

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
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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| | | DAY ON TEST | | | | | | | | | | | | | | | | | | | | males (cont...) | |
|----------------------|-----------|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--------------------|---|
| WISTAR HAN RATS MALE | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| Control | ANIMAL ID | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | |

ALIMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Esophagus | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Cecum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Colon | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Rectum Metaplasia, Squamous | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 2 | + | + | + | + | + | + |
| Intestine Small, Duodenum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Small, Ileum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Small, Jejunum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Liver | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Angiectasis | | | | | | | | | | | | | | | | | | | | | | |
| Basophilic Focus | | | | | X | | | | | | | | | | | | X | | X | | | |
| Clear Cell Focus | | X | X | X | | X | | X | X | X | | | X | X | X | | X | X | | | X | X |
| Degeneration, Cystic | | | | | | | | | | | | | | | | | | | | | | |
| Eosinophilic Focus | | | | | X | | | | | | | | | | | | | | | | | |
| Fatty Change, Focal | | | | | 1 | | | | | | | | | 1 | | | | | | | | |
| Fatty Change, Diffuse | | | | | | | | | | | | 4 | | | | | | | | | | |
| Hematopoietic Cell Proliferation | | | | | | | | 1 | 1 | | | | | | | | | | | | | |
| Hepatodiaphragmatic Nodule | | | | | | | | | | | | | | | | | | | | | | |
| Infiltration Cellular, Lymphocyte | | | | | | | | | | | | | | | | | | | | | | |
| Infiltration Cellular, Mixed Cell | | | | | | | | 1 | | | | | | | | | 1 | | | | | |
| Mixed Cell Focus | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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| Wistar Han Rats Male Control | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | ANIMAL ID | males (cont...) |
|--|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----------|--------------------|
| | 04 | 06 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | | |
| | 8 | 3 | 2 | 2 | 3 | 3 | 7 | 3 | 3 | 2 | 2 | 9 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | | |
| | 6 | 3 | 9 | 9 | 1 | 0 | 9 | 0 | 0 | 2 | 9 | 5 | 9 | 0 | 3 | 1 | 9 | 3 | 1 | 0 | 9 | 9 | 9 | 9 | 9 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | | |
| Necrosis, Focal Bile Duct, Hyperplasia Centrilobular, Necrosis | | | | | | | | | 2 | | | | | 1 | | | | | | | | | | | | | |
| Mesentery Fat, Necrosis | + | | | | | | | | | | | | | + | | | | | | | | | | | + | | |
| Oral Mucosa | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pancreas Atrophy Acinus, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Salivary Glands | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Stomach, Forestomach Inflammation Epithelium, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Stomach, Glandular | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| CARDIOVASCULAR SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Blood Vessel Inflammation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Heart Cardiomyopathy Septum Interventricular, Necrosis, Acute | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| | 1 | | 1 | 1 | 1 | | | | 1 | | | | | 2 | | 2 | 1 | 2 | 2 | 1 | 1 | | | 1 | 1 | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ENDOCRINE SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
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| Wistar Han Rats Male Control | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | males (cont...) | |
|---|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--------------------|---|
| | 0486 | 0633 | 0729 | 0729 | 0771 | 0773 | 0777 | 0835 | 0857 | 0974 | 0974 | 0977 | 0977 | 0977 | 0977 | 0977 | 0977 | 0977 | 0977 | 0977 | 0977 | 0977 | 0977 | 0977 | 0977 | | |
| ANIMAL ID | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | |
| Adrenal Cortex | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Degeneration, Cystic | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Zona Fasciculata, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Zona Fasciculata, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Zona Fasciculata, Hypertrophy | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Zona Fasciculata, Hypertrophy, Focal | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Zona Fasciculata, Hypertrophy, Multifocal | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Adrenal Medulla | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Islets, Pancreatic | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Parathyroid Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pituitary Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Pars Distalis, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pars Intermedia, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Thyroid Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| C-cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Follicular Cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Follicular Cell, Hypertrophy | | | | | | | | | | | | | | | | | | | | | | | | | | | |

GENERAL BODY SYSTEM

NONE

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
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1-4 .. Lesion qualified as:
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| DAY ON TEST | WISTAR HAN RATS MALE | | | | | | | | | | | | | | | | | | | | | | | | | males (cont...) |
|----------------|----------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--------------------|
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Control | 4 | 6 | 7 | 7 | 7 | 7 | 3 | 5 | 7 | 4 | 7 | 7 | 6 | 7 | 7 | 5 | 7 | 7 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | |
| | 8 | 3 | 2 | 2 | 3 | 3 | 7 | 3 | 3 | 3 | 2 | 2 | 9 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | |
| | 6 | 3 | 9 | 9 | 1 | 0 | 9 | 0 | 0 | 2 | 9 | 9 | 5 | 9 | 0 | 3 | 3 | 1 | 9 | 3 | 1 | 0 | 9 | 9 | 9 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| ANIMAL ID | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | |

GENITAL SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Epididymis | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Granuloma Sperm | | | | | | | | | | | | | | | | | | | | | | | | | |
| Preputial Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Prostate | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Inflammation | 2 | | | | 2 | | 2 | | 1 | | | 1 | 1 | 1 | 1 | | | | | | | 1 | | 1 | |
| Epithelium, Ventral, Hyperplasia | | | | | 1 | | | | | | | | 1 | | | | | 1 | | | 4 | 1 | | | |
| Seminal Vesicle | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Testes | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Edema | | | | 1 | | | | | | | | 2 | | | | | | | | | | | | | 2 |
| Germinal Epithelium, Degeneration | | | | 1 | 1 | | | | 4 | | | | | | | | | 3 | | | | 3 | | | |
| Interstitial Cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | |

HEMATOPOIETIC SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bone Marrow | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Myeloid Cell, Hyperplasia | | 2 | | | | | | | | 4 | 4 | | 4 | | | | | | | | | | 2 | | |
| Lymph Node | | | | | | | | | | | | | | | | | | | | | | | | | |
| Axillary, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | | |
| Inguinal, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lumbar, Hyperplasia, Lymphoid | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lumbar, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | | |
| Popliteal, Hyperplasia, Lymphoid | | | | | | | | | | | | | | | | | | | | | | | | | |
| Popliteal, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
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 X .. Lesion present
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| Wistar Han Rats Male Control | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | males (cont...) |
|---------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|--------------------|
| | 0 4 8 6 | 0 6 3 3 | 0 7 2 9 | 0 7 2 9 | 0 7 3 1 | 0 7 3 0 | 0 3 7 9 | 0 5 3 0 | 0 7 3 0 | 0 4 3 2 | 0 7 2 9 | 0 6 9 5 | 0 7 2 9 | 0 5 3 0 | 0 7 2 1 | 0 6 3 9 | 0 7 3 1 | 0 7 3 0 | 0 7 2 9 | 0 7 2 9 | 0 7 2 9 | 0 7 2 9 | 0 7 2 9 | | | |
| ANIMAL ID | 0 0 0 0 1 | 0 0 0 0 2 | 0 0 0 0 3 | 0 0 0 0 4 | 0 0 0 0 5 | 0 0 0 0 6 | 0 0 0 0 7 | 0 0 0 0 8 | 0 0 0 0 9 | 0 0 0 0 0 | 0 0 0 0 1 | 0 0 0 0 2 | 0 0 0 0 3 | 0 0 0 0 4 | 0 0 0 0 5 | 0 0 0 0 6 | 0 0 0 0 7 | 0 0 0 0 8 | 0 0 0 0 9 | 0 0 0 0 0 | 0 0 0 0 1 | 0 0 0 0 2 | 0 0 0 0 3 | 0 0 0 0 4 | 0 0 0 0 5 | |

Renal, Infiltration Cellular, Plasma Cell

Lymph Node, Bronchial + + + + M + + + + + + + + + + + + + + + + + + M

Lymph Node, Mandibular + + M + + + + + + + + + + + + + + + + + + M + + +

Lymph Node, Mediastinal Atrophy Ectasia M + + + + + + 2 + + + + + + 3 M M + + + + + + + M +

Lymph Node, Mesenteric Necrosis +

Spleen Congestion +
 Hematopoietic Cell Proliferation 2 2 1 2 1 4 3 1 2 2 2 1 2 1 2 1 2 1 2 2 2
 Pigmentation, Hemosiderin 2 1 2 2 1 1 1 1 1 2 2 2
 Lymphoid Follicle, Atrophy 1 2 2 2

Thymus Atrophy Hemorrhage Hyperplasia, Lymphoid M + + + + + + + + + + + M + + + + + + + + + + +
 3 2 2 2 3 2 2 2 4 3 3 2 3 2 3 4 1 2 3 3 2 3

INTEGUMENTARY SYSTEM

Mammary Gland M M M + M M + M M M M M + M + + + M M + M + M M +

Skin Epidermis, Hyperplasia Foot, Inflammation, Acute +
 3 3

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically M .. Missing tissue 1-4 .. Lesion qualified as:
 X .. Lesion present A .. Autolysis precludes evaluation 1) Minimal 3) Moderate
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|----------------------|-----------|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|--------------------|
| WISTAR HAN RATS MALE | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Control | ANIMAL ID | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | | |

Foot, Inflammation, Chronic Active
 Foot, Ulcer
 Prepuce, Inflammation, Acute
 Prepuce, Ulcer, Focal

4
 4
 4
 2
 2

MUSCULOSKELETAL SYSTEM

Bone +
 Skeletal Muscle +

NERVOUS SYSTEM

Brain +
 Cerebrum, Gray Matter, Hemorrhage, Focal
 Cranial Nerve, Glial Cell, Hyperplasia 3
 Peripheral Nerve +
 Spinal Cord +

RESPIRATORY SYSTEM

Larynx +
 Foreign Body X
 Inflammation, Chronic Active 1 2 1 1 2
 Squamous Epithelium, Hyperplasia
 Lung +
 Inflammation, Granulomatous 1 1 1
 Inflammation, Chronic Active

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
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 Time Report Requested: 16:27:54
 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

| WISTAR HAN RATS MALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | males (cont...) |
|----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | 0 4 8 6 | 0 6 3 3 | 0 7 2 9 | 0 7 2 9 | 0 7 3 1 | 0 7 3 0 | 0 3 7 9 | 0 5 3 0 | 0 7 3 0 | 0 4 3 2 | 0 7 2 9 | 0 6 9 5 | 0 7 2 9 | 0 5 3 3 | 0 7 3 1 | 0 6 2 9 | 0 7 3 3 | 0 7 3 1 | 0 7 2 9 | 0 7 2 9 | 0 7 2 9 | 0 7 2 9 | 0 7 2 9 | | | |
| Control | 0 0 0 0 1 | 0 0 0 0 2 | 0 0 0 0 3 | 0 0 0 0 4 | 0 0 0 0 5 | 0 0 0 0 6 | 0 0 0 0 7 | 0 0 0 0 8 | 0 0 0 0 9 | 0 0 0 0 0 | 0 0 0 0 1 | 0 0 0 0 1 | 0 0 0 0 2 | 0 0 0 0 3 | 0 0 0 0 4 | 0 0 0 0 5 | 0 0 0 0 6 | 0 0 0 0 7 | 0 0 0 0 8 | 0 0 0 0 9 | 0 0 0 0 0 | 0 0 0 0 1 | 0 0 0 0 2 | 0 0 0 0 3 | 0 0 0 0 4 | 0 0 0 0 5 |

