Adrenal Cortex

Adrenal Medulla

Brain

Heart

Liver

Nose

Ovary

Pituitary Gland

Testes

Thyroid Gland

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SUMMARY OF STATISTICALLY SIGNIFICANT ($P \leq .05$) RESULTS IN THE ANALYSIS OF 2,3-BUTANEDIONE

MALE RATS

Organ

Nose
Testes
Thyroid Gland: C-Cell

All Organs

Morphology

Squamous Cell Carcinoma
Adenoma
Adenoma
Carcinoma or Adenoma
Malignant Lymphoma: Histiocytic, Lymphocytic, Mixed, NOS, or Undifferentiated Cell Type
Benign Tumors
Malignant and Benign Tumors

FEMALE RATS

Organ

Adrenal Medulla

Liver
Lymph Node, Mesenteric
Mammary Gland

Nose
Ovary
Skin
Uterus

All Organs

Morphology

Pheochromocytoma Benign
Pheochromocytoma: Benign, Complex, Malignant, NOS
Cholangioma
Hemangiosarcoma
Adenoma
Carcinoma
Squamous Cell Carcinoma
Sertoli Cell Tumor Benign
Hibernoma
Adenoma
Granular Cell Tumor Benign
Hemangiosarcoma
Hemangiosarcoma or Hemangioma

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**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Adrenal Cortex				
Adenoma				
TUMOR RATES				
OVERALL (a)	2/50 (4%)	2/50 (4%)	1/50 (2%)	1/50 (2%)
POLY-3 RATE (b)	2/44.79	2/45.52	1/43.05	1/39.40
POLY-3 PERCENT (g)	4.5%	4.4%	2.3%	2.5%
TERMINAL (d)	0/36 (0%)	1/37 (3%)	1/33 (3%)	1/22 (5%)
FIRST INCIDENCE	633	633	729 (T)	729 (T)
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.375N	P=0.688N	P=0.514N	P=0.545N
POLY 1.5	P=0.359N	P=0.690N	P=0.510N	P=0.522N
POLY 6	P=0.400N	P=0.689N	P=0.519N	P=0.581N
COCH-ARM / FISHERS	P=0.339N	P=0.691N	P=0.500N	P=0.500N
MAX-ISO-POLY-3	P=0.509N	P=0.493N	P=0.296N	P=0.329N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

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 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Adrenal Medulla				
Pheochromocytoma Benign				
TUMOR RATES				
OVERALL (a)	1/50 (2%)	3/50 (6%)	1/50 (2%)	3/50 (6%)
POLY-3 RATE (b)	1/44.45	3/45.17	1/43.05	3/39.83
POLY-3 PERCENT (g)	2.3%	6.6%	2.3%	7.5%
TERMINAL (d)	0/36 (0%)	3/37 (8%)	1/33 (3%)	1/22 (5%)
FIRST INCIDENCE	724	729 (T)	729 (T)	628
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.266	P=0.311	P=0.754	P=0.267
POLY 1.5	P=0.287	P=0.309	P=0.755	P=0.286
POLY 6	P=0.236	P=0.310	P=0.752	P=0.237
COCH-ARM / FISHERS	P=0.309	P=0.309	P=0.753N	P=0.309
MAX-ISO-POLY-3	P=0.227	P=0.160	P=0.490	P=0.141
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

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**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Adrenal Medulla				
Pheochromocytoma: Benign, Complex, Malignant, NOS				
TUMOR RATES				
OVERALL (a)	1/50 (2%)	3/50 (6%)	1/50 (2%)	3/50 (6%)
POLY-3 RATE (b)	1/44.45	3/45.17	1/43.05	3/39.83
POLY-3 PERCENT (g)	2.3%	6.6%	2.3%	7.5%
TERMINAL (d)	0/36 (0%)	3/37 (8%)	1/33 (3%)	1/22 (5%)
FIRST INCIDENCE	724	729 (T)	729 (T)	628
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.266	P=0.311	P=0.754	P=0.267
POLY 1.5	P=0.287	P=0.309	P=0.755	P=0.286
POLY 6	P=0.236	P=0.310	P=0.752	P=0.237
COCH-ARM / FISHERS	P=0.309	P=0.309	P=0.753N	P=0.309
MAX-ISO-POLY-3	P=0.227	P=0.160	P=0.490	P=0.141
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

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 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Brain				
Granular Cell Tumor Benign				
TUMOR RATES				
OVERALL (a)	3/50 (6%)	2/50 (4%)	2/50 (4%)	1/50 (2%)
POLY-3 RATE (b)	3/44.43	2/45.79	2/43.08	1/40.08
POLY-3 PERCENT (g)	6.8%	4.4%	4.6%	2.5%
TERMINAL (d)	3/36 (8%)	0/37 (0%)	1/33 (3%)	0/22 (0%)
FIRST INCIDENCE	729 (T)	603	722	499
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.267N	P=0.486N	P=0.514N	P=0.343N
POLY 1.5	P=0.250N	P=0.492N	P=0.512N	P=0.323N
POLY 6	P=0.294N	P=0.482N	P=0.518N	P=0.378N
COCH-ARM / FISHERS	P=0.231N	P=0.500N	P=0.500N	P=0.309N
MAX-ISO-POLY-3	P=0.310N	P=0.314N	P=0.338N	P=0.192N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

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**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Heart				
Schwannoma Malignant				
TUMOR RATES				
OVERALL (a)	0/50 (0%)	2/50 (4%)	1/50 (2%)	0/50 (0%)
POLY-3 RATE (b)	0/44.43	2/45.17	1/43.08	0/39.40
POLY-3 PERCENT (g)	0%	4.4%	2.3%	0%
TERMINAL (d)	0/36 (0%)	2/37 (5%)	0/33 (0%)	0/22 (0%)
FIRST INCIDENCE	---	729 (T)	722	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.509N	P=0.241	P=0.494	(e)
POLY 1.5	P=0.489N	P=0.239	P=0.495	(e)
POLY 6	P=0.542N	P=0.240	P=0.492	(e)
COCH-ARM / FISHERS	P=0.469N	P=0.247	P=0.500	(e)
MAX-ISO-POLY-3	P=0.361	P=0.080	P=0.158	(e)
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

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**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Liver				
Cholangioma				
TUMOR RATES				
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	0/44.43	0/45.17	0/43.05	0/39.40
POLY-3 PERCENT (g)	0%	0%	0%	0%
TERMINAL (d)	0/36 (0%)	0/37 (0%)	0/33 (0%)	0/22 (0%)
FIRST INCIDENCE	---	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

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 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Lymph Node, Mesenteric Hemangiosarcoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	2/50 (4%)	0/50 (0%)	1/50 (2%)	0/50 (0%)
POLY-3 RATE (b)	2/44.43	0/45.17	1/43.05	0/39.40
POLY-3 PERCENT (g)	4.5%	0%	2.3%	0%
TERMINAL (d)	2/36 (6%)	0/37 (0%)	1/33 (3%)	0/22 (0%)
FIRST INCIDENCE	729 (T)	---	729 (T)	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.198N	P=0.233N	P=0.511N	P=0.265N
POLY 1.5	P=0.191N	P=0.235N	P=0.509N	P=0.251N
POLY 6	P=0.205N	P=0.233N	P=0.514N	P=0.290N
COCH-ARM / FISHERS	P=0.184N	P=0.247N	P=0.500N	P=0.247N
MAX-ISO-POLY-3	P=0.112N	P=0.076N	P=0.293N	P=0.102N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

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**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Mammary Gland Adenoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	0/44.43	0/45.17	0/43.05	0/39.40
POLY-3 PERCENT (g)	0%	0%	0%	0%
TERMINAL (d)	0/36 (0%)	0/37 (0%)	0/33 (0%)	0/22 (0%)
FIRST INCIDENCE	---	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

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DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Mammary Gland Carcinoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	1/50 (2%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	1/44.43	0/45.17	0/43.05	0/39.40
POLY-3 PERCENT (g)	2.3%	0%	0%	0%
TERMINAL (d)	1/36 (3%)	0/37 (0%)	0/33 (0%)	0/22 (0%)
FIRST INCIDENCE	729 (T)	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

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**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Mammary Gland Carcinoma or Adenoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	1/50 (2%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	1/44.43	0/45.17	0/43.05	0/39.40
POLY-3 PERCENT (g)	2.3%	0%	0%	0%
TERMINAL (d)	1/36 (3%)	0/37 (0%)	0/33 (0%)	0/22 (0%)
FIRST INCIDENCE	729 (T)	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

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**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Mammary Gland Fibroadenoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	0/44.43	0/45.17	0/43.05	0/39.40
POLY-3 PERCENT (g)	0%	0%	0%	0%
TERMINAL (d)	0/36 (0%)	0/37 (0%)	0/33 (0%)	0/22 (0%)
FIRST INCIDENCE	---	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