Thrombus X
 Alveolar Epithelium, Hyperplasia
 Alveolar Epithelium, Hyperplasia, Focal 2
 Alveolus, Infiltration Cellular, Histiocyte 1
 Pleura, Fibrosis, Focal 1

Nose +
 Foreign Body
 Inflammation, Suppurative 1
 Inflammation, Chronic Active 2
 Polyp, Inflammatory
 Olfactory Epithelium, Accumulation, Hyaline Droplet 2
 Olfactory Epithelium, Metaplasia, Respiratory 1

Trachea +

SPECIAL SENSES SYSTEM

Eye +
 Cornea, Inflammation, Chronic Active
 Cornea, Mineralization
 Lens, Cataract
 Retina, Degeneration 2 2 3 2 3

Harderian Gland +
 Hyperplasia
 Metaplasia

URINARY SYSTEM

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically M .. Missing tissue
 X .. Lesion present A .. Autolysis precludes evaluation
 I .. Insufficient tissue BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 2,3-Butanedione
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| WISTAR HAN RATS MALE Control | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | ANIMAL ID | males (cont...) |
|--|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|---|---|--------------------|
| | 0 4 8 6 | 0 6 3 3 | 0 7 2 9 | 0 7 2 9 | 0 7 3 1 | 0 7 3 0 | 0 3 7 9 | 0 5 3 0 | 0 7 3 0 | 0 4 3 2 | 0 7 2 9 | 0 6 9 5 | 0 7 2 9 | 0 5 3 1 | 0 7 2 9 | 0 6 3 3 | 0 7 3 1 | 0 7 3 0 | 0 7 2 9 | 0 7 2 9 | 0 7 2 9 | 0 7 2 9 | 0 7 2 9 | 0 7 2 9 | | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 0 0 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 | |
| Kidney | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Calculus Micro Observation Only | | | X | | | | | | | | | | | | | | | | | | | | | | | | |
| Infarct | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | |
| Nephropathy | 1 | | 2 | 1 | | 2 | | | 1 | 2 | 1 | | 2 | | | 2 | | 1 | 3 | | | | | | 2 | | |
| Papilla, Necrosis | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | |
| Pelvis, Dilatation | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | |
| Pelvis, Inflammation | | | | | | | | | | 1 | | 1 | | 3 | | | | | | 1 | | | | | | | |
| Pelvis, Transitional Epithelium, Hyperplasia | | | | | | | | | | | | | 3 | | | | | | | | | | | | | | |
| Renal Tubule, Dilatation | | | | | | | | | | 3 | | | | | | | | | | | | | | | | | |
| Urinary Bladder | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |

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 I .. Insufficient tissue
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| WISTAR HAN RATS MALE Control | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS | | |
|--|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|-----|-----|
| | 0730 | 0733 | 0730 | 0732 | 0736 | 0737 | 0737 | 0737 | 0736 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0736 | 0737 | 0737 | 0737 | 0736 | | | |
| ANIMAL ID | 00026 | 00007 | 00008 | 00009 | 00010 | 00011 | 00012 | 00013 | 00014 | 00015 | 00016 | 00017 | 00018 | 00019 | 00020 | 00021 | 00022 | 00023 | 00024 | 00025 | 00026 | 00027 | 00028 | 00029 | | | |
| Necrosis, Focal | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | 1.0 | |
| Bile Duct, Hyperplasia | | | | 1 | 1 | | | | | | | | | | | | | | | | | | | | 1 | 5 | 1.2 |
| Centrilobular, Necrosis | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3.0 |
| Mesentery | | | + | | | | | | | | | | | | | | | | | | | | | | | 5 | |
| Fat, Necrosis | | | 1 | | | | | | | | | | | | | | | | | | | | | | | 3 | 1.0 |
| Oral Mucosa | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Pancreas | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 4.0 |
| Acinus, Hyperplasia | | | | 1 | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 |
| Salivary Glands | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Stomach, Forestomach | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 |
| Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3.0 |
| Stomach, Glandular | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| CARDIOVASCULAR SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Blood Vessel | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 3.0 |
| Heart | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Cardiomyopathy | | | 1 | 1 | 2 | | 1 | | 2 | 1 | 2 | 1 | | | 1 | | 1 | | 1 | 1 | 1 | 1 | 1 | 2 | 31 | 1.3 | |
| Septum Interventricular, Necrosis, Acute | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 |
| ENDOCRINE SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
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|---|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----------|------|------|------|------|------|------|------|------|------|--------|--------|--------|
| | 0730 | 0733 | 0730 | 0732 | 0739 | 0734 | 0737 | 0737 | 0737 | 0736 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0736 | 0737 | | 0737 | 0736 | | | | | | | | | | |
| Control | ANIMAL ID | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0026 | 0007 | 0008 | 0009 | 0000 | 0001 | 0002 | 0003 | 0004 | 0005 | 0006 | 0007 | 0008 | 0009 | 0000 | 0001 | 0002 | 0003 | 0004 | 0005 | 0006 | 0007 | 0008 | 0009 | 0000 | 0001 | 0002 | 0003 | 0004 | 0005 | 0006 | 0007 | 0008 | 0009 | 0000 | | |
| Adrenal Cortex | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Degeneration, Cystic | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 1.0 | |
| Zona Fasciculata, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 1.0 | |
| Zona Fasciculata, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 1.5 | |
| Zona Fasciculata, Hypertrophy | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 1.3 | |
| Zona Fasciculata, Hypertrophy, Focal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 12 2.2 | |
| Zona Fasciculata, Hypertrophy, Multifocal | 2 | 4 | | 2 | 3 | 3 | 2 | | | 1 | | | 2 | 2 | | | | | | | | | | | | | | | | | | | | | 14 2.5 | | |
| Adrenal Medulla | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | |
| Islets, Pancreatic | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 1.4 |
| Parathyroid Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 49 | |
| Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | |
| Pituitary Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Pars Distalis, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 16 2.1 |
| Pars Intermedia, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 |
| Thyroid Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| C-cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 1.6 |
| Follicular Cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 1.3 |
| Follicular Cell, Hypertrophy | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 2.0 |

GENERAL BODY SYSTEM

NONE

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
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|----------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----------|
| | 0730 | 0733 | 0736 | 0739 | 0742 | 0745 | 0748 | 0751 | 0754 | 0757 | 0760 | 0763 | 0766 | 0769 | 0772 | 0775 | 0778 | 0781 | 0784 | 0787 | 0790 | 0793 | 0796 | | |
| Control | 0026 | 0027 | 0028 | 0029 | 0030 | 0031 | 0032 | 0033 | 0034 | 0035 | 0036 | 0037 | 0038 | 0039 | 0040 | 0041 | 0042 | 0043 | 0044 | 0045 | 0046 | 0047 | 0048 | 0049 | 50 |

GENITAL SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|----|-----|-----|
| Epididymis | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | |
| Granuloma Sperm | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3.0 |
| Preputial Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | |
| Prostate | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | |
| Inflammation | | 1 | | | 1 | | | | | | 1 | 1 | 1 | | | 1 | | | | | | 2 | 1 | 1 | | 21 | 1.2 | |
| Epithelium, Ventral, Hyperplasia | | | | | | | | | | | 1 | | | | 2 | | | | | | 1 | | 1 | | | 9 | 1.4 | |
| Seminal Vesicle | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | |
| Testes | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | |
| Edema | | | | | | | | | | | | 3 | | | | | | | | | | | | | | 4 | 2.0 | |
| Germinal Epithelium, Degeneration | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | 2.4 | |
| Interstitial Cell, Hyperplasia | | | | | | | | | | | 2 | | 1 | | | | | | | | 4 | | 1 | | | 4 | 2.0 | |

HEMATOPOIETIC SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|----|-----|
| Bone Marrow | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Myeloid Cell, Hyperplasia | | 2 | | | 2 | | | | 3 | 4 | | | | 2 | | | 4 | | 3 | | 2 | | | 3 | | 15 | 2.9 |
| Lymph Node | | | + | + | | | | | | | | | + | | | + | | | | | | | | + | 6 | | |
| Axillary, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | 2 | | 1 | 2.0 |
| Inguinal, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | 2 | | 1 | 2.0 |
| Lumbar, Hyperplasia, Lymphoid | | | | | | | | | | | | 2 | | | | | | | | | | | | | | 1 | 2.0 |
| Lumbar, Infiltration Cellular, Plasma Cell | | | 4 | 3 | | | | | | | | | | | | | 2 | | | | | | | 2 | | 5 | 2.8 |
| Popliteal, Hyperplasia, Lymphoid | | | | | | | | | | | | | | | | | | | | | | | | 3 | | 1 | 3.0 |
| Popliteal, Inflammation, Chronic Active | | | | | 2 | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
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|---|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----------|------|-------|--------|----------------|
| | 0730 | 0730 | 0730 | 0732 | 0739 | 0734 | 0739 | 0730 | 0734 | 0732 | 0733 | 0733 | 0733 | 0731 | 0739 | 0734 | 0730 | 0731 | 0739 | 0734 | 0735 | 0733 | 0733 | 0731 | | 0732 | 0733 | 0739 | 0733 |
| ANIMAL ID | 0026 | 0007 | 0008 | 0009 | 0000 | 0001 | 0002 | 0003 | 0004 | 0005 | 0006 | 0007 | 0008 | 0009 | 0000 | 0001 | 0002 | 0003 | 0004 | 0005 | 0006 | 0007 | 0008 | 0009 | 0000 | 0001 | 0002 | 0003 | 0009 |
| Renal, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 3 | 2 3.0 | | |
| Lymph Node, Bronchial | M | + | + | + | M | + | M | + | + | + | + | M | + | + | M | + | + | + | + | + | + | + | + | + | + | M | M | 41 | |
| Lymph Node, Mandibular | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 48 |
| Lymph Node, Mediastinal Atrophy Ectasia | + | + | + | + | M | + | + | + | + | M | M | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | M | 42 | 1 2.0 1 3.0 |
| Lymph Node, Mesenteric Necrosis | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 1 1.0 |
| Spleen Congestion | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 1 4.0 |
| Hematopoietic Cell Proliferation | 2 | 2 | | 1 | | 2 | 1 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | 41 | 1.9 | | |
| Pigmentation, Hemosiderin | | | | 1 | | | 1 | | | | | | | 1 | | | 1 | 1 | | 1 | 1 | | | 1 | 18 | 1.2 | | | |
| Lymphoid Follicle, Atrophy | | | | | 2 | | | | | | | | | | | | | | | 1 | | | | | 6 | 1.7 | | | |
| Thymus Atrophy | + | + | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 47 | 46 2.7 | |
| Hemorrhage | 3 | 3 | 2 | 3 | 4 | 2 | 4 | | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 2 | 1 | 3.0 | | |
| Hyperplasia, Lymphoid | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 1 | 3.0 | |

INTEGUMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|-------|
| Mammary Gland | M | M | + | M | + | M | M | M | M | + | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | 12 |
| Skin Epidermis, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 2 2.5 |
| Foot, Inflammation, Acute | | | | | 2 | | | | | 3 | | | | | | | | | | | | | | | | | 4 | 3 3.3 |