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**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Mammary Gland				
Fibroma, Fibroadenoma or Adenoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	0/44.43	0/45.17	0/43.05	0/39.40
POLY-3 PERCENT (g)	0%	0%	0%	0%
TERMINAL (d)	0/36 (0%)	0/37 (0%)	0/33 (0%)	0/22 (0%)
FIRST INCIDENCE	---	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Mammary Gland				
Fibroma, Fibroadenoma, Carcinoma, or Adenoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	1/50 (2%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	1/44.43	0/45.17	0/43.05	0/39.40
POLY-3 PERCENT (g)	2.3%	0%	0%	0%
TERMINAL (d)	1/36 (3%)	0/37 (0%)	0/33 (0%)	0/22 (0%)
FIRST INCIDENCE	729 (T)	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Nose				
Squamous Cell Carcinoma				
TUMOR RATES				
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	3/50 (6%)
POLY-3 RATE (b)	0/44.43	0/45.17	0/43.05	3/40.01
POLY-3 PERCENT (g)	0%	0%	0%	7.5%
TERMINAL (d)	0/36 (0%)	0/37 (0%)	0/33 (0%)	1/22 (5%)
FIRST INCIDENCE	---	---	---	6/16
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.010**	(e)	(e)	P=0.101
POLY 1.5	P=0.010**	(e)	(e)	P=0.110
POLY 6	P=0.009**	(e)	(e)	P=0.088
COCH-ARM / FISHERS	P=0.012*	(e)	(e)	P=0.121
MAX-ISO-POLY-3	P=0.009**	(e)	(e)	P=0.037*
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Pituitary Gland: Pars Distalis or Unspecified Site Adenoma				
TUMOR RATES				
OVERALL (a)	9/50 (18%)	14/50 (28%)	9/50 (18%)	5/50 (10%)
POLY-3 RATE (b)	9/46.49	14/47.22	9/46.76	5/40.46
POLY-3 PERCENT (g)	19.4%	29.7%	19.3%	12.4%
TERMINAL (d)	4/36 (11%)	7/37 (19%)	1/33 (3%)	2/22 (9%)
FIRST INCIDENCE	379	600	527	616
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.141N	P=0.179	P=0.598N	P=0.277N
POLY 1.5	P=0.108N	P=0.172	P=0.596	P=0.236N
POLY 6	P=0.197N	P=0.188	P=0.581N	P=0.345N
COCH-ARM / FISHERS	P=0.077N	P=0.171	P=0.602N	P=0.194N
MAX-ISO-POLY-3	P=0.155N	P=0.125	P=0.494N	P=0.205N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Pituitary Gland: Pars Intermedia Adenoma				
TUMOR RATES				
OVERALL (a)	2/50 (4%)	1/50 (2%)	0/50 (0%)	1/50 (2%)
POLY-3 RATE (b)	2/44.77	1/45.28	0/43.05	1/39.92
POLY-3 PERCENT (g)	4.5%	2.2%	0%	2.5%
TERMINAL (d)	1/36 (3%)	0/37 (0%)	0/33 (0%)	0/22 (0%)
FIRST INCIDENCE	633	701	---	570
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.377N	P=0.496N	P=0.246N	P=0.540N
POLY 1.5	P=0.373N	P=0.498N	P=0.244N	P=0.520N
POLY 6	P=0.380N	P=0.498N	P=0.249N	P=0.573N
COCH-ARM / FISHERS	P=0.366N	P=0.500N	P=0.247N	P=0.500N
MAX-ISO-POLY-3	P=0.285N	P=0.278N	P=0.084N	P=0.323N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Skin				
Basal Cell Carcinoma, Basal Cell Adenoma, Basosquamous Tumor (benign, malignant or NOS), or Trichoepithelioma				
TUMOR RATES	#	#	#	#
OVERALL (a)	0/50 (0%)	2/50 (4%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	0/44.43	2/45.17	0/43.05	0/39.40
POLY-3 PERCENT (g)	0%	4.4%	0%	0%
TERMINAL (d)	0/36 (0%)	2/37 (5%)	0/33 (0%)	0/22 (0%)
FIRST INCIDENCE	---	729 (T)	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.435N	P=0.241	(e)	(e)
POLY 1.5	P=0.426N	P=0.239	(e)	(e)
POLY 6	P=0.451N	P=0.240	(e)	(e)
COCH-ARM / FISHERS	P=0.416N	P=0.247	(e)	(e)
MAX-ISO-POLY-3	P=0.301N	P=0.080	(e)	(e)
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Skin				
Basal or Sq. Cell Carcinoma, Carcinoma, Basosq. Tumor (M or B), Basal Cell Adenoma, Adenoma, Papilloma, Sq Papilloma, Keratoacanthoma, Trichoepithelioma				
TUMOR RATES	#	#	#	#
OVERALL (a)	3/50 (6%)	5/50 (10%)	2/50 (4%)	1/50 (2%)
POLY-3 RATE (b)	3/44.43	5/45.17	2/43.05	1/39.76
POLY-3 PERCENT (g)	6.8%	11.1%	4.7%	2.5%
TERMINAL (d)	3/36 (8%)	5/37 (14%)	2/33 (6%)	0/22 (0%)
FIRST INCIDENCE	729 (T)	729 (T)	729 (T)	628
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.173N	P=0.365	P=0.514N	P=0.346N
POLY 1.5	P=0.156N	P=0.362	P=0.512N	P=0.325N
POLY 6	P=0.202N	P=0.364	P=0.518N	P=0.382N
COCH-ARM / FISHERS	P=0.139N	P=0.357	P=0.500N	P=0.309N
MAX-ISO-POLY-3	P=0.210N	P=0.240	P=0.339N	P=0.195N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Skin				
Fibroma, Fibrosarcoma, Sarcoma, Myxoma, Myxosarcoma, or Fibrous Histiocytoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	2/50 (4%)	1/50 (2%)	0/50 (0%)	1/50 (2%)
POLY-3 RATE (b)	2/45.22	1/45.17	0/43.05	1/39.85
POLY-3 PERCENT (g)	4.4%	2.2%	0%	2.5%
TERMINAL (d)	1/36 (3%)	1/37 (3%)	0/33 (0%)	0/22 (0%)
FIRST INCIDENCE	432	729 (T)	---	599
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.377N	P=0.500N	P=0.248N	P=0.544N
POLY 1.5	P=0.374N	P=0.501N	P=0.246N	P=0.523N
POLY 6	P=0.380N	P=0.502N	P=0.251N	P=0.577N
COCH-ARM / FISHERS	P=0.366N	P=0.500N	P=0.247N	P=0.500N
MAX-ISO-POLY-3	P=0.291N	P=0.281N	P=0.087N	P=0.328N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Skin				
Hibernoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	0/44.43	0/45.17	0/43.05	0/39.40
POLY-3 PERCENT (g)	0%	0%	0%	0%
TERMINAL (d)	0/36 (0%)	0/37 (0%)	0/33 (0%)	0/22 (0%)
FIRST INCIDENCE	---	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
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Date Report Requested: 04/12/2016
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 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Skin				
Keratoacanthoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	3/50 (6%)	2/50 (4%)	1/50 (2%)	0/50 (0%)
POLY-3 RATE (b)	3/44.43	2/45.17	1/43.05	0/39.40
POLY-3 PERCENT (g)	6.8%	4.4%	2.3%	0%
TERMINAL (d)	3/36 (8%)	2/37 (5%)	1/33 (3%)	0/22 (0%)
FIRST INCIDENCE	729 (T)	729 (T)	729 (T)	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.073N	P=0.492N	P=0.316N	P=0.141N
POLY 1.5	P=0.068N	P=0.496N	P=0.315N	P=0.130N
POLY 6	P=0.082N	P=0.493N	P=0.319N	P=0.163N
COCH-ARM / FISHERS	P=0.062N	P=0.500N	P=0.309N	P=0.121N
MAX-ISO-POLY-3	P=0.092N	P=0.318N	P=0.166N	P=0.058N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTEs	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTEs	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
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 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Skin				
Squamous Cell Papilloma, Papilloma, Squamous Cell Carcinoma or Keratoacanthoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	3/50 (6%)	3/50 (6%)	2/50 (4%)	1/50 (2%)
POLY-3 RATE (b)	3/44.43	3/45.17	2/43.05	1/39.76
POLY-3 PERCENT (g)	6.8%	6.6%	4.7%	2.5%
TERMINAL (d)	3/36 (8%)	3/37 (8%)	2/33 (6%)	0/22 (0%)
FIRST INCIDENCE	729 (T)	729 (T)	729 (T)	628
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.231N	P=0.655N	P=0.514N	P=0.346N
POLY 1.5	P=0.214N	P=0.658N	P=0.512N	P=0.325N
POLY 6	P=0.259N	P=0.656N	P=0.518N	P=0.382N
COCH-ARM / FISHERS	P=0.195N	P=0.661N	P=0.500N	P=0.309N
MAX-ISO-POLY-3	P=0.337N	P=0.491N	P=0.339N	P=0.195N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTEs	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTEs	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Skin				
Squamous Cell Papilloma, Papilloma, or Keratoacanthoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	3/50 (6%)	3/50 (6%)	1/50 (2%)	0/50 (0%)
POLY-3 RATE (b)	3/44.43	3/45.17	1/43.05	0/39.40
POLY-3 PERCENT (g)	6.8%	6.6%	2.3%	0%
TERMINAL (d)	3/36 (8%)	3/37 (8%)	1/33 (3%)	0/22 (0%)
FIRST INCIDENCE	729 (T)	729 (T)	729 (T)	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.065N	P=0.655N	P=0.316N	P=0.141N
POLY 1.5	P=0.059N	P=0.658N	P=0.315N	P=0.130N
POLY 6	P=0.074N	P=0.656N	P=0.319N	P=0.163N
COCH-ARM / FISHERS	P=0.053N	P=0.661N	P=0.309N	P=0.121N