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 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE Control | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS |
|-------------------------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|
| | 0730 | 0733 | 0739 | 0762 | 0772 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | |
| ANIMAL ID | 00026 | 00007 | 00008 | 00009 | 00010 | 00011 | 00012 | 00013 | 00014 | 00015 | 00016 | 00017 | 00018 | 00019 | 00020 | 00021 | 00022 | 00023 | 00024 | 00025 | 00026 | 00027 | 00028 | 00029 | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------------------------|---|---|--|--|--|--|---|---|---|---|--|--|--|--|---|---|--|--|--|--|--|---|---|----|-----|-----|
| Foot, Inflammation, Chronic Active | 3 | 4 | | | | | 4 | 4 | 3 | 3 | | | | | 3 | | | | | | | 3 | 3 | 11 | 3.3 | |
| Foot, Ulcer | 3 | 4 | | | | | 4 | 4 | 3 | 3 | | | | | 4 | 3 | | | | | | 4 | 3 | 14 | 3.5 | |
| Prepuce, Inflammation, Acute | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 |
| Prepuce, Ulcer, Focal | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 |

MUSCULOSKELETAL SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|
| Bone | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Skeletal Muscle | | | | | | | | + | + | | | | | | + | | | | | | | | | + | 6 |

NERVOUS SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|-----|
| Brain | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Cerebrum, Gray Matter, Hemorrhage, Focal | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 |
| Cranial Nerve, Glial Cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3.0 |
| Peripheral Nerve | | + | | | | | | + | + | | | | | | + | | | | | | | | | + | 6 | |
| Spinal Cord | | + | | | | | | + | + | | | | | | + | | | | | | | | | + | 6 | |

RESPIRATORY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|-----|-----|
| Larynx | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Foreign Body | | | | | | | | | X | | | | | | | | | | | | | | | | 2 | |
| Inflammation, Chronic Active | 1 | | | | 1 | | 1 | | | | | | | | 1 | | 1 | | | 1 | 1 | | 1 | 14 | 1.1 | |
| Squamous Epithelium, Hyperplasia | | 1 | | | | | | | | | | | | | | | | | | | 1 | | | | 2 | 1.0 |
| Lung | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Inflammation, Granulomatous | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 4.0 |
| Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | | | | |
|---|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|-----|-----|-----|-----|--|
| | 07 | 07 | 07 | 07 | 06 | 07 | 07 | 07 | 07 | 06 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 06 | 07 | | 07 | 07 | 06 | | |
| Control | 030 | 030 | 030 | 029 | 049 | 009 | 004 | 002 | 003 | 004 | 003 | 003 | 003 | 002 | 002 | 003 | 001 | 009 | 004 | 005 | 003 | 003 | 003 | 002 | 003 | |
| | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 | |
| | 002 | 002 | 002 | 002 | 003 | 003 | 003 | 003 | 003 | 003 | 003 | 003 | 003 | 003 | 004 | 004 | 004 | 004 | 004 | 004 | 004 | 004 | 004 | 004 | 005 | |
| | 006 | 007 | 008 | 009 | 000 | 001 | 002 | 003 | 004 | 005 | 006 | 007 | 008 | 009 | 000 | 001 | 002 | 003 | 004 | 005 | 006 | 007 | 008 | 009 | 000 | |
| Thrombus | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Alveolar Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | 2 | |
| Alveolar Epithelium, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | | | | | 4 | |
| Alveolus, Infiltration Cellular, Histiocyte | | | | | | | 1 | 1 | 2 | | | | | 1 | | 1 | | | | | | | | 1 | | |
| Pleura, Fibrosis, Focal | | | | | | | | | | | | | | | | | | | | | | | | | 10 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | 1.1 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | 1.0 | |
| Nose | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Foreign Body | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | | | 3 | |
| Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | 1.0 | |
| Polyp, Inflammatory | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Olfactory Epithelium, Accumulation, Hyaline Droplet | | | | | | | | | | | | | | | | | | | | | | | | | 2.0 | |
| Olfactory Epithelium, Metaplasia, Respiratory | | | | | | | | | | | | | | | | | | | | | | | | | 10 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | 1.9 | |
| Trachea | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| SPECIAL SENSES SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Eye | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Cornea, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Cornea, Mineralization | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Lens, Cataract | | | | | | | | | | | | | | | | | | | | | | | | | 2 | |
| Retina, Degeneration | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | 1.0 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | 1.0 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | 2 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | 1.0 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | 2.0 | |
| URINARY SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

Experiment Number: 20725 - 03
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 Species/Strain: RATS/Wistar Han

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE Control | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS | |
|--|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----------|--------|
| | 0730 | 0733 | 0730 | 0732 | 0739 | 0734 | 0737 | 0737 | 0737 | 0736 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0736 | 0737 | 0737 | 0737 | 0736 | | |
| ANIMAL ID | 0026 | 0007 | 0008 | 0009 | 0000 | 0001 | 0002 | 0003 | 0004 | 0005 | 0006 | 0007 | 0008 | 0009 | 0000 | 0001 | 0002 | 0003 | 0004 | 0005 | 0006 | 0007 | 0008 | 0009 | | |
| Kidney | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Calculus Micro Observation Only | | | | | | X | | X | | | | | | | | | | | | | | | X | | 4 | |
| Infarct | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | |
| Nephropathy | 3 | 1 | 2 | 2 | | 1 | 2 | 2 | 2 | 2 | 1 | 3 | 1 | 1 | 1 | | 1 | 2 | | | 1 | 2 | 2 | 2 | 1 | 33 1.7 |
| Papilla, Necrosis | | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 |
| Pelvis, Dilatation | | | | | | | | | | | | | | | | | | | | | | | | | | 1 1.0 |
| Pelvis, Inflammation | | | | | | 3 | | 2 | | 1 | | | | 2 | | 2 | | | | | | | 3 | | 10 1.9 | |
| Pelvis, Transitional Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | 1 3.0 |
| Renal Tubule, Dilatation | | | | | | | | | | | | | | | | | | | | | | | | | | 1 3.0 |
| Urinary Bladder | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
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 Lab: BNW

| Wistar Han Rats Male 12.5 ppm | DAY ON TEST | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | males (cont...) | |
|----------------------------------|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--------------------|--|
| | ANIMAL ID | 7 | 6 | 7 | 7 | 7 | 6 | 7 | 6 | 7 | 7 | 7 | 6 | 7 | 7 | 7 | 6 | 7 | 6 | 7 | 6 | 7 | 7 | 7 | | |
| | | 2 | 0 | 2 | 2 | 3 | 0 | 0 | 3 | 5 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 8 | 2 | 1 | 1 | 3 | 3 | | |
| | | 9 | 0 | 9 | 9 | 0 | 6 | 1 | 0 | 6 | 9 | 0 | 0 | 0 | 3 | 9 | 0 | 0 | 3 | 2 | 9 | 1 | 1 | 0 | 0 | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | | |

ALIMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Esophagus | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Cecum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Colon | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Rectum Metaplasia, Squamous | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 2 | + | + | + | + | 1 | + | + | + |
| Intestine Small, Duodenum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Small, Ileum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Small, Jejunum Inflammation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Liver | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Angiectasis | | | | | | | | | | | | | | | | | | | | | | | |
| Basophilic Focus | X | | | | | | | X | | X | | | X | | | | X | | | | X | X | |
| Clear Cell Focus | X | | X | X | X | | | | | | X | X | | X | X | | | X | | | X | | X |
| Eosinophilic Focus | | | | | | | | | | | | | | | | | | | | | | | |
| Mixed Cell Focus | | | X | | | | | | | | | | X | | | | | | | | | | |
| Necrosis, Focal | | | | | | | | | | | | | | | | | | | | | | | |
| Pigmentation, Hemosiderin | | | | | | | | | | | | | | | | | | | | | | | |
| Bile Duct, Cyst | | | | | | | | | | X | | | | | | | | | | | | | |
| Bile Duct, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Serosa, Fibrosis | | | | | | | | | | | | | | | | 2 | | | | | | | |
| Mesentery | | | | | | | | | | | | | | | | | | | | | | | + |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
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 Lab: BNW

| Wistar Han Rats Male 12.5 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | males (cont...) |
|---|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--------------------|
| | 0729 | 0600 | 0702 | 0702 | 0703 | 0706 | 0707 | 0707 | 0706 | 0707 | 0707 | 0707 | 0707 | 0706 | 0707 | 0707 | 0707 | 0706 | 0706 | 0707 | 0706 | 0707 | 0707 | 0707 | | |
| ANIMAL ID | 0001 | 0002 | 0003 | 0004 | 0005 | 0006 | 0007 | 0008 | 0009 | 0010 | 0011 | 0012 | 0013 | 0014 | 0015 | 0016 | 0017 | 0018 | 0019 | 0020 | 0021 | 0022 | 0023 | 0024 | 0025 | |
| Fat, Necrosis | | | | | | | | | | | | | | | | | | | | | | | | | 2 | |
| Oral Mucosa | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pancreas | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Atrophy | | | | 1 | 1 | | | | | | | | | | | 1 | | | | | | 1 | | | | |
| Basophilic Focus Acinus, Hyperplasia | | | | 1 | | | | | | | | | | | | | | | | | | | | | | |
| Salivary Glands | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Inflammation | | | | | | | 2 | | | | | | | | | | | | | | | | | | | |
| Stomach, Forestomach Epithelium, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Stomach, Glandular | | | | | | | | | | | | | | | | | | | | | | | | | | |

CARDIOVASCULAR SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Blood Vessel | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Mineralization | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aorta, Mineralization | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Heart | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Cardiomyopathy | 2 | 1 | 1 | | 1 | | | | 1 | 1 | | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | | 1 | | 2 | 1 | 1 |
| Valve, Degeneration | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Valve, Inflammation, Chronic | | | | | | | | | | | | | | | | | | | | | | | | | | |

ENDOCRINE SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Adrenal Cortex | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
|----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
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 X .. Lesion present
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Experiment Number: 20725 - 03

Test Type: CHRONIC

Route: RESPIRATORY EXPOSURE WHOLE BODY

Species/Strain: RATS/Wistar Han

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL

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

| WISTAR HAN RATS MALE 12.5 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | ANIMAL ID | males (cont...) |
|--|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----------|--------------------|
| | 0729 | 0600 | 0702 | 0722 | 0730 | 0600 | 0701 | 0707 | 0606 | 0707 | 0607 | 0706 | 0707 | 0607 | 0706 | 0707 | 0606 | 0706 | 0707 | 0606 | 0706 | 0707 | 0606 | 0706 | 0707 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000200 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000200 | |
| | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 200200 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 000200 | |
| Degeneration, Cystic | | | | | | | | 1 | | | | | | 1 | | | | | | | | | | | | | |
| Zona Fasciculata, Hyperplasia, Focal | | | 1 | | | | | | | | | | 1 | | 2 | | | | | | | | | | | | |
| Zona Fasciculata, Hyperplasia, Multifocal | | | | | | | | | | | | | | | | | | 2 | | | 1 | | | | | | |
| Zona Fasciculata, Hypertrophy | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| Zona Fasciculata, Hypertrophy, Focal | | | 1 | | | | | | | 1 | | | | | | | | 2 | | | | 2 | | | | | |
| Zona Fasciculata, Hypertrophy, Multifocal | | | | 2 | | | | | | | 2 | 2 | | | 1 | | | | | | | | | 1 | | | |
| Adrenal Medulla Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 1 | 1 | |
| Islets, Pancreatic Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | | |
| Parathyroid Gland Hyperplasia, Focal | + | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | M | + | + | + | + | + | | | |
| Pituitary Gland Pars Distalis, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 4 | 2 | |
| Pituitary Gland Pars Intermedia, Hyperplasia | | | | | | | | | | | | | | | | | | | | | 2 | | 2 | | | | |
| Thyroid Gland C-cell, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 1 | | |
| Thyroid Gland Follicular Cell, Hyperplasia | | | 2 | | | | | 4 | | | | | | | | | | | | | | | | | | | |
| Thyroid Gland Follicular Cell, Hypertrophy | | | | | | | | | | | | | | | | | | | | | | | | | | | |