MAX-ISO-POLY-3	P=0.100N	P=0.491N	P=0.166N	P=0.058N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Stomach, Forestomach Squamous Cell Carcinoma or Papilloma Squamous				
TUMOR RATES	#	#	#	#
OVERALL (a)	0/50 (0%)	1/50 (2%)	2/50 (4%)	0/50 (0%)
POLY-3 RATE (b)	0/44.43	1/45.65	2/43.08	0/39.40
POLY-3 PERCENT (g)	0%	2.2%	4.6%	0%
TERMINAL (d)	0/36 (0%)	0/37 (0%)	1/33 (3%)	0/22 (0%)
FIRST INCIDENCE	---	586	722	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.621	P=0.505	P=0.230	(e)
POLY 1.5	P=0.642N	P=0.503	P=0.232	(e)
POLY 6	P=0.560	P=0.506	P=0.228	(e)
COCH-ARM / FISHERS	P=0.618N	P=0.500	P=0.247	(e)
MAX-ISO-POLY-3	P=0.349	P=0.165	P=0.076	(e)
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Testes				
Adenoma				
TUMOR RATES				
OVERALL (a)	3/50 (6%)	3/50 (6%)	0/50 (0%)	1/50 (2%)
POLY-3 RATE (b)	3/44.57	3/45.17	0/43.05	1/39.40
POLY-3 PERCENT (g)	6.7%	6.6%	0%	2.5%
TERMINAL (d)	2/36 (6%)	3/37 (8%)	0/33 (0%)	1/22 (5%)
FIRST INCIDENCE	694	729 (T)	---	729 (T)
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.152N	P=0.656N	P=0.125N	P=0.350N
POLY 1.5	P=0.145N	P=0.659N	P=0.124N	P=0.327N
POLY 6	P=0.163N	P=0.658N	P=0.127N	P=0.391N
COCH-ARM / FISHERS	P=0.136N	P=0.661N	P=0.121N	P=0.309N
MAX-ISO-POLY-3	P=0.187N	P=0.492N	P=0.043N*	P=0.200N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTEs	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTEs	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Thyroid Gland: C-Cell Adenoma				
TUMOR RATES				
OVERALL (a)	6/50 (12%)	5/50 (10%)	4/50 (8%)	1/50 (2%)
POLY-3 RATE (b)	6/44.84	5/45.17	4/43.11	1/39.40
POLY-3 PERCENT (g)	13.4%	11.1%	9.3%	2.5%
TERMINAL (d)	4/36 (11%)	5/37 (14%)	3/33 (9%)	1/22 (5%)
FIRST INCIDENCE	654	729 (T)	715	729 (T)
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.059N	P=0.495N	P=0.394N	P=0.079N
POLY 1.5	P=0.048N*	P=0.497N	P=0.388N	P=0.067N
POLY 6	P=0.079N	P=0.501N	P=0.404N	P=0.104N
COCH-ARM / FISHERS	P=0.039N*	P=0.500N	P=0.370N	P=0.056N
MAX-ISO-POLY-3	P=0.087N	P=0.369N	P=0.278N	P=0.044N*
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTEs	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTEs	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Thyroid Gland: C-Cell Carcinoma or Adenoma				
TUMOR RATES				
OVERALL (a)	6/50 (12%)	6/50 (12%)	5/50 (10%)	1/50 (2%)
POLY-3 RATE (b)	6/44.84	6/45.65	5/43.11	1/39.40
POLY-3 PERCENT (g)	13.4%	13.1%	11.6%	2.5%
TERMINAL (d)	4/36 (11%)	5/37 (14%)	4/33 (12%)	1/22 (5%)
FIRST INCIDENCE	654	586	715	729 (T)
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.064N	P=0.608N	P=0.528N	P=0.079N
POLY 1.5	P=0.051N	P=0.613N	P=0.521N	P=0.067N
POLY 6	P=0.091N	P=0.611N	P=0.539N	P=0.104N
COCH-ARM / FISHERS	P=0.040N*	P=0.620N	P=0.500N	P=0.056N
MAX-ISO-POLY-3	P=0.100N	P=0.486N	P=0.401N	P=0.044N*
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Thyroid Gland: Follicular Cell Adenoma				
TUMOR RATES				
OVERALL (a)	2/50 (4%)	1/50 (2%)	2/50 (4%)	0/50 (0%)
POLY-3 RATE (b)	2/44.43	1/45.58	2/43.05	0/39.40
POLY-3 PERCENT (g)	4.5%	2.2%	4.7%	0%
TERMINAL (d)	2/36 (6%)	0/37 (0%)	2/33 (6%)	0/22 (0%)
FIRST INCIDENCE	729 (T)	611	729 (T)	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.232N	P=0.491N	P=0.683	P=0.265N
POLY 1.5	P=0.216N	P=0.495N	P=0.685	P=0.251N
POLY 6	P=0.259N	P=0.489N	P=0.680	P=0.290N
COCH-ARM / FISHERS	P=0.198N	P=0.500N	P=0.691N	P=0.247N
MAX-ISO-POLY-3	P=0.206N	P=0.275N	P=0.487	P=0.102N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
Thyroid Gland: Follicular Cell Carcinoma or Adenoma				
TUMOR RATES				
OVERALL (a)	2/50 (4%)	1/50 (2%)	2/50 (4%)	0/50 (0%)
POLY-3 RATE (b)	2/44.43	1/45.58	2/43.05	0/39.40
POLY-3 PERCENT (g)	4.5%	2.2%	4.7%	0%
TERMINAL (d)	2/36 (6%)	0/37 (0%)	2/33 (6%)	0/22 (0%)
FIRST INCIDENCE	729 (T)	611	729 (T)	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.232N	P=0.491N	P=0.683	P=0.265N
POLY 1.5	P=0.216N	P=0.495N	P=0.685	P=0.251N
POLY 6	P=0.259N	P=0.489N	P=0.680	P=0.290N
COCH-ARM / FISHERS	P=0.198N	P=0.500N	P=0.691N	P=0.247N
MAX-ISO-POLY-3	P=0.206N	P=0.275N	P=0.487	P=0.102N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Hemangioma				
TUMOR RATES	#	#	#	#
OVERALL (a)	1/50 (2%)	0/50 (0%)	2/50 (4%)	1/50 (2%)
POLY-3 RATE (b)	1/44.56	0/45.17	2/43.05	1/39.48
POLY-3 PERCENT (g)	2.2%	0%	4.7%	2.5%
TERMINAL (d)	0/36 (0%)	0/37 (0%)	2/33 (6%)	0/22 (0%)
FIRST INCIDENCE	695	---	729 (T)	710
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.450	P=0.497N	P=0.488	P=0.733
POLY 1.5	P=0.478	P=0.498N	P=0.491	P=0.747
POLY 6	P=0.407	P=0.498N	P=0.484	P=0.708
COCH-ARM / FISHERS	P=0.505	P=0.500N	P=0.500	P=0.753N
MAX-ISO-POLY-3	P=0.387	P=0.158N	P=0.273	P=0.467
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Hemangiosarcoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	3/50 (6%)	2/50 (4%)	2/50 (4%)	0/50 (0%)
POLY-3 RATE (b)	3/44.43	2/45.17	2/43.05	0/39.40
POLY-3 PERCENT (g)	6.8%	4.4%	4.7%	0%
TERMINAL (d)	3/36 (8%)	2/37 (5%)	2/33 (6%)	0/22 (0%)
FIRST INCIDENCE	729 (T)	729 (T)	729 (T)	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.106N	P=0.492N	P=0.514N	P=0.141N
POLY 1.5	P=0.096N	P=0.496N	P=0.512N	P=0.130N
POLY 6	P=0.124N	P=0.493N	P=0.518N	P=0.163N
COCH-ARM / FISHERS	P=0.086N	P=0.500N	P=0.500N	P=0.121N
MAX-ISO-POLY-3	P=0.115N	P=0.318N	P=0.339N	P=0.058N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTEs	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTEs	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Hemangiosarcoma or Hemangioma				
TUMOR RATES	#	#	#	#
OVERALL (a)	4/50 (8%)	2/50 (4%)	4/50 (8%)	1/50 (2%)
POLY-3 RATE (b)	4/44.56	2/45.17	4/43.05	1/39.48
POLY-3 PERCENT (g)	9%	4.4%	9.3%	2.5%
TERMINAL (d)	3/36 (8%)	2/37 (5%)	4/33 (12%)	0/22 (0%)
FIRST INCIDENCE	695	729 (T)	729 (T)	710
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.232N	P=0.331N	P=0.625	P=0.217N
POLY 1.5	P=0.208N	P=0.334N	P=0.628	P=0.197N
POLY 6	P=0.272N	P=0.332N	P=0.618	P=0.253N
COCH-ARM / FISHERS	P=0.184N	P=0.339N	P=0.643N	P=0.181N
MAX-ISO-POLY-3	P=0.211N	P=0.197N	P=0.479	P=0.120N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTEs	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTEs	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Malignant Lymphoma: Histiocytic, Lymphocytic, Mixed, NOS, or Undifferentiated Cell Type				
TUMOR RATES	#	#	#	#
OVERALL (a)	3/50 (6%)	0/50 (0%)	3/50 (6%)	1/50 (2%)
POLY-3 RATE (b)	3/45.67	0/45.17	3/44.43	1/39.77
POLY-3 PERCENT (g)	6.6%	0%	6.8%	2.5%
TERMINAL (d)	1/36 (3%)	0/37 (0%)	1/33 (3%)	0/22 (0%)
FIRST INCIDENCE	523	---	325	626
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.412N	P=0.121N	P=0.650	P=0.356N
POLY 1.5	P=0.389N	P=0.120N	P=0.652	P=0.331N
POLY 6	P=0.443N	P=0.123N	P=0.644	P=0.397N
COCH-ARM / FISHERS	P=0.365N	P=0.121N	P=0.661N	P=0.309N
MAX-ISO-POLY-3	P=0.305N	P=0.040N*	P=0.486	P=0.206N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
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 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Mesothelioma: Benign, Malignant, NOS				
TUMOR RATES	#	#	#	#
OVERALL (a)	1/50 (2%)	2/50 (4%)	1/50 (2%)	2/50 (4%)
POLY-3 RATE (b)	1/44.43	2/45.28	1/43.05	2/39.92
POLY-3 PERCENT (g)	2.3%	4.4%	2.3%	5%
TERMINAL (d)	1/36 (3%)	1/37 (3%)	1/33 (3%)	1/22 (5%)
FIRST INCIDENCE	729 (T)	701	729 (T)	571
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.398	P=0.507	P=0.754	P=0.463
POLY 1.5	P=0.419	P=0.504	P=0.755	P=0.482
POLY 6	P=0.364	P=0.507	P=0.752	P=0.431
COCH-ARM / FISHERS	P=0.442	P=0.500	P=0.753N	P=0.500
MAX-ISO-POLY-3	P=0.419	P=0.288	P=0.490	P=0.260
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

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 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Mesothelioma: Malignant				
TUMOR RATES	#	#	#	#
OVERALL (a)	1/50 (2%)	2/50 (4%)	1/50 (2%)	2/50 (4%)
POLY-3 RATE (b)	1/44.43	2/45.28	1/43.05	2/39.92
POLY-3 PERCENT (g)	2.3%	4.4%	2.3%	5%
TERMINAL (d)	1/36 (3%)	1/37 (3%)	1/33 (3%)	1/22 (5%)
FIRST INCIDENCE	729 (T)	701	729 (T)	571
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.398	P=0.507	P=0.754	P=0.463
POLY 1.5	P=0.419	P=0.504	P=0.755	P=0.482
POLY 6	P=0.364	P=0.507	P=0.752	P=0.431
COCH-ARM / FISHERS	P=0.442	P=0.500	P=0.753N	P=0.500
MAX-ISO-POLY-3	P=0.419	P=0.288	P=0.490	P=0.260
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Benign Tumors				
TUMOR RATES	#	#	#	#
OVERALL (a)	27/50 (54%)	30/50 (60%)	22/50 (44%)	16/50 (32%)
POLY-3 RATE (b)	27/47.62	30/48.59	22/46.85	16/42.64
POLY-3 PERCENT (g)	56.7%	61.7%	47%	37.5%
TERMINAL (d)	17/36 (47%)	19/37 (51%)	12/33 (36%)	7/22 (32%)
FIRST INCIDENCE	379	586	527	499
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.017N*	P=0.384	P=0.228N	P=0.049N*
POLY 1.5	P=0.009N**	P=0.357	P=0.235N	P=0.031N*
POLY 6	P=0.040N*	P=0.413	P=0.223N	P=0.094N
COCH-ARM / FISHERS	P=0.005N**	P=0.343	P=0.212N	P=0.021N*
MAX-ISO-POLY-3	P=0.025N*	P=0.309	P=0.173N	P=0.037N*
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Malignant Tumors				
TUMOR RATES	#	#	#	#
OVERALL (a)	13/50 (26%)	12/50 (24%)	13/50 (26%)	11/50 (22%)
POLY-3 RATE (b)	13/46.95	12/46.37	13/45.19	11/42.61
POLY-3 PERCENT (g)	27.7%	25.9%	28.8%	25.8%
TERMINAL (d)	8/36 (22%)	8/37 (22%)	8/33 (24%)	2/22 (9%)
FIRST INCIDENCE	432	586	325	549
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.494N	P=0.514N	P=0.546	P=0.515N
POLY 1.5	P=0.440N	P=0.511N	P=0.558	P=0.464N
POLY 6	P=0.515	P=0.523N	P=0.530	P=0.589N
COCH-ARM / FISHERS	P=0.379N	P=0.500N	P=0.590N	P=0.408N
MAX-ISO-POLY-3	P=0.656N	P=0.420N	P=0.454	P=0.422N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Males			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Malignant and Benign Tumors				
TUMOR RATES	#	#	#	#
OVERALL (a)	35/50 (70%)	36/50 (72%)	30/50 (60%)	22/50 (44%)
POLY-3 RATE (b)	35/50.00	36/49.01	30/48.96	22/44.65
POLY-3 PERCENT (g)	70%	73.5%	61.3%	49.3%
TERMINAL (d)	21/36 (58%)	24/37 (65%)	16/33 (49%)	8/22 (36%)
FIRST INCIDENCE	379	586	325	499
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.010N**	P=0.438	P=0.242N	P=0.028N*
POLY 1.5	P=0.004N**	P=0.444	P=0.241N	P=0.015N*
POLY 6	P=0.027N*	P=0.437	P=0.244N	P=0.064N
COCH-ARM / FISHERS	P=0.002N**	P=0.500	P=0.201N	P=0.007N**
MAX-ISO-POLY-3	P=0.014N*	P=0.353	P=0.184N	P=0.022N*
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Adrenal Cortex				
Adenoma				
TUMOR RATES				
OVERALL (a)	1/50 (2%)	0/50 (0%)	1/50 (2%)	1/50 (2%)
POLY-3 RATE (b)	1/43.58	0/43.03	1/40.02	1/43.50
POLY-3 PERCENT (g)	2.3%	0%	2.5%	2.3%
TERMINAL (d)	1/34 (3%)	0/31 (0%)	1/24 (4%)	1/30 (3%)
FIRST INCIDENCE	731 (T)	---	731 (T)	731 (T)
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Adrenal Medulla				
Pheochromocytoma Benign				
TUMOR RATES				
OVERALL (a)	3/50 (6%)	0/50 (0%)	0/49 (0%)	0/50 (0%)
POLY-3 RATE (b)	3/44.03	0/43.03	0/39.02	0/43.50
POLY-3 PERCENT (g)	6.8%	0%	0%	0%
TERMINAL (d)	2/34 (6%)	0/31 (0%)	0/23 (0%)	0/30 (0%)
FIRST INCIDENCE	599	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.044N*	P=0.123N	P=0.141N	P=0.121N
POLY 1.5	P=0.044N*	P=0.122N	P=0.133N	P=0.119N
POLY 6	P=0.045N*	P=0.123N	P=0.151N	P=0.123N
COCH-ARM / FISHERS	P=0.046N*	P=0.121N	P=0.125N	P=0.121N
MAX-ISO-POLY-3	P=0.010N**	P=0.041N*	P=0.057N	P=0.040N*
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Adrenal Medulla				
Pheochromocytoma: Benign, Complex, Malignant, NOS				
TUMOR RATES				
OVERALL (a)	3/50 (6%)	0/50 (0%)	0/49 (0%)	1/50 (2%)
POLY-3 RATE (b)	3/44.03	0/43.03	0/39.02	1/43.58
POLY-3 PERCENT (g)	6.8%	0%	0%	2.3%
TERMINAL (d)	2/34 (6%)	0/31 (0%)	0/23 (0%)	0/30 (0%)
FIRST INCIDENCE	599	---	---	711
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.244N	P=0.123N	P=0.141N	P=0.309N
POLY 1.5	P=0.242N	P=0.122N	P=0.133N	P=0.306N
POLY 6	P=0.246N	P=0.123N	P=0.151N	P=0.314N
COCH-ARM / FISHERS	P=0.243N	P=0.121N	P=0.125N	P=0.309N
MAX-ISO-POLY-3	P=0.046N*	P=0.041N*	P=0.057N	P=0.158N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Brain				
Granular Cell Tumor Benign				
TUMOR RATES				
OVERALL (a)	1/50 (2%)	2/50 (4%)	1/50 (2%)	1/50 (2%)
POLY-3 RATE (b)	1/43.89	2/43.08	1/40.02	1/43.53
POLY-3 PERCENT (g)	2.3%	4.6%	2.5%	2.3%
TERMINAL (d)	0/34 (0%)	1/31 (3%)	1/24 (4%)	0/30 (0%)
FIRST INCIDENCE	647	718	731 (T)	725
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.541N	P=0.494	P=0.740	P=0.759
POLY 1.5	P=0.536N	P=0.495	P=0.749	P=0.761N
POLY 6	P=0.548N	P=0.493	P=0.730	P=0.756
COCH-ARM / FISHERS	P=0.534N	P=0.500	P=0.753N	P=0.753N
MAX-ISO-POLY-3	P=0.588N	P=0.277	P=0.474	P=0.497
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Heart				
Schwannoma Malignant				
TUMOR RATES				
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	0/43.58	0/43.03	0/40.02	0/43.50
POLY-3 PERCENT (g)	0%	0%	0%	0%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	0/24 (0%)	0/30 (0%)
FIRST INCIDENCE	---	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Liver				
Cholangioma				
TUMOR RATES				
OVERALL (a)	3/50 (6%)	1/50 (2%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	3/43.99	1/43.03	0/40.02	0/43.50
POLY-3 PERCENT (g)	6.8%	2.3%	0%	0%
TERMINAL (d)	2/34 (6%)	1/31 (3%)	0/24 (0%)	0/30 (0%)
FIRST INCIDENCE	614	731 (T)	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.043N*	P=0.313N	P=0.136N	P=0.120N
POLY 1.5	P=0.043N*	P=0.311N	P=0.129N	P=0.119N
POLY 6	P=0.044N*	P=0.314N	P=0.145N	P=0.123N
COCH-ARM / FISHERS	P=0.043N*	P=0.309N	P=0.121N	P=0.121N
MAX-ISO-POLY-3	P=0.024N*	P=0.162N	P=0.053N	P=0.039N*
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Lymph Node, Mesenteric Hemangiosarcoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	2/50 (4%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	2/43.58	0/43.03	0/40.02	0/43.50
POLY-3 PERCENT (g)	4.6%	0%	0%	0%
TERMINAL (d)	2/34 (6%)	0/31 (0%)	0/24 (0%)	0/30 (0%)
FIRST INCIDENCE	731 (T)	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.112N	P=0.240N	P=0.256N	P=0.237N
POLY 1.5	P=0.111N	P=0.240N	P=0.248N	P=0.236N
POLY 6	P=0.113N	P=0.239N	P=0.265N	P=0.239N
COCH-ARM / FISHERS	P=0.112N	P=0.247N	P=0.247N	P=0.247N
MAX-ISO-POLY-3	P=0.033N*	P=0.078N	P=0.094N	P=0.076N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Mammary Gland Adenoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	5/50 (10%)	3/50 (6%)	2/50 (4%)	1/50 (2%)
POLY-3 RATE (b)	5/44.57	3/43.20	2/40.02	1/44.09
POLY-3 PERCENT (g)	11.2%	6.9%	5%	2.3%
TERMINAL (d)	2/34 (6%)	2/31 (7%)	2/24 (8%)	0/30 (0%)
FIRST INCIDENCE	614	687	731 (T)	544
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.065N	P=0.373N	P=0.261N	P=0.103N
POLY 1.5	P=0.063N	P=0.369N	P=0.242N	P=0.101N
POLY 6	P=0.068N	P=0.379N	P=0.285N	P=0.107N
COCH-ARM / FISHERS	P=0.064N	P=0.357N	P=0.218N	P=0.102N