GENERAL BODY SYSTEM

NONE

GENITAL SYSTEM

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade

+ .. Tissue examined microscopically

X .. Lesion present

I .. Insufficient tissue

M .. Missing tissue

A .. Autolysis precludes evaluation

BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:

1) Minimal 3) Moderate

2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE 12.5 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | ANIMAL ID | males (cont...) | |
|--|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----------|--------------------|------|
| | 0729 | 0600 | 0729 | 0729 | 0770 | 0671 | 0770 | 0676 | 0776 | 0677 | 0776 | 0677 | 0776 | 0677 | 0776 | 0677 | 0776 | 0677 | 0776 | 0677 | | | 0776 |
| Epididymis Granuloma Sperm | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| | | | | | 4 | | | | | | | | | | | | | | | | | | |
| Preputial Gland Inflammation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| | | | | | | | | 2 | | | | | | | | | | | | | | | |
| Prostate Inflammation Epithelium, Ventral, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| | 1 | 2 | | | 2 | | | 2 | 1 | | | 2 | | 2 | | | | 1 | 2 | | | 1 | 1 |
| Seminal Vesicle Hyperplasia Inflammation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| | | 2 | | | | | | | | | | | | | | | | | | | | | |
| Testes Edema Germinal Epithelium, Degeneration Interstitial Cell, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| | | | | | 4 | | 3 | | 4 | | | | | 4 | | 2 | | 1 | | 4 | | 1 | |
| | | | | | | | | | | | 1 | | | | | | | | | | | | |

HEMATOPOIETIC SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bone Marrow Myeloid Cell, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| | 2 | | | | 3 | | | | | | 3 | 2 | | | | 3 | 2 | 2 | | | 2 | | |
| Lymph Node Iliac, Ectasia Lumbar, Infiltration Cellular, Plasma Cell Renal, Infiltration Cellular, Plasma Cell | | | | + | | | + | | + | | | | | | | | | | | | | | |
| | | | | | | | 2 | | | 1 | | | | | | | | | | | | | |
| Lymph Node, Bronchial | + | + | + | + | + | + | + | + | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

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 2,3-Butanedione
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 Lab: BNW

| WISTAR HAN RATS MALE 12.5 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | males (cont...) | | | | | | | | | |
|------------------------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--------------------|------|------|------|------|------|------|------|------|------|
| | 0729 | 0600 | 0709 | 0722 | 0730 | 0606 | 0701 | 0703 | 0605 | 0706 | 0707 | 0608 | 0709 | 0710 | 0611 | 0712 | 0713 | 0614 | 0715 | 0716 | 0617 | 0718 | 0719 | 0620 | 0721 | | 0722 | 0623 | 0724 | 0725 | 0626 | 0727 | 0728 | 0629 | 0730 |
| ANIMAL ID | 0020 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 |
| Atrophy | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lymph Node, Mandibular | + | + | + | + | + | + | + | + | M | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Lymph Node, Mediastinal | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | M | + | + | + | + | + | |
| Lymph Node, Mesenteric Ectasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Hyperplasia, Lymphoid Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| Spleen | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Hematopoietic Cell Proliferation | 2 | 1 | 2 | 2 | 2 | | | | 1 | | 2 | 2 | 2 | | | 1 | 1 | 2 | 2 | 2 | 2 | | | | | | | | | | | | 3 | 2 | |
| Pigmentation, Hemosiderin | 1 | 1 | 1 | | 1 | 1 | | | | 1 | | | | | 2 | 1 | 1 | 1 | | | | 1 | 1 | | | | | | | | | | 1 | | |
| Lymphoid Follicle, Atrophy | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Thymus | + | + | + | I | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | M | + | |
| Atrophy | 4 | 2 | 2 | | 3 | 3 | 4 | 2 | 4 | 3 | 2 | 3 | 2 | 3 | 3 | | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | | |
| Hyperplasia, Lymphoid | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INTEGUMENTARY SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mammary Gland | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | + | M | M | M | + | M | + | M | + | M | + | M | + | M | + | M | + | | | |
| Skin | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Foot, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Foot, Ulcer | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MUSCULOSKELETAL SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bone | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

Experiment Number: 20725 - 03
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 Species/Strain: RATS/Wistar Han

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 2,3-Butanedione
 CAS Number: 431-03-8

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 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

| WISTAR HAN RATS MALE 12.5 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | ANIMAL ID | males (cont...) |
|----------------------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----------|--------------------|
| | 0729 | 0600 | 0729 | 0729 | 0776 | 0777 | 0677 | 0777 | 0676 | 0777 | 0676 | 0777 | 0676 | 0777 | 0676 | 0777 | 0676 | 0777 | 0676 | 0777 | 0676 | 0777 | 0676 | 0777 | 0676 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0020 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0022 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 0001 | |

Skeletal Muscle + + +

NERVOUS SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Brain | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Cranial Nerve, Glial Cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | 3 | |
| Peripheral Nerve | | | | | | | | | | | | | | | | | | | | | | | | | | + |
| Spinal Cord | | | | | | | | | | | | | | | | | | | | | | | | | | + |

RESPIRATORY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Larynx | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Inflammation, Chronic Active | 1 | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Respiratory Epithelium, Metaplasia, Squamous | | | | | | | | | | | | | | | | | | | | | | | | | |
| Squamous Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lung | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Inflammation, Granulomatous | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Metaplasia, Osseous | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alveolar Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Alveolar Epithelium, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| Alveolus, Infiltration Cellular, Histiocyte | 1 | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Interstitial, Fibrosis | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Nose | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Foreign Body | | | | | | | | | | | | | | | | | | | | | | | | | X |
| Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Nerve, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | 3 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
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| WISTAR HAN RATS MALE 12.5 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | ANIMAL ID | males (cont...) |
|---|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|---|---|-----------|--------------------|
| | 0 7 2 9 | 0 6 0 0 | 0 7 2 9 | 0 7 2 9 | 0 7 3 0 | 0 7 0 6 | 0 7 0 1 | 0 7 0 0 | 0 6 3 5 | 0 7 2 6 | 0 7 3 9 | 0 7 3 0 | 0 7 3 0 | 0 6 3 3 | 0 7 2 9 | 0 7 3 0 | 0 6 3 3 | 0 6 8 2 | 0 7 2 1 | 0 6 1 1 | 0 7 3 0 | 0 7 3 0 | 0 7 3 0 | | | | |
| Olfactory Epithelium, Accumulation, Hyaline Droplet | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | |
| Olfactory Epithelium, Atrophy | 2 | | | | | | | | 2 | | | | | | | | | | | | | | | | 1 | | |
| Olfactory Epithelium, Metaplasia, Respiratory Epithelium, Hyperplasia | | | | | | | | | 2 | | | | | | | | | | | | | | | | 1 | | |
| Pleura | | | | | | | | | | | | | | | | | | | | | | | | | + | | |
| Trachea | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | | |

SPECIAL SENSES SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Eye | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Anterior Chamber, Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | | |
| Cornea, Inflammation, Chronic Active | | | | | | | | | | | | | 2 | | | | | | | | | | | |
| Cornea, Mineralization | | | | | | | | | | | | | | | | | | 1 | | 1 | | | | |
| Cornea, Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | |
| Cornea, Epithelium, Ulcer | | | | | | | | | | | | | 1 | | | | | | | | | | | |
| Iris, Inflammation, Acute | | | | | | | | | | | | | | | | | | | | | | | | |
| Lens, Cataract | | | | 2 | | | 1 | | | | | | | | | | | | | | | | | |
| Retina, Degeneration | | | | 3 | | | 2 | | | | | | | | | | | 2 | | 2 | | | 2 | |
| Unilateral, Phthisis Bulbi | | | | | | | | | | | | | | | | | | | | | | | | |
| Harderian Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |

URINARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kidney | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Calculus Micro Observation Only | | | X | X | | | | | | | | X | | | | | | | X | | X | | | |
| Infarct | | | | | | | | | | | | | | | | | | | | | | | | |
| Nephropathy | 2 | | 3 | 1 | 3 | | 1 | 2 | | 2 | 2 | 2 | 2 | 1 | 3 | 1 | 1 | | | 1 | 1 | | 2 | 1 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

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| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------------------|--|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--------------------|
| WISTAR HAN RATS MALE 12.5 ppm | DAY ON TEST | 07 | 06 | 07 | 07 | 07 | 06 | 07 | 07 | 06 | 07 | 07 | 07 | 06 | 07 | 07 | 07 | 06 | 06 | 07 | 06 | 07 | 07 | 06 | 07 | 07 | 07 | | |
| | ANIMAL ID | 29 | 00 | 02 | 02 | 03 | 00 | 00 | 03 | 05 | 02 | 03 | 03 | 03 | 02 | 03 | 03 | 03 | 08 | 02 | 01 | 01 | 03 | 03 | 00 | 00 | 00 | | |
| | | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| | | 20 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 | |
| | | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 02 | 02 | 02 | 02 | 02 | 02 | 02 | 02 | 02 | males (cont...) |
| | Pelvis, Dilatation | | | | | | | | | | | | | | | | | 2 | | | | 2 | | | | | | | |
| | Pelvis, Inflammation | | | | | | | | | | | | | | | | 1 | | 1 | | 1 | | | | | | | | |
| | Pelvis, Transitional Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Ureter Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Urinary Bladder | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Calculus Gross Observation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| | Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
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 Lab: BNW