MAX-ISO-POLY-3	P=0.063N	P=0.248N	P=0.163N	P=0.046N*
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Mammary Gland Carcinoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	4/50 (8%)	4/50 (8%)	1/50 (2%)	9/50 (18%)
POLY-3 RATE (b)	4/44.44	4/43.84	1/40.02	9/45.45
POLY-3 PERCENT (g)	9%	9.1%	2.5%	19.8%
TERMINAL (d)	2/34 (6%)	3/31 (10%)	1/24 (4%)	4/30 (13%)
FIRST INCIDENCE	599	418	731 (T)	491
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.053	P=0.636	P=0.212N	P=0.123
POLY 1.5	P=0.054	P=0.638	P=0.197N	P=0.122
POLY 6	P=0.052	P=0.633	P=0.228N	P=0.122
COCH-ARM / FISHERS	P=0.056	P=0.643N	P=0.181N	P=0.117
MAX-ISO-POLY-3	P=0.032*	P=0.491	P=0.115N	P=0.073
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Mammary Gland Carcinoma or Adenoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	8/50 (16%)	7/50 (14%)	3/50 (6%)	10/50 (20%)
POLY-3 RATE (b)	8/45.01	7/44.01	3/40.02	10/46.03
POLY-3 PERCENT (g)	17.8%	15.9%	7.5%	21.7%
TERMINAL (d)	4/34 (12%)	5/31 (16%)	3/24 (13%)	4/30 (13%)
FIRST INCIDENCE	599	418	731 (T)	491
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.344	P=0.519N	P=0.138N	P=0.417
POLY 1.5	P=0.345	P=0.513N	P=0.120N	P=0.414
POLY 6	P=0.340	P=0.529N	P=0.163N	P=0.415
COCH-ARM / FISHERS	P=0.339	P=0.500N	P=0.100N	P=0.398
MAX-ISO-POLY-3	P=0.246	P=0.406N	P=0.091N	P=0.320
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Mammary Gland Fibroadenoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	13/50 (26%)	13/50 (26%)	12/50 (24%)	11/50 (22%)
POLY-3 RATE (b)	13/45.24	13/43.39	12/40.92	11/44.89
POLY-3 PERCENT (g)	28.7%	30%	29.3%	24.5%
TERMINAL (d)	8/34 (24%)	12/31 (39%)	7/24 (29%)	5/30 (17%)
FIRST INCIDENCE	561	630	442	544
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.341N	P=0.542	P=0.571	P=0.414N
POLY 1.5	P=0.333N	P=0.559	P=0.566N	P=0.406N
POLY 6	P=0.357N	P=0.522	P=0.509	P=0.430N
COCH-ARM / FISHERS	P=0.339N	P=0.590N	P=0.500N	P=0.408N
MAX-ISO-POLY-3	P=0.483N	P=0.449	P=0.476	P=0.325N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Mammary Gland Fibroma, Fibroadenoma or Adenoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	15/50 (30%)	15/50 (30%)	14/50 (28%)	11/50 (22%)
POLY-3 RATE (b)	15/46.05	15/43.56	14/40.92	11/44.89
POLY-3 PERCENT (g)	32.6%	34.4%	34.2%	24.5%
TERMINAL (d)	8/34 (24%)	13/31 (42%)	9/24 (38%)	5/30 (17%)
FIRST INCIDENCE	561	630	442	544
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.202N	P=0.515	P=0.526	P=0.267N
POLY 1.5	P=0.190N	P=0.541	P=0.585N	P=0.253N
POLY 6	P=0.225N	P=0.480	P=0.441	P=0.292N
COCH-ARM / FISHERS	P=0.189N	P=0.586N	P=0.500N	P=0.247N
MAX-ISO-POLY-3	P=0.272N	P=0.426	P=0.437	P=0.200N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Mammary Gland				
Fibroma, Fibroadenoma, Carcinoma, or Adenoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	15/50 (30%)	17/50 (34%)	15/50 (30%)	18/50 (36%)
POLY-3 RATE (b)	15/46.05	17/44.37	15/40.92	18/46.46
POLY-3 PERCENT (g)	32.6%	38.3%	36.7%	38.7%
TERMINAL (d)	8/34 (24%)	14/31 (45%)	10/24 (42%)	9/30 (30%)
FIRST INCIDENCE	561	418	442	491
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.337	P=0.362	P=0.431	P=0.343
POLY 1.5	P=0.343	P=0.382	P=0.501	P=0.347
POLY 6	P=0.322	P=0.333	P=0.345	P=0.330
COCH-ARM / FISHERS	P=0.331	P=0.415	P=0.586N	P=0.335
MAX-ISO-POLY-3	P=0.425	P=0.287	P=0.351	P=0.269
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Nose				
Squamous Cell Carcinoma				
TUMOR RATES				
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	3/50 (6%)
POLY-3 RATE (b)	0/43.58	0/43.03	0/40.02	3/43.53
POLY-3 PERCENT (g)	0%	0%	0%	6.9%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	0/24 (0%)	2/30 (7%)
FIRST INCIDENCE	---	---	---	724
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.011*	(e)	(e)	P=0.118
POLY 1.5	P=0.011*	(e)	(e)	P=0.119
POLY 6	P=0.010**	(e)	(e)	P=0.116
COCH-ARM / FISHERS	P=0.012*	(e)	(e)	P=0.121
MAX-ISO-POLY-3	P=0.009**	(e)	(e)	P=0.038*
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Ovary				
Granulosa Cell Tumor Malignant				
TUMOR RATES				
OVERALL (a)	0/50 (0%)	1/50 (2%)	2/50 (4%)	0/50 (0%)
POLY-3 RATE (b)	0/43.58	1/43.08	2/40.80	0/43.50
POLY-3 PERCENT (g)	0%	2.3%	4.9%	0%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	0/24 (0%)	0/30 (0%)
FIRST INCIDENCE	---	718	520	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.618N	P=0.498	P=0.222	(e)
POLY 1.5	P=0.616N	P=0.498	P=0.229	(e)
POLY 6	P=0.623N	P=0.498	P=0.217	(e)
COCH-ARM / FISHERS	P=0.618N	P=0.500	P=0.247	(e)
MAX-ISO-POLY-3	P=0.319	P=0.158	P=0.075	(e)
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Ovary				
Sertoli Cell Tumor Benign				
TUMOR RATES				
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	2/50 (4%)
POLY-3 RATE (b)	0/43.58	0/43.03	0/40.02	2/43.67
POLY-3 PERCENT (g)	0%	0%	0%	4.6%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	0/24 (0%)	1/30 (3%)
FIRST INCIDENCE	---	---	---	687
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.046*	(e)	(e)	P=0.237
POLY 1.5	P=0.046*	(e)	(e)	P=0.238
POLY 6	P=0.045*	(e)	(e)	P=0.236
COCH-ARM / FISHERS	P=0.047*	(e)	(e)	P=0.247
MAX-ISO-POLY-3	P=0.033*	(e)	(e)	P=0.076
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
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 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Pituitary Gland: Pars Distalis or Unspecified Site Adenoma				
TUMOR RATES				
OVERALL (a)	26/50 (52%)	24/50 (48%)	24/50 (48%)	23/50 (46%)
POLY-3 RATE (b)	26/48.86	24/47.30	24/46.55	23/46.91
POLY-3 PERCENT (g)	53.2%	50.7%	51.6%	49%
TERMINAL (d)	14/34 (41%)	9/31 (29%)	9/24 (38%)	10/30 (33%)
FIRST INCIDENCE	253	418	361	537
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.389N	P=0.485N	P=0.517N	P=0.418N
POLY 1.5	P=0.359N	P=0.476N	P=0.480N	P=0.390N
POLY 6	P=0.426N	P=0.480N	P=0.556N	P=0.448N
COCH-ARM / FISHERS	P=0.324N	P=0.421N	P=0.421N	P=0.345N
MAX-ISO-POLY-3	P=0.542N	P=0.404N	P=0.435N	P=0.343N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
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 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Pituitary Gland: Pars Intermedia Adenoma				
TUMOR RATES				
OVERALL (a)	1/50 (2%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	1/43.99	0/43.03	0/40.02	0/43.50
POLY-3 PERCENT (g)	2.3%	0%	0%	0%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	0/24 (0%)	0/30 (0%)
FIRST INCIDENCE	614	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTEs	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTEs	(n)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
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 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Skin				
Basal Cell Carcinoma, Basal Cell Adenoma, Basosquamous Tumor (benign, malignant or NOS), or Trichoepithelioma				
TUMOR RATES	#	#	#	#
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	0/43.58	0/43.03	0/40.02	0/43.50
POLY-3 PERCENT (g)	0%	0%	0%	0%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	0/24 (0%)	0/30 (0%)
FIRST INCIDENCE	---	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

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 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Skin				
Basal or Sq. Cell Carcinoma, Carcinoma, Basosq. Tumor (M or B), Basal Cell Adenoma, Adenoma, Papilloma, Sq Papilloma, Keratoacanthoma, Trichoepithelioma				
TUMOR RATES	#	#	#	#
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	0/43.58	0/43.03	0/40.02	0/43.50
POLY-3 PERCENT (g)	0%	0%	0%	0%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	0/24 (0%)	0/30 (0%)
FIRST INCIDENCE	---	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

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 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Skin				
Fibroma, Fibrosarcoma, Sarcoma, Myxoma, Myxosarcoma, or Fibrous Histiocytoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	0/43.58	0/43.03	0/40.02	0/43.50
POLY-3 PERCENT (g)	0%	0%	0%	0%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	0/24 (0%)	0/30 (0%)
FIRST INCIDENCE	---	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

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 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Skin				
Hibernoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	2/50 (4%)
POLY-3 RATE (b)	0/43.58	0/43.03	0/40.02	2/43.50
POLY-3 PERCENT (g)	0%	0%	0%	4.6%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	0/24 (0%)	2/30 (7%)
FIRST INCIDENCE	---	---	---	731 (T)
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.045*	(e)	(e)	P=0.237
POLY 1.5	P=0.046*	(e)	(e)	P=0.238
POLY 6	P=0.045*	(e)	(e)	P=0.234
COCH-ARM / FISHERS	P=0.047*	(e)	(e)	P=0.247
MAX-ISO-POLY-3	P=0.032*	(e)	(e)	P=0.076
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Skin				
Keratoacanthoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	0/43.58	0/43.03	0/40.02	0/43.50
POLY-3 PERCENT (g)	0%	0%	0%	0%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	0/24 (0%)	0/30 (0%)
FIRST INCIDENCE	---	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Skin				
Squamous Cell Papilloma, Papilloma, Squamous Cell Carcinoma or Keratoacanthoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	0/43.58	0/43.03	0/40.02	0/43.50
POLY-3 PERCENT (g)	0%	0%	0%	0%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	0/24 (0%)	0/30 (0%)
FIRST INCIDENCE	---	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Skin				
Squamous Cell Papilloma, Papilloma, or Keratoacanthoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	0/43.58	0/43.03	0/40.02	0/43.50
POLY-3 PERCENT (g)	0%	0%	0%	0%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	0/24 (0%)	0/30 (0%)
FIRST INCIDENCE	---	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
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 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Stomach, Forestomach Squamous Cell Carcinoma or Papilloma Squamous				
TUMOR RATES	#	#	#	#
OVERALL (a)	1/50 (2%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	1/43.58	0/43.03	0/40.02	0/43.50
POLY-3 PERCENT (g)	2.3%	0%	0%	0%
TERMINAL (d)	1/34 (3%)	0/31 (0%)	0/24 (0%)	0/30 (0%)
FIRST INCIDENCE	731 (T)	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Thyroid Gland: C-Cell Adenoma				
TUMOR RATES				
OVERALL (a)	2/50 (4%)	4/50 (8%)	3/50 (6%)	3/50 (6%)
POLY-3 RATE (b)	2/43.58	4/43.20	3/40.08	3/43.50
POLY-3 PERCENT (g)	4.6%	9.3%	7.5%	6.9%
TERMINAL (d)	2/34 (6%)	3/31 (10%)	1/24 (4%)	3/30 (10%)
FIRST INCIDENCE	731 (T)	687	723	731 (T)
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.493	P=0.333	P=0.462	P=0.499
POLY 1.5	P=0.498	P=0.333	P=0.478	P=0.502
POLY 6	P=0.484	P=0.335	P=0.446	P=0.494
COCH-ARM / FISHERS	P=0.497	P=0.339	P=0.500	P=0.500
MAX-ISO-POLY-3	P=0.438	P=0.198	P=0.297	P=0.323
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Thyroid Gland: C-Cell Carcinoma or Adenoma				
TUMOR RATES				
OVERALL (a)	3/50 (6%)	4/50 (8%)	3/50 (6%)	3/50 (6%)
POLY-3 RATE (b)	3/43.58	4/43.20	3/40.08	3/43.50
POLY-3 PERCENT (g)	6.9%	9.3%	7.5%	6.9%
TERMINAL (d)	3/34 (9%)	3/31 (10%)	1/24 (4%)	3/30 (10%)
FIRST INCIDENCE	731 (T)	687	723	731 (T)
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.527N	P=0.495	P=0.624	P=0.662
POLY 1.5	P=0.522N	P=0.495	P=0.640	P=0.661N
POLY 6	P=0.537N	P=0.498	P=0.607	P=0.658
COCH-ARM / FISHERS	P=0.522N	P=0.500	P=0.661N	P=0.661N
MAX-ISO-POLY-3	P=0.647N	P=0.343	P=0.458	P=0.498
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Thyroid Gland: Follicular Cell Adenoma				
TUMOR RATES				
OVERALL (a)	2/50 (4%)	4/50 (8%)	1/50 (2%)	0/50 (0%)
POLY-3 RATE (b)	2/43.99	4/43.03	1/40.02	0/43.50
POLY-3 PERCENT (g)	4.6%	9.3%	2.5%	0%
TERMINAL (d)	1/34 (3%)	4/31 (13%)	1/24 (4%)	0/30 (0%)
FIRST INCIDENCE	614	731 (T)	731 (T)	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.092N	P=0.327	P=0.533N	P=0.239N
POLY 1.5	P=0.089N	P=0.329	P=0.519N	P=0.237N
POLY 6	P=0.096N	P=0.324	P=0.548N	P=0.243N
COCH-ARM / FISHERS	P=0.089N	P=0.339	P=0.500N	P=0.247N
MAX-ISO-POLY-3	P=0.077N	P=0.195	P=0.316N	P=0.078N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTEs	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTEs	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Thyroid Gland: Follicular Cell Carcinoma or Adenoma				
TUMOR RATES				
OVERALL (a)	2/50 (4%)	5/50 (10%)	1/50 (2%)	0/50 (0%)
POLY-3 RATE (b)	2/43.99	5/43.03	1/40.02	0/43.50
POLY-3 PERCENT (g)	4.6%	11.6%	2.5%	0%
TERMINAL (d)	1/34 (3%)	5/31 (16%)	1/24 (4%)	0/30 (0%)
FIRST INCIDENCE	614	731 (T)	731 (T)	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.077N	P=0.206	P=0.533N	P=0.239N
POLY 1.5	P=0.074N	P=0.209	P=0.519N	P=0.237N
POLY 6	P=0.081N	P=0.204	P=0.548N	P=0.243N
COCH-ARM / FISHERS	P=0.075N	P=0.218	P=0.500N	P=0.247N
MAX-ISO-POLY-3	P=0.054N	P=0.115	P=0.316N	P=0.078N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTEs	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTEs	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Uterus				
Adenoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	2/50 (4%)
POLY-3 RATE (b)	0/43.58	0/43.03	0/40.02	2/43.50
POLY-3 PERCENT (g)	0%	0%	0%	4.6%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	0/24 (0%)	2/30 (7%)
FIRST INCIDENCE	---	---	---	731 (T)
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.045*	(e)	(e)	P=0.237
POLY 1.5	P=0.046*	(e)	(e)	P=0.238
POLY 6	P=0.045*	(e)	(e)	P=0.234
COCH-ARM / FISHERS	P=0.047*	(e)	(e)	P=0.247
MAX-ISO-POLY-3	P=0.032*	(e)	(e)	P=0.076
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Uterus Carcinoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	2/50 (4%)	4/50 (8%)	2/50 (4%)	3/50 (6%)
POLY-3 RATE (b)	2/43.58	4/43.26	2/40.02	3/43.75
POLY-3 PERCENT (g)	4.6%	9.3%	5%	6.9%
TERMINAL (d)	2/34 (6%)	2/31 (7%)	2/24 (8%)	1/30 (3%)
FIRST INCIDENCE	731 (T)	687	731 (T)	687
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.515	P=0.333	P=0.663	P=0.502
POLY 1.5	P=0.518	P=0.333	P=0.676	P=0.503
POLY 6	P=0.510	P=0.336	P=0.650	P=0.500
COCH-ARM / FISHERS	P=0.517	P=0.339	P=0.691N	P=0.500
MAX-ISO-POLY-3	P=0.505	P=0.198	P=0.466	P=0.325
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
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 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Uterus				
Granular Cell Tumor Benign				
TUMOR RATES	#	#	#	#
OVERALL (a)	0/50 (0%)	3/50 (6%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	0/43.58	3/43.39	0/40.02	0/43.50
POLY-3 PERCENT (g)	0%	6.9%	0%	0%
TERMINAL (d)	0/34 (0%)	2/31 (7%)	0/24 (0%)	0/30 (0%)
FIRST INCIDENCE	---	630	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.328N	P=0.118	(e)	(e)
POLY 1.5	P=0.325N	P=0.117	(e)	(e)
POLY 6	P=0.332N	P=0.119	(e)	(e)
COCH-ARM / FISHERS	P=0.324N	P=0.121	(e)	(e)
MAX-ISO-POLY-3	P=0.166N	P=0.038*	(e)	(e)
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