| WISTAR HAN RATS MALE 12.5 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS | | | |
|----------------------------------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|-----|-----|--|
| | 0730 | 0739 | 0770 | 0773 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | | | | |
| ANIMAL ID | 002226 | 002227 | 002228 | 002229 | 002230 | 002231 | 002232 | 002233 | 002234 | 002235 | 002236 | 002237 | 002238 | 002239 | 002240 | 002241 | 002242 | 002243 | 002244 | 002245 | 002246 | 002247 | 002248 | 002249 | | | | |
| Fat, Necrosis | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 2 | 2.0 | |
| Oral Mucosa | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | |
| Pancreas | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | |
| Atrophy | | | | | 1 | | 1 | | | | | | | | | | | | | | | | | | 7 | 1.1 | | |
| Basophilic Focus | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 | | |
| Acinus, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 | | |
| Salivary Glands | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | |
| Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 | | |
| Stomach, Forestomach | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | |
| Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 1.3 | | |
| Stomach, Glandular | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | |
| CARDIOVASCULAR SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Blood Vessel | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | |
| Mineralization | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 | | |
| Aorta, Mineralization | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 | | |
| Heart | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | |
| Cardiomyopathy | 1 | | 1 | 1 | 1 | 2 | 2 | 3 | | | | | | 2 | 1 | 1 | 2 | | | 3 | 2 | 1 | 3 | 1 | 38 | 1.4 | | |
| Valve, Degeneration | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 | | |
| Valve, Inflammation, Chronic | | | | | | | | | | | | | | 1 | | | | | | | | | | | 1 | 1.0 | | |
| ENDOCRINE SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Adrenal Cortex | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE 12.5 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS | | |
|---|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|------|-----|
| | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | | 0730 | |
| ANIMAL ID | 002226 | 002227 | 002228 | 002229 | 002230 | 002231 | 002232 | 002233 | 002234 | 002235 | 002236 | 002237 | 002238 | 002239 | 002240 | 002241 | 002242 | 002243 | 002244 | 002245 | 002246 | 002247 | 002248 | 002249 | 002250 | | |
| Degeneration, Cystic | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 1.0 |
| Zona Fasciculata, Hyperplasia, Focal | | | | | | | | | | | | | 1 | | | | | | | | | | | | | 4 | 1.3 |
| Zona Fasciculata, Hyperplasia, Multifocal | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 1.5 |
| Zona Fasciculata, Hypertrophy | | | 1 | | | | | | | | | | | | | | | | | | | | | | | 2 | 1.5 |
| Zona Fasciculata, Hypertrophy, Focal | | | | | 2 | 2 | | | | 1 | | | | 2 | 1 | 2 | | | | 1 | 1 | | | | | 12 | 1.5 |
| Zona Fasciculata, Hypertrophy, Multifocal | | | | | | | | | | | | | | | | 2 | 3 | | | | | 3 | 1 | | | 9 | 1.9 |
| Adrenal Medulla Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 2 | 1.0 |
| Islets, Pancreatic Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 1 | 1.0 |
| Parathyroid Gland Hyperplasia, Focal | + | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | + | M | + | + | + | + | 46 | 1 | 1.0 |
| Pituitary Gland Pars Distalis, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 18 | 2.1 |
| Pars Intermedia, Hyperplasia | | | | | 1 | | | | | | | | | | 1 | | | | | | | | | | 3 | 2.0 | |
| Thyroid Gland C-cell, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 13 | 1.4 |
| Follicular Cell, Hyperplasia | | | | | 2 | | | 1 | 1 | 1 | | | | 3 | | | | | | | | 2 | 1 | | 2 | 3.0 | |
| Follicular Cell, Hypertrophy | 2 | | | | | | 2 | | | | | | | | | | | | | | | | | | 2 | 2.0 | |

GENERAL BODY SYSTEM

NONE

GENITAL SYSTEM

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
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|--|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----|--|
| | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | | | |
| ANIMAL ID | 002226 | 002227 | 002228 | 002229 | 002230 | 002231 | 002232 | 002233 | 002234 | 002235 | 002236 | 002237 | 002238 | 002239 | 002240 | 002241 | 002242 | 002243 | 002244 | 002245 | 002246 | 002247 | 002248 | 002249 | | | |
| Epididymis | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Granuloma Sperm | | | | | | | | | | | | | | | | | | | | | | | | | 1 4.0 | | |
| Preputial Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | | |
| Prostate | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Inflammation | | 2 | | 2 | | 1 | | | | 2 | | 1 | | | | | 1 | | | 1 | | 2 | | 1 | 18 1.4 | | |
| Epithelium, Ventral, Hyperplasia | 1 | | | 1 | | | | | | 2 | 1 | | | | 1 | | | | | | | | | | 9 1.4 | | |
| Seminal Vesicle | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Hyperplasia | | | 1 | | | | | | | | | | | | | | | | | | | | | | 1 1.0 | | |
| Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | | |
| Testes | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Edema | | | | | | | | | | | | | | | | 3 | | | | | | | | 3 | 2 3.0 | | |
| Germinal Epithelium, Degeneration | | | | 4 | | | | | 1 | | | | | | | | | | | | | | | | 10 2.8 | | |
| Interstitial Cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | 1 1.0 | | |
| HEMATOPOIETIC SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bone Marrow | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Myeloid Cell, Hyperplasia | | | | | 3 | | | | | 4 | | | | | | 4 | | | | | 3 | | | | 12 2.8 | | |
| Lymph Node | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | |
| Iliac, Ectasia | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | | |
| Lumbar, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | | 3 1.7 | | |
| Renal, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | | |
| Lymph Node, Bronchial | + | + | + | + | + | + | + | + | + | M | + | + | + | M | + | + | + | + | + | + | + | M | + | + | + | 46 | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
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|------------------------------------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|------|--|
| | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | | 0730 | |
| ANIMAL ID | 002226 | 002227 | 002228 | 002229 | 002230 | 002231 | 002232 | 002233 | 002234 | 002235 | 002236 | 002237 | 002238 | 002239 | 002240 | 002241 | 002242 | 002243 | 002244 | 002245 | 002246 | 002247 | 002248 | 002249 | 002250 | | |
| Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | 1 3.0 | | |
| Lymph Node, Mandibular | + | + | + | + | + | + | + | + | + | + | M | M | + | + | + | M | + | M | + | + | + | + | + | + | 44 | | |
| Lymph Node, Mediastinal | + | + | + | + | + | + | + | + | + | + | + | + | + | + | M | + | + | M | + | + | + | + | + | + | 47 | | |
| Lymph Node, Mesenteric Ectasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Hyperplasia, Lymphoid Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | 1 4.0 | | |
| Spleen | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Hematopoietic Cell Proliferation | 1 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 41 1.9 | | |
| Pigmentation, Hemosiderin | | | 1 | | | | | 1 | 1 | | 1 | | | | | | | 1 | 1 | | | 1 | 1 | 1 | 22 1.0 | | |
| Lymphoid Follicle, Atrophy | | | | | | | | | | 3 | | | | | | | | | | 2 | | 3 | | | 5 2.2 | | |
| Thymus | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 48 | | |
| Atrophy | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 1 | 2 | 3 | 3 | 2 | 2 | 3 | 4 | 3 | 4 | 2 | 3 | 47 2.7 | | |
| Hyperplasia, Lymphoid | | | | | | | | | | | | | | | 2 | | | | | | | | 2 | | 2 2.0 | | |
| INTEGUMENTARY SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mammary Gland | + | M | M | M | + | M | M | + | + | M | M | M | M | M | M | M | + | M | M | M | M | M | M | M | 9 | | |
| Skin | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Foot, Inflammation, Chronic Active | | | | | 3 | | | | | | | | | | | | | | | | | | | | 7 3.1 | | |
| Foot, Ulcer | | | | | 4 | | | | | | | | | | | | | | | | | | | | 7 3.4 | | |
| MUSCULOSKELETAL SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bone | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
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|----------------------------------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|
| | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | 07030 | |
| ANIMAL ID | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 | 002226 |
| | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 | 67890 |

Skeletal Muscle 3

NERVOUS SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|----|-------|
| Brain | + | | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Cranial Nerve, Glial Cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | 1 3.0 |
| Peripheral Nerve | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Spinal Cord | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |

RESPIRATORY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|----|--------|
| Larynx | + | | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | | 7 1.1 |
| Respiratory Epithelium, Metaplasia, Squamous | | | | | | | | | | | | | | | | | | | | | | | | | | 1 1.0 |
| Squamous Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | 2 2.0 |
| Lung | + | | | | | | | | | | | | | | | | | | | | | | | | 49 | |
| Inflammation, Granulomatous | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3 1.0 |
| Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | | 2 1.0 |
| Metaplasia, Osseous | | | | | | | | | | | | | | | | | | | | | | | | | | 1 1.0 |
| Alveolar Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | 4 1.0 |
| Alveolar Epithelium, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3 2.0 |
| Alveolus, Infiltration Cellular, Histiocyte | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 14 1.2 |
| Interstitial, Fibrosis | | | | | | | | | | | | | | | | | | | | | | | | | | 1 1.0 |
| Nose | + | | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Foreign Body | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | | | | 4 1.5 |
| Nerve, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3 3.0 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
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| | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | 0730 | | 0730 |
| ANIMAL ID | 0022 | 0022 | 0022 | 0022 | 0022 | 0022 | 0022 | 0022 | 0022 | 0022 | 0022 | 0022 | 0022 | 0022 | 0022 | 0022 | 0022 | 0022 | 0022 | 0022 | 0022 | |
| Olfactory Epithelium, Accumulation, Hyaline Droplet | 2 | | | | 2 | | | | | 1 | | | 1 | | | | | 2 | | | | 6 1.5 |
| Olfactory Epithelium, Atrophy | | | | | | | | | | 1 | | | | | | | | | | | | 5 1.4 |
| Olfactory Epithelium, Metaplasia, Respiratory | | | | | | | | | | | | | 1 | | | | | | | | | 3 1.3 |
| Respiratory Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | 2 1.0 |
| Pleura | | | | | | | | | | | | | | | | | | | | | | 1 |
| Trachea | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |

SPECIAL SENSES SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--------|
| Eye | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Anterior Chamber, Inflammation, Suppurative | | | 1 | | | | | | | | | | | | | | | | | | | 1 1.0 |
| Cornea, Inflammation, Chronic Active | 1 | 2 | | | | | | 3 | 3 | | | | 3 | | | | | | | | | 6 2.3 |
| Cornea, Mineralization | | 1 | | | | | | | 1 | | | | | | | | | | | | | 4 1.0 |
| Cornea, Epithelium, Hyperplasia | | 1 | | | | | | | | | | | 1 | | | | | | | | | 2 1.0 |
| Cornea, Epithelium, Ulcer | | | | | | | | | | | | | | | | | | | | | | 1 1.0 |
| Iris, Inflammation, Acute | | | | | | | | | 1 | | | | | | | | | | | | | 1 1.0 |
| Lens, Cataract | | | | | | 1 | | | | | | | 1 | | | | | | | | 3 | 5 1.6 |
| Retina, Degeneration | | | | 3 | | | | | | | | | 1 | 1 | | | | | 3 | | 3 | 11 2.2 |
| Unilateral, Phthisis Bulbi | | | | | | | | | 4 | | | | | | | | | | | | | 1 4.0 |
| Harderian Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |

URINARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----------|--------|
| Kidney | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Calculus Micro Observation Only | | X | X | | X | | | | | | | | X | | | X | | | | | | 10 |
| Infarct | | | | | | | | | | | | | | | | | | 1 | | | | 1 1.0 |
| Nephropathy | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 3 | | 1 | 2 | 1 | 3 | | 1 | 1 | 2 | | 2 2 1 2 1 | 40 1.7 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE 12.5 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS |
|--|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----------|
| | 0730 | 0772 | 0773 | 0773 | 0773 | 0773 | 0773 | 0773 | 0773 | 0773 | 0773 | 0773 | 0773 | 0773 | 0773 | 0773 | 0773 | 0773 | 0773 | 0773 | 0773 | 0773 | 0773 | 0773 | |
| ANIMAL ID | 0022 | 0022 | 0022 | 0022 | 0023 | 0023 | 0023 | 0023 | 0023 | 0023 | 0023 | 0023 | 0023 | 0023 | 0023 | 0023 | 0023 | 0023 | 0023 | 0023 | 0023 | 0023 | 0023 | 0023 | 0023 |
| Pelvis, Dilatation | | | | | | | | | | | | | | | | | | | | | | | | | 4 |
| Pelvis, Inflammation | | 1 | | | | 1 | | | | | | | | 1 | | 1 | | | | | | | | | 4 |
| Pelvis, Transitional Epithelium, Hyperplasia | | | | | | | 1 | | | | | | | | | | | | | | | | | | 1 |
| Ureter Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | + |
| Urinary Bladder Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | + |
| Urinary Bladder Calculus Gross Observation | | | | | | | | | | | | | | | | | | | | | | | | | X |
| Urinary Bladder Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| | | | | | | | | | | | | | | | | | | | | | | | | | 50 |
| | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| | | | | | | | | | | | | | | | | | | | | | | | | | 1 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE 25 ppm | DAY ON TEST | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ANIMAL ID | males (cont...) | | |
|--------------------------------|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----------|--------------------|---|---|
| | | 7 | 7 | 7 | 7 | 7 | 7 | 5 | 7 | 3 | 7 | 5 | 7 | 5 | 5 | 7 | 7 | 7 | 7 | 7 | 6 | 7 | 7 | 5 | | | 6 | |
| | | 3 | 3 | 2 | 3 | 3 | 8 | 3 | 2 | 2 | 2 | 4 | 9 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 9 | 4 | 2 | 3 | 2 | 9 | 1 | 7 |
| | | 1 | 1 | 9 | 0 | 0 | 2 | 0 | 5 | 9 | 7 | 9 | 3 | 2 | 0 | 0 | 1 | 0 | 9 | 4 | 9 | 4 | 9 | 2 | 2 | 1 | 2 | 7 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

ALIMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Esophagus | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Cecum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Colon | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Rectum Metaplasia, Squamous | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Small, Duodenum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Small, Ileum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Small, Jejunum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Liver | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Angiectasis | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Basophilic Focus | X | X | | X | X | | | | | | | X | | | | X | | | | | | X | X | | | | |
| Clear Cell Focus | | | X | X | X | X | | X | | X | | X | | X | | | | X | X | | | X | X | X | | | |
| Degeneration, Cystic | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | |
| Eosinophilic Focus | X | | X | | | | | | | | | | | | | | | | | | | | | | | | |
| Fatty Change, Focal | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hematopoietic Cell Proliferation | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | |
| Hepatodiaphragmatic Nodule | | | | | | | | | | X | | | | | | | | | | | | | | | | | |
| Infiltration Cellular, Mixed Cell | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | |
| Mixed Cell Focus | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Necrosis, Focal | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | |
| Pigmentation, Hemosiderin | | | | | | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
+ .. Tissue examined microscopically
X .. Lesion present
I .. Insufficient tissue
M .. Missing tissue
A .. Autolysis precludes evaluation
BLANK .. Not examined microscopically
1-4 .. Lesion qualified as:
1) Minimal 3) Moderate
2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | ANIMAL ID | males (cont...) |
|--|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--------------------------------------|-----------|--------------------|
| | 0731 | 0731 | 0732 | 0733 | 0733 | 0733 | 0758 | 0773 | 0773 | 0775 | 0775 | 0775 | 0775 | 0775 | 0775 | 0775 | 0775 | 0775 | 0775 | 0775 | 0775 | 0775 | 0775 | 0775 | 0775 | | |
| 25 ppm | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | | |
| Tension Lipidosis Bile Duct, Hyperplasia | 1 | | | | | | | | | 1 | | | | | | | | | | | 1 | | | | | | |
| Mesentery Fat, Necrosis | | | | | | | | | | | | | | | | | | | | | | | | | + | | |
| Pancreas Atrophy | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 1 | | |
| Salivary Glands Inflammation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 2 | | |
| Stomach, Forestomach Inflammation Ulcer Epithelium, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 3 3 | | |
| Stomach, Glandular | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| CARDIOVASCULAR SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Blood Vessel Mineralization | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Heart Cardiomyopathy Inflammation, Suppurative | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 2 1 1 1 1 1 1 1 | | |
| ENDOCRINE SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Adrenal Cortex | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| Wistar Han Rats Male 25 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | ANIMAL ID | males (cont...) |
|---|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----------|--------------------|
| | 0731 | 0731 | 0732 | 0733 | 0733 | 0733 | 0738 | 0733 | 0732 | 0732 | 0732 | 0734 | 0739 | 0733 | 0733 | 0733 | 0733 | 0733 | 0737 | 0737 | 0737 | 0737 | 0737 | 0735 | 0736 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0040 | |
| Degeneration, Cystic | | | | | | | | 1 | | | | | | | | | | 1 | | | | | | | | 0041 | |
| Hematopoietic Cell Proliferation | | | | | | | | | | | | | | | | | | | | | | | | | | 0042 | |
| Zona Fasciculata, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | 1 | | | 1 | | 0043 | |
| Zona Fasciculata, Hyperplasia, Multifocal | | | | | | | | | | | | | | | | | | | | | | | | | | 0044 | |
| Zona Fasciculata, Hypertrophy, Focal | | | | | | | | | | | | | | | | | | | | | | | | | | 0045 | |
| Zona Fasciculata, Hypertrophy, Multifocal | | | | | | | | | | | | | | | | | | | | | | | | | | 0046 | |
| Adrenal Medulla | | | | | | | | | | | | | | | | | | | | | | | | | | 0047 | |
| Islets, Pancreatic | | | | | | | | | | | | | | | | | | | | | | | | | | 0048 | |
| Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | 0049 | |
| Parathyroid Gland | | | | | | | | | | | | | | | | | | | | | | | | | | 0050 | |
| Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | | | | | | 0051 | |
| Pituitary Gland | | | | | | | | | | | | | | | | | | | | | | | | | | 0052 | |
| Pars Distalis, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | 0053 | |
| Pars Intermedia, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | 0054 | |
| Thyroid Gland | | | | | | | | | | | | | | | | | | | | | | | | | | 0055 | |
| C-cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | 0056 | |
| Follicular Cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | 0057 | |
| Follicular Cell, Hypertrophy | | | | | | | | | | | | | | | | | | | | | | | | | | 0058 | |

GENERAL BODY SYSTEM

NONE

GENITAL SYSTEM

Epididymis +

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically M .. Missing tissue 1-4 .. Lesion qualified as:
 X .. Lesion present A .. Autolysis precludes evaluation 1) Minimal 3) Moderate
 I .. Insufficient tissue BLANK .. Not examined microscopically 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE 25 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | ANIMAL ID | males (cont...) | | | |
|--|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----------|--------------------|------|------|------|
| | 0731 | 0731 | 0732 | 0733 | 0733 | 0733 | 0738 | 0733 | 0732 | 0735 | 0737 | 0735 | 0735 | 0737 | 0737 | 0737 | 0737 | 0737 | 0736 | 0732 | | | 0737 | 0737 | 0735 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0040 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0040 | |
| | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0044 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 0040 | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 0041 | |
| Preputial Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | | |
| Prostate Inflammation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | | |
| Epithelium, Ventral, Hyperplasia | 1 | | | | 1 | 2 | | | 2 | | | | | 1 | 1 | 1 | 2 | | 1 | 1 | 1 | 1 | | 3 | |
| Seminal Vesicle | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | | |
| Testes Germinal Epithelium, Degeneration | 4 | | | | | | | | | | | | | | | | | | | | | | | 1 4 | |
| Interstitial Cell, Hyperplasia | 2 | | | | | | | | | | | | | | | | | | | | | | | | |
| Rete Testes, Inflammation, Granulomatous | | | | | | | | | | | | | | | | | | | | | | | | 2 | |

HEMATOPOIETIC SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|---|
| Bone Marrow Myeloid Cell, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Lymph Node Axillary, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| Lymph Node Lumbar, Ectasia | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| Lymph Node Lumbar, Infiltration Cellular, Plasma Cell | 3 | | | | | | | | | | | | | | | | | | | | | | | |
| Lymph Node Pancreatic, Inflammation | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| Lymph Node Popliteal, Hyperplasia, Lymphoid | | | | | | | | | | | | | | | | | | | | | | | | |
| Lymph Node Popliteal, Infiltration Cellular, Plasma Cell | 4 | | | | | | | | | | | | | | | | | | | | | | | |
| Lymph Node Renal, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | |
| Lymph Node, Bronchial Atrophy | + | + | + | + | + | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | M | + | | + |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| Wistar Han Rats Male 25 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | ANIMAL ID | males (cont...) | |
|--------------------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----------|--------------------|------|
| | 0731 | 0731 | 0732 | 0733 | 0733 | 0733 | 0738 | 0733 | 0732 | 0732 | 0732 | 0734 | 0735 | 0737 | 0735 | 0735 | 0737 | 0737 | 0737 | 0737 | 0732 | 0736 | 0737 | 0737 | 0735 | | | 0736 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0040 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0040 | |
| | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0044 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 0041 | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lymph Node, Mandibular Hemorrhage | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Lymph Node, Mediastinal Infiltration Cellular, Plasma Cell | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | M | + | + |
| Lymph Node, Mesenteric | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Spleen Cyst | + | + | + | + | + | + | + | + | + | + | X | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Hematopoietic Cell Proliferation | 1 | | 2 | 2 | 2 | 1 | 1 | 1 | | 1 | | 1 | | 1 | 2 | 2 | 1 | | 1 | 4 | 3 | | 2 | 2 | | |
| Inflammation | | | 2 | | | | | | | | | | | | | | | | | | | | | | | |
| Pigmentation, Hemosiderin | | 1 | 1 | 1 | 1 | | 1 | 1 | | | 1 | | 1 | 1 | 1 | | | | | | | 1 | | | 1 | |
| Lymphoid Follicle, Atrophy | | | | | | | | | | | | | 2 | 2 | | | | | | | | | | | | |
| Thymus Atrophy | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Hyperplasia, Lymphoid | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 1 | | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | | 3 | |

INTEGUMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mammary Gland Galactocele | M | M | + | + | M | M | M | M | M | M | + | + | M | M | M | M | M | M | + | M | + | M | + | M | M |
| Skin | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Dorsal, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dorsal, Ulcer, Focal | | | | | | | | | | | | | | | | | | | | | | | | | |
| Epidermis, Cyst | | | | | | | | | | | | | | | | | | | | | | | | | |
| Foot, Inflammation, Chronic Active | 4 | 3 | | | | 3 | | | | | | | 2 | 4 | 3 | | | | 3 | | | 3 | | | |
| Foot, Ulcer | 4 | 3 | | | | 3 | | | | | | | 2 | 3 | 3 | | | | 4 | | | 3 | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | males (cont...) |
|----------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--------------------|
| | 0731 | 0731 | 0732 | 0733 | 0733 | 0733 | 0738 | 0733 | 0732 | 0732 | 0732 | 0735 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | |
| 25 ppm | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | |
| | 12 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | |

Inguinal, Inflammation, Granulomatous 3
 Inguinal, Ulcer, Focal 2
 Tail, Cyst Epithelial Inclusion X