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 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Uterus				
Polyp Stromal				
TUMOR RATES	#	#	#	#
OVERALL (a)	9/50 (18%)	13/50 (26%)	7/50 (14%)	13/50 (26%)
POLY-3 RATE (b)	9/44.42	13/45.89	7/40.50	13/44.73
POLY-3 PERCENT (g)	20.3%	28.3%	17.3%	29.1%
TERMINAL (d)	6/34 (18%)	6/31 (19%)	6/24 (25%)	9/30 (30%)
FIRST INCIDENCE	614	409	589	491
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.277	P=0.259	P=0.471N	P=0.236
POLY 1.5	P=0.289	P=0.245	P=0.437N	P=0.240
POLY 6	P=0.257	P=0.278	P=0.509N	P=0.227
COCH-ARM / FISHERS	P=0.294	P=0.235	P=0.393N	P=0.235
MAX-ISO-POLY-3	P=0.262	P=0.190	P=0.368N	P=0.168
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

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 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Uterus				
Sarcoma Stromal				
TUMOR RATES	#	#	#	#
OVERALL (a)	1/50 (2%)	0/50 (0%)	3/50 (6%)	0/50 (0%)
POLY-3 RATE (b)	1/44.08	0/43.03	3/41.03	0/43.50
POLY-3 PERCENT (g)	2.3%	0%	7.3%	0%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	1/24 (4%)	0/30 (0%)
FIRST INCIDENCE	579	---	516	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.495N	P=0.505N	P=0.280	P=0.503N
POLY 1.5	P=0.491N	P=0.504N	P=0.290	P=0.501N
POLY 6	P=0.501N	P=0.506N	P=0.270	P=0.506N
COCH-ARM / FISHERS	P=0.495N	P=0.500N	P=0.309	P=0.500N
MAX-ISO-POLY-3	P=0.264N	P=0.165N	P=0.145	P=0.162N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
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 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Uterus				
Sarcoma Stromal or Polyp Stromal				
TUMOR RATES	#	#	#	#
OVERALL (a)	10/50 (20%)	13/50 (26%)	9/50 (18%)	13/50 (26%)
POLY-3 RATE (b)	10/44.92	13/45.89	9/41.51	13/44.73
POLY-3 PERCENT (g)	22.3%	28.3%	21.7%	29.1%
TERMINAL (d)	6/34 (18%)	6/31 (19%)	6/24 (25%)	9/30 (30%)
FIRST INCIDENCE	579	409	516	491
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.328	P=0.336	P=0.577N	P=0.310
POLY 1.5	P=0.344	P=0.325	P=0.544N	P=0.319
POLY 6	P=0.301	P=0.353	P=0.595	P=0.294
COCH-ARM / FISHERS	P=0.351	P=0.318	P=0.500N	P=0.318
MAX-ISO-POLY-3	P=0.369	P=0.256	P=0.474N	P=0.231
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
Uterus				
Schwannoma Malignant				
TUMOR RATES	#	#	#	#
OVERALL (a)	1/50 (2%)	2/50 (4%)	4/50 (8%)	2/50 (4%)
POLY-3 RATE (b)	1/43.92	2/43.87	4/41.28	2/43.85
POLY-3 PERCENT (g)	2.3%	4.6%	9.7%	4.6%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	0/24 (0%)	1/30 (3%)
FIRST INCIDENCE	635	418	528	633
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.386	P=0.500	P=0.160	P=0.499
POLY 1.5	P=0.390	P=0.499	P=0.167	P=0.501
POLY 6	P=0.379	P=0.500	P=0.153	P=0.496
COCH-ARM / FISHERS	P=0.387	P=0.500	P=0.181	P=0.500
MAX-ISO-POLY-3	P=0.251	P=0.280	P=0.078	P=0.280
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

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 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Hemangioma				
TUMOR RATES	#	#	#	#
OVERALL (a)	1/50 (2%)	0/50 (0%)	1/50 (2%)	1/50 (2%)
POLY-3 RATE (b)	1/43.58	0/43.03	1/40.02	1/43.50
POLY-3 PERCENT (g)	2.3%	0%	2.5%	2.3%
TERMINAL (d)	1/34 (3%)	0/31 (0%)	1/24 (4%)	1/30 (3%)
FIRST INCIDENCE	731 (T)	---	731 (T)	731 (T)
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