MUSCULOSKELETAL SYSTEM

Bone +
 Hyperostosis
 Skeletal Muscle

NERVOUS SYSTEM

Brain +
 Peripheral Nerve
 Spinal Cord

RESPIRATORY SYSTEM

Larynx +
 Inflammation, Chronic Active 1
 Squamous Epithelium, Hyperplasia 2 1
 Lung +
 Inflammation, Suppurative 2
 Inflammation, Granulomatous
 Alveolar Epithelium, Hyperplasia 1 1
 Alveolar Epithelium, Hyperplasia, Focal 3
 Alveolus, Infiltration Cellular, Histiocyte 1

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically M .. Missing tissue 1-4 .. Lesion qualified as:
 X .. Lesion present A .. Autolysis precludes evaluation 1) Minimal 3) Moderate
 I .. Insufficient tissue BLANK .. Not examined microscopically 2) Mild 4) Marked

Experiment Number: 20725 - 03
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 Lab: BNW

| | | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | males (cont...) | | |
|---|-----------|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--------------------|---|---|
| WISTAR HAN RATS MALE 25 ppm | ANIMAL ID | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | |
| | | 7 | 7 | 7 | 7 | 7 | 7 | 5 | 7 | 3 | 7 | 5 | 7 | 5 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 2 | 6 | 7 | 7 | 5 | | 6 | |
| | | 3 | 3 | 2 | 3 | 3 | 3 | 8 | 3 | 2 | 2 | 2 | 4 | 9 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 9 | 9 | 4 | 2 | 7 | 7 | 5 | 6 |
| | | 1 | 1 | 9 | 0 | 0 | 0 | 2 | 0 | 5 | 9 | 7 | 9 | 3 | 2 | 0 | 0 | 1 | 0 | 0 | 9 | 4 | 9 | 1 | 2 | 2 | 2 | 1 | 7 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Bronchus, Epithelium, Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bronchus, Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bronchus, Epithelium, Regeneration | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Interstitialium, Fibrosis | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nose | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Foreign Body | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Inflammation, Suppurative | | 4 | | 1 | 2 | | 1 | 2 | 3 | | | | 1 | | 4 | 1 | 1 | 1 | 2 | | 1 | 3 | 1 | 2 | 2 | | | | |
| Inflammation, Chronic Active | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | |
| Lamina Propria, Fibrosis | | 1 | 1 | 1 | | 1 | 1 | 1 | | | 1 | 1 | 1 | | 1 | | 1 | 1 | | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | |
| Olfactory Epithelium, Accumulation, Hyaline Droplet | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Olfactory Epithelium, Atrophy | | | | 2 | 1 | | 1 | | 2 | 2 | 1 | 1 | | 1 | | 1 | | | | | | 2 | | | | 2 | 2 | | |
| Olfactory Epithelium, Metaplasia, Respiratory | | 2 | | | | | | 2 | | | | | | | | | | | | | | 2 | | | | | | | 2 |
| Respiratory Epithelium, Hyperplasia | | 1 | | | | | | | | | | | | | 2 | | | | | | | | | | | | 1 | 1 | |
| Respiratory Epithelium, Metaplasia, Squamous | | 1 | | | | | | | 1 | | | | | | | 1 | | | | | 1 | | | | | | | | |
| Turbinate, Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Trachea | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Epithelium, Regeneration | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

SPECIAL SENSES SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ear | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Eye | | + | + | + | I | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Anterior Chamber, Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bilateral, Phthisis Bulbi | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cornea, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade

+ .. Tissue examined microscopically

X .. Lesion present

I .. Insufficient tissue

M .. Missing tissue

A .. Autolysis precludes evaluation

BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:

1) Minimal 3) Moderate

2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| Wistar Han Rats Male 25 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | males (cont...) |
|---------------------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--------------------|
| | 0731 | 0731 | 0732 | 0733 | 0733 | 0733 | 0738 | 0733 | 0735 | 0737 | 0735 | 0735 | 0735 | 0737 | 0737 | 0737 | 0737 | 0737 | 0737 | 0736 | 0732 | 0733 | 0732 | 0732 | 0735 | |
| ANIMAL ID | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 | 0040 |
| Cornea, Mineralization | | | | | | | | | | | | | | | | | | | | | 1 | | | | | |
| Cornea, Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | 1 | | 3 | | | |
| Cornea, Epithelium, Ulcer | | | | | | | | | | | | | | | | | | | | | | 1 | | | | |
| Iris, Inflammation, Acute | | | 1 | | | | | | | | | | | 1 | | | | | | | | | | | | |
| Lens, Cataract | | | 2 | | | | | | | 1 | | | | | | 1 | | | | | | | 1 | | | |
| Retina, Degeneration | | | 2 | | | 2 | | | | 3 | | | | | | 3 | | | | | 1 | | | | 2 | |
| Unilateral, Phthisis Bulbi | | | | | | | | | | | | | | | | | | | | | 4 | | | | | |
| Harderian Gland Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |

URINARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kidney | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Calculus Micro Observation Only | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fibrosis, Focal | | | | | | | | | | | | | | | | | | | | | | | | | |
| Infarct | | | | | | | | | | | | | | | | | | | | | | 1 | | | |
| Infiltration Cellular, Lymphoid | | | | | | | | | 2 | | | | | | | | | | | | | | | | |
| Nephropathy | 2 | | 1 | 1 | 2 | 1 | 1 | 2 | | 1 | 1 | 2 | | 2 | 2 | 2 | | 1 | 2 | | 2 | 2 | 3 | 1 | |
| Thrombosis | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cortex, Cyst | | | | | | | | | | | 1 | | | | | | | | | | | | | | |
| Pelvis, Dilatation | | | | | | | | | | | | | | | 1 | | | | | | | | | | |
| Pelvis, Inflammation | | | 1 | | | | | | | | 2 | | | | | 2 | | | | | | | | | |
| Urinary Bladder Hemorrhage | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

Experiment Number: 20725 - 03
 Test Type: CHRONIC
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 2,3-Butanedione
 CAS Number: 431-03-8

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

| WISTAR HAN RATS MALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | |
|----------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|------|
| | 0729 | 0731 | 0730 | 0732 | 0733 | 0734 | 0735 | 0736 | 0737 | 0738 | 0739 | 0740 | 0741 | 0742 | 0743 | 0744 | 0745 | 0746 | 0747 | 0748 | | 0749 |
| 25 ppm | 00426 | 00447 | 00448 | 00449 | 00450 | 00451 | 00452 | 00453 | 00454 | 00455 | 00456 | 00457 | 00458 | 00459 | 00460 | 00461 | 00462 | 00463 | 00464 | 00465 | 00466 | 50 |

ALIMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|-------|
| Esophagus | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Intestine Large, Cecum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Intestine Large, Colon | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Intestine Large, Rectum Metaplasia, Squamous | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 3 2.0 |
| Intestine Small, Duodenum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Intestine Small, Ileum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Intestine Small, Jejunum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Liver | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 6 1.0 |
| Angiectasis | | | | | | | | | | | | | | | | | | | | | | | | | | | | 18 |
| Basophilic Focus | X | | | | | | | | | | | | | | | | | | | | | | | | | | | 27 |
| Clear Cell Focus | X | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 1.5 |
| Degeneration, Cystic | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| Eosinophilic Focus | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 1.0 |
| Fatty Change, Focal | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 1.0 |
| Hematopoietic Cell Proliferation | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| Hepatodiaphragmatic Nodule | X | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 1.0 |
| Infiltration Cellular, Mixed Cell | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Mixed Cell Focus | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 3.0 |
| Necrosis, Focal | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 |
| Pigmentation, Hemosiderin | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade

+ .. Tissue examined microscopically

X .. Lesion present

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 Lab: BNW

| WISTAR HAN RATS MALE 25 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS | |
|-----------------------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---|----------|--|
| | 0729 | 0731 | 0730 | 0732 | 0733 | 0734 | 0735 | 0736 | 0737 | 0738 | 0739 | 0740 | 0741 | 0742 | 0743 | 0744 | 0745 | 0746 | 0747 | 0748 | 0749 | 0750 | 0751 | 0752 | | | |
| ANIMAL ID | 00426 | 00447 | 00448 | 00449 | 00450 | 00451 | 00452 | 00453 | 00454 | 00455 | 00456 | 00457 | 00458 | 00459 | 00460 | 00461 | 00462 | 00463 | 00464 | 00465 | 00466 | 00467 | 00468 | 00469 | | | |
| Tension Lipidosis | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | |
| Bile Duct, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Mesentery Fat, Necrosis | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | |
| Pancreas Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Salivary Glands Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Stomach, Forestomach Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Ulcer Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Stomach, Glandular | | | | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| CARDIOVASCULAR SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Blood Vessel Mineralization | | | | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Heart Cardiomyopathy | | | | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| ENDOCRINE SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Adrenal Cortex | | | | | | | | | | | | | | | | | | | | | | | | | | 50 | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue

M .. Missing tissue
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| WISTAR HAN RATS MALE 25 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | |
|--|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|------|----|
| | 0729 | 0731 | 0730 | 0732 | 0733 | 0734 | 0735 | 0736 | 0737 | 0738 | 0739 | 0740 | 0741 | 0742 | 0743 | 0744 | 0745 | 0746 | 0747 | 0748 | | 0749 | |
| ANIMAL ID | 00426 | 00427 | 00428 | 00429 | 00430 | 00431 | 00432 | 00433 | 00434 | 00435 | 00436 | 00437 | 00438 | 00439 | 00440 | 00441 | 00442 | 00443 | 00444 | 00445 | 00446 | | |
| Degeneration, Cystic | | | | | | | | | | | | | | | | | | | | | | 2 | |
| Hematopoietic Cell Proliferation | | | | | | | | | | | | | | | 2 | | | | | | | | 2 |
| Zona Fasciculata, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | 1 | | | 3 |
| Zona Fasciculata, Hyperplasia, Multifocal | | | | 2 | | | | | | | | | | | | | | | | | | | 1 |
| Zona Fasciculata, Hypertrophy, Focal | | | | | | 1 | | | | | | | | | | | | | | | | | 11 |
| Zona Fasciculata, Hypertrophy, Multifocal | | | 2 | 2 | | | 2 | | 2 | | | | | | 2 | 3 | 3 | | 3 | 1 | 2 | 2 | 2 |
| Adrenal Medulla | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Islets, Pancreatic Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Parathyroid Gland Hyperplasia, Focal | M | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 49 |
| Pituitary Gland Pars Distalis, Hyperplasia | 1 | 2 | 1 | 1 | 3 | 1 | 1 | | 3 | | | | | | 2 | 3 | | 1 | 2 | | | 1 | 23 |
| Pituitary Gland Pars Intermedia, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Thyroid Gland C-cell, Hyperplasia | | | 1 | | | | | | | | | | | | | | | | | | | | 50 |
| Thyroid Gland Follicular Cell, Hyperplasia | | | | | | | | | | | | | | | 1 | | | | | | | 2 | 8 |
| Thyroid Gland Follicular Cell, Hypertrophy | | | | | | | | | | | | | | | | | | | | | | | 1 |