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**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Hemangiosarcoma				
TUMOR RATES	#	#	#	#
OVERALL (a)	2/50 (4%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	2/43.58	0/43.03	0/40.02	0/43.50
POLY-3 PERCENT (g)	4.6%	0%	0%	0%
TERMINAL (d)	2/34 (6%)	0/31 (0%)	0/24 (0%)	0/30 (0%)
FIRST INCIDENCE	731 (T)	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.112N	P=0.240N	P=0.256N	P=0.237N
POLY 1.5	P=0.111N	P=0.240N	P=0.248N	P=0.236N
POLY 6	P=0.113N	P=0.239N	P=0.265N	P=0.239N
COCH-ARM / FISHERS	P=0.112N	P=0.247N	P=0.247N	P=0.247N
MAX-ISO-POLY-3	P=0.033N*	P=0.078N	P=0.094N	P=0.076N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
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 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Hemangiosarcoma or Hemangioma				
TUMOR RATES	#	#	#	#
OVERALL (a)	3/50 (6%)	0/50 (0%)	1/50 (2%)	1/50 (2%)
POLY-3 RATE (b)	3/43.58	0/43.03	1/40.02	1/43.50
POLY-3 PERCENT (g)	6.9%	0%	2.5%	2.3%
TERMINAL (d)	3/34 (9%)	0/31 (0%)	1/24 (4%)	1/30 (3%)
FIRST INCIDENCE	731 (T)	---	731 (T)	731 (T)
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.291N	P=0.121N	P=0.336N	P=0.306N
POLY 1.5	P=0.289N	P=0.121N	P=0.323N	P=0.304N
POLY 6	P=0.295N	P=0.120N	P=0.350N	P=0.309N
COCH-ARM / FISHERS	P=0.290N	P=0.121N	P=0.309N	P=0.309N
MAX-ISO-POLY-3	P=0.108N	P=0.040N*	P=0.185N	P=0.154N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
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 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Malignant Lymphoma: Histiocytic, Lymphocytic, Mixed, NOS, or Undifferentiated Cell Type				
TUMOR RATES	#	#	#	#
OVERALL (a)	1/50 (2%)	1/50 (2%)	3/50 (6%)	1/50 (2%)
POLY-3 RATE (b)	1/43.66	1/43.09	3/40.77	1/44.29
POLY-3 PERCENT (g)	2.3%	2.3%	7.4%	2.3%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	0/24 (0%)	0/30 (0%)
FIRST INCIDENCE	710	715	614	435
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.570	P=0.758	P=0.281	P=0.758N
POLY 1.5	P=0.569	P=0.758	P=0.291	P=0.757N
POLY 6	P=0.566	P=0.758	P=0.272	P=0.759N
COCH-ARM / FISHERS	P=0.558	P=0.753N	P=0.309	P=0.753N
MAX-ISO-POLY-3	P=0.432	P=0.495	P=0.145	P=0.495N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
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 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Mesothelioma: Benign, Malignant, NOS				
TUMOR RATES	#	#	#	#
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	0/43.58	0/43.03	0/40.02	0/43.50
POLY-3 PERCENT (g)	0%	0%	0%	0%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	0/24 (0%)	0/30 (0%)
FIRST INCIDENCE	---	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

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 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Mesothelioma: Malignant				
TUMOR RATES	#	#	#	#
OVERALL (a)	0/50 (0%)	0/50 (0%)	0/50 (0%)	0/50 (0%)
POLY-3 RATE (b)	0/43.58	0/43.03	0/40.02	0/43.50
POLY-3 PERCENT (g)	0%	0%	0%	0%
TERMINAL (d)	0/34 (0%)	0/31 (0%)	0/24 (0%)	0/30 (0%)
FIRST INCIDENCE	---	---	---	---
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	(n)	(n)	(n)	(n)
POLY 1.5	(n)	(n)	(n)	(n)
POLY 6	(n)	(n)	(n)	(n)
COCH-ARM / FISHERS	(n)	(n)	(n)	(n)
MAX-ISO-POLY-3	(n)	(n)	(n)	(n)
HISTCONT SAME RTE	(n)	(n)	(n)	(n)
HISTCONT ALL RTES	(n)	(n)	(n)	(n)
CURR VS HC SAME RTE	(n)			
CURR VS HC ALL RTES	(n)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
 2,3-Butanedione
 CAS Number: 431-03-8

Date Report Requested: 04/12/2016
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 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Benign Tumors				
TUMOR RATES	#	#	#	#
OVERALL (a)	39/50 (78%)	42/50 (84%)	38/50 (76%)	37/50 (74%)
POLY-3 RATE (b)	39/50.00	42/48.48	38/47.93	37/47.78
POLY-3 PERCENT (g)	78%	86.6%	79.3%	77.4%
TERMINAL (d)	23/34 (68%)	25/31 (81%)	17/24 (71%)	22/30 (73%)
FIRST INCIDENCE	253	409	361	491
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.389N	P=0.195	P=0.537	P=0.571N
POLY 1.5	P=0.317N	P=0.215	P=0.593N	P=0.503N
POLY 6	P=0.493N	P=0.179	P=0.454	P=0.540
COCH-ARM / FISHERS	P=0.248N	P=0.306	P=0.500N	P=0.408N
MAX-ISO-POLY-3	P=0.442N	P=0.134	P=0.437	P=0.473N
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
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**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Malignant Tumors				
TUMOR RATES	#	#	#	#
OVERALL (a)	12/50 (24%)	14/50 (28%)	17/50 (34%)	19/50 (38%)
POLY-3 RATE (b)	12/45.37	14/45.58	17/43.88	19/47.52
POLY-3 PERCENT (g)	26.5%	30.7%	38.7%	40%
TERMINAL (d)	7/34 (21%)	6/31 (19%)	4/24 (17%)	8/30 (27%)
FIRST INCIDENCE	579	137	516	435
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.085	P=0.414	P=0.153	P=0.120
POLY 1.5	P=0.079	P=0.417	P=0.166	P=0.114
POLY 6	P=0.090	P=0.408	P=0.146	P=0.126
COCH-ARM / FISHERS	P=0.067	P=0.410	P=0.189	P=0.097
MAX-ISO-POLY-3	P=0.134	P=0.326	P=0.109	P=0.086
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS

2,3-Butanedione
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 Lab: BNW

**STATISTICAL ANALYSIS OF PRIMARY TUMORS IN RATS(Wistar Han)
 TERMINAL SACRIFICE AT 105 WEEKS**

DOSE	Females			
	Control	12.5 ppm	25 ppm	50 ppm
All Organs				
Malignant and Benign Tumors				
TUMOR RATES	#	#	#	#
OVERALL (a)	40/50 (80%)	45/50 (90%)	44/50 (88%)	40/50 (80%)
POLY-3 RATE (b)	40/50.00	45/49.48	44/50.00	40/48.92
POLY-3 PERCENT (g)	80%	91%	88%	81.8%
TERMINAL (d)	24/34 (71%)	27/31 (87%)	18/24 (75%)	23/30 (77%)
FIRST INCIDENCE	253	137	361	435
HC TUMORS SAME ROUTE	0/0 (0%)			
HC TUMORS ALL ROUTES	0/0 (0%)			
STATISTICAL TESTS				
POLY 3	P=0.510N	P=0.101	P=0.208	P=0.513
POLY 1.5	P=0.466N	P=0.112	P=0.208	P=0.552
POLY 6	P=0.531	P=0.089	P=0.208	P=0.454
COCH-ARM / FISHERS	P=0.414N	P=0.131	P=0.207	P=0.598N
MAX-ISO-POLY-3	P=0.267	P=0.060	P=0.138	P=0.410
HISTCONT SAME RTE	(e)	(e)	(e)	(e)
HISTCONT ALL RTES	(e)	(e)	(e)	(e)
CURR VS HC SAME RTE	(e)			
CURR VS HC ALL RTES	(e)			

Experiment Number: 20725 - 03
Test Type: CHRONIC
Route: RESPIRATORY EXPOSURE WHOLE BODY
Species/Strain: RATS/Wistar Han

P08: STATISTICAL ANALYSIS OF PRIMARY TUMORS
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LEGEND

- (a) Number of tumor-bearing animals/number of animals examined at site.
- (b) Number of tumor-bearing animals/Poly-3 number
- (d) Observed incidence at terminal kill.
- (e) Value of statistic cannot be computed.
- (f) Beneath the control incidence are the P-values associated with the trend test. Beneath the dosed group incidence are the P-values corresponding to pairwise comparisons between the controls and that dosed group.
- (g) Poly-3 adjusted lifetime tumor incidence.
- (h) Historical Controls statistic is not calculated when the HC Poly-3 rate is higher than the Poly-3 rates for all dose groups.
- (n) No statistics are calculated if all dose groups have fewer than two tumors.
- (I) Interim sacrifice
- (T) Terminal sacrifice
- # Tumor rates based on numbers of animals necropsied.
- * To the right of any statistical result, indicates significance at ($P \leq 0.05$).
- ** To the right of any statistical result, indicates significance at ($P \leq 0.01$).
- N Indicates a negative trend for all tests
The Cochran-Armitage and Fishers exact tests compare directly the overall incidence rates.

*** END OF REPORT ***