GENERAL BODY SYSTEM

NONE

GENITAL SYSTEM

Epididymis + 50

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE 25 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | |
|---|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|--------|--------|
| | 0729 | 0731 | 0730 | 0732 | 0733 | 0734 | 0735 | 0736 | 0737 | 0738 | 0739 | 0740 | 0741 | 0742 | 0743 | 0744 | 0745 | 0746 | 0747 | 0748 | | 0749 | |
| ANIMAL ID | 00426 | 00407 | 00408 | 00409 | 00410 | 00411 | 00412 | 00413 | 00414 | 00415 | 00416 | 00417 | 00418 | 00419 | 00420 | 00421 | 00422 | 00423 | 00424 | 00425 | 00426 | | |
| Preputial Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Prostate | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Inflammation | | | | 1 | | | | 1 | | 1 | | 2 | 1 | | 1 | | | 1 | | | | 18 1.3 | |
| Epithelium, Ventral, Hyperplasia | | | | | | | | | | | 2 | | | | | | | | | | 1 | 7 1.3 | |
| Seminal Vesicle | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Testes | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Germinal Epithelium, Degeneration | | 4 | | | | | | | | | | | | | | | | | | | | 4 3.3 | |
| Interstitial Cell, Hyperplasia | | | | | | | 1 | | | | | | | | | | | | | 4 | | 3 2.3 | |
| Rete Testes, Inflammation, Granulomatous | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | |
| HEMATOPOIETIC SYSTEM | | | | | | | | | | | | | | | | | | | | | | | |
| Bone Marrow | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Myeloid Cell, Hyperplasia | 2 | 2 | 3 | | | 4 | 3 | | | | | | 3 | | 4 | | | | | 2 | | 3 | 16 2.8 |
| Lymph Node | | + | + | | | + | | | | | | | | + | | | | | | + | | 9 | |
| Axillary, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | 1 3.0 | |
| Lumbar, Ectasia | | | | | | | | | | | | | | | | | | | | | | 1 3.0 | |
| Lumbar, Infiltration Cellular, Plasma Cell | | | 3 | | | 2 | | | | | | | 2 | | | | | | 3 | | 4 | 6 2.8 | |
| Pancreatic, Inflammation | | | | | | | | | | | | | | | | | | | | | | 1 3.0 | |
| Popliteal, Hyperplasia, Lymphoid | | | | | | | 2 | | | | | | | | | | | | | | 3 | 2 2.5 | |
| Popliteal, Infiltration Cellular, Plasma Cell | | 3 | | | | 4 | | | | | | | | | | | | | | | 2 | 4 3.3 | |
| Renal, Infiltration Cellular, Plasma Cell | | | 3 | | | | | | | | | | | | | | | | | | | 1 3.0 | |
| Lymph Node, Bronchial | + | + | + | + | + | + | M | + | + | + | + | + | + | M | + | + | M | + | + | + | + | 43 | |
| Atrophy | | | | | | | | | | | | 4 | | | | | | | | | | 2 3.0 | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
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Experiment Number: 20725 - 03
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 2,3-Butanedione
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 Lab: BNW

| WISTAR HAN RATS MALE 25 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | | | | | | | | | | | | | | | |
|--|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|-----|
| | 0729 | 0731 | 0730 | 0732 | 0733 | 0734 | 0735 | 0736 | 0737 | 0738 | 0739 | 0740 | 0741 | 0742 | 0743 | 0744 | 0745 | 0746 | 0747 | 0748 | | 0749 | 0750 | 0751 | 0752 | 0753 | 0754 | 0755 | 0756 | 0757 | 0758 | 0759 | 0760 | | | | |
| ANIMAL ID | 00426 | 00447 | 00448 | 00449 | 00450 | 00451 | 00452 | 00453 | 00454 | 00455 | 00456 | 00457 | 00458 | 00459 | 00460 | 00461 | 00462 | 00463 | 00464 | 00465 | 00466 | 00467 | 00468 | 00469 | 00470 | 00471 | 00472 | 00473 | 00474 | 00475 | 00476 | 00477 | 00478 | 00479 | 00480 | | |
| Lymph Node, Mandibular Hemorrhage | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 49 | |
| | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 |
| Lymph Node, Mediastinal Infiltration Cellular, Plasma Cell | + | + | + | + | + | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | + | + | 47 | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 |
| Lymph Node, Mesenteric | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Spleen Cyst | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Hematopoietic Cell Proliferation | 1 | 2 | 1 | 2 | 2 | 2 | | | | 2 | | 2 | | 2 | 2 | 1 | 3 | 2 | | 1 | 1 | 2 | 1 | | 1 | | | | | | | | | 36 | 1.7 | | |
| Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 | |
| Pigmentation, Hemosiderin | 1 | | | | 1 | | | | 1 | | 2 | 1 | | | | | 1 | 1 | | | | | | | | | | | | | | | | | 20 | 1.1 | |
| Lymphoid Follicle, Atrophy | | | | | | | | | | 2 | | | 3 | | | | | | | | | | | | | | | | | | | | | | 4 | 2.3 | |
| Thymus Atrophy | + | + | + | + | + | + | + | + | + | M | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 48 | | | |
| Hyperplasia, Lymphoid | 2 | 2 | 4 | 2 | 3 | 1 | 2 | 3 | 2 | | 3 | 3 | 3 | | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | | 2 | 3 | 3 | | 2 | 4 | | | | 45 | 2.6 | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3.0 | |
| INTEGUMENTARY SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mammary Gland Galactocele | + | M | M | M | M | M | M | + | + | M | + | M | + | M | M | M | M | + | M | M | M | M | M | M | M | M | M | M | M | + | | | | 14 | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 |
| Skin | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | |
| Dorsal, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 1 | 2.0 |
| Dorsal, Ulcer, Focal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 1 | 2.0 |
| Epidermis, Cyst | | | | | | | | | | X | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | |
| Foot, Inflammation, Chronic Active | | | | 4 | | 4 | | | 3 | | | | | 3 | | | | 3 | 3 | 3 | 3 | | | | 4 | | | | | | | | | 17 | 3.2 | | |
| Foot, Ulcer | | | | 4 | | 4 | | | 3 | | | | 4 | | | | 3 | 4 | 3 | 4 | | | | 4 | | | | | | | | | | 17 | 3.4 | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
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Experiment Number: 20725 - 03
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| WISTAR HAN RATS MALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS |
|----------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|---|----------|
| | 0729 | 0731 | 0730 | 0732 | 0733 | 0734 | 0735 | 0736 | 0737 | 0738 | 0739 | 0740 | 0741 | 0742 | 0743 | 0744 | 0745 | 0746 | 0747 | 0748 | 0749 | 0750 | 0751 | 0752 | | |
| 25 ppm | 0026 | 0004 | 0002 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 1 | |
| | 0042 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 1 | |
| | 0022 | 0002 | 0002 | 0003 | 0003 | 0003 | 0003 | 0003 | 0003 | 0003 | 0003 | 0003 | 0003 | 0003 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0005 | 1 | |
| | 0006 | 0007 | 0008 | 0009 | 0000 | 0001 | 0002 | 0003 | 0004 | 0005 | 0006 | 0007 | 0008 | 0009 | 0000 | 0001 | 0002 | 0003 | 0004 | 0005 | 0006 | 0007 | 0008 | 0009 | 1 | |

Inguinal, Inflammation, Granulomatous 1 3.0
 Inguinal, Ulcer, Focal 1 2.0
 Tail, Cyst Epithelial Inclusion 1

MUSCULOSKELETAL SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|---|--|---|--|--|--|--|---|-------|----|--|
| Bone | + | | | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Hyperostosis | | | | | | | | | | | | | | | | | | | | | | | | 3 | 1 3.0 | | |
| Skeletal Muscle | + | | | | | | | | | | | | | | | | + | | 4 | | | | | | | | |

NERVOUS SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------|---|--|--|--|--|--|--|--|--|--|--|--|--|--|---|--|---|--|---|--|---|--|--|--|--|----|--|
| Brain | + | | | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Peripheral Nerve | | | | | | | | | | | | | | | | | | | + | | 3 | | | | | | |
| Spinal Cord | | | | | | | | | | | | | | | + | | 3 | | | | | | | | | | |

RESPIRATORY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|--|--|--|--|--|--|--|--|--|--|---|---|--|-------|--|--|---|---|---|-------|---|-------|---|-------|-------|--------|
| Larynx | + | | | | | | | | | | | | | | | | | | | | | | | | | 50 | | |
| Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 7 1.0 | | | | | | |
| Squamous Epithelium, Hyperplasia | 2 | | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 8 1.3 | | | | |
| Lung | + | | | | | | | | | | | | | | | | | | | | | | | | | 50 | | |
| Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | |
| Inflammation, Granulomatous | | | | | | | | | | | | | | | | | | | | | | | | 1 | | 1 1.0 | | |
| Alveolar Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | 2 1.0 | | |
| Alveolar Epithelium, Hyperplasia, Focal | | | | | | | | | | | | | 4 | 1 | | 5 2.0 | | | | | | | | | | | | |
| Alveolus, Infiltration Cellular, Histiocyte | 2 | 1 | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 16 1.1 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
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Experiment Number: 20725 - 03
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| WISTAR HAN RATS MALE 25 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | | | | | | | |
|---|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|-------|-------|-------|-------|-----|-----|-----|-----|
| | 0729 | 0731 | 0730 | 0732 | 0733 | 0734 | 0735 | 0736 | 0737 | 0738 | 0739 | 0740 | 0741 | 0742 | 0743 | 0744 | 0745 | 0746 | 0747 | 0748 | | 0749 | 0750 | | | | | | |
| ANIMAL ID | 00426 | 00427 | 00428 | 00429 | 00430 | 00431 | 00432 | 00433 | 00434 | 00435 | 00436 | 00437 | 00438 | 00439 | 00440 | 00441 | 00442 | 00443 | 00444 | 00445 | 00446 | 00447 | 00448 | 00449 | 00450 | | | | |
| Bronchus, Epithelium, Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 | | | |
| Bronchus, Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 | | |
| Bronchus, Epithelium, Regeneration | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 | | |
| Interstitial, Fibrosis | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 | | |
| Nose | | | | | | | | | | | | | | | | | | | | | | | | | | | 50 | | |
| Foreign Body | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | |
| Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | | | | | 35 | 1.9 | |
| Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 1.5 | |
| Lamina Propria, Fibrosis | | | | | | | | | | | | | | | | | | | | | | | | | | | 28 | 1.0 | |
| Olfactory Epithelium, Accumulation, Hyaline Droplet | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | 1.8 | |
| Olfactory Epithelium, Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | | | 27 | 1.4 | |
| Olfactory Epithelium, Metaplasia, Respiratory | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | 1.7 | |
| Respiratory Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | 1.2 | |
| Respiratory Epithelium, Metaplasia, Squamous | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | 1.0 | |
| Turbinate, Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 | |
| Trachea | | | | | | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 |
| Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 |
| Epithelium, Regeneration | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | 1.0 |
| SPECIAL SENSES SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ear | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Eye | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 49 |
| Anterior Chamber, Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | 1.3 |
| Bilateral, Phthisis Bulbi | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 4.0 |
| Cornea, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | | | | 16 | 1.6 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
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 I .. Insufficient tissue
 M .. Missing tissue
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| WISTAR HAN RATS MALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS |
|----------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----|----------|
| | 0729 | 0731 | 0730 | 0732 | 0733 | 0734 | 0735 | 0736 | 0737 | 0738 | 0739 | 0740 | 0741 | 0742 | 0743 | 0744 | 0745 | 0746 | 0747 | 0748 | 0749 | 0750 | 0751 | 0752 | | |
| 25 ppm | 0026 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 0004 | 50 | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------|--|--|--|--|--|--|--|---|--|--|--|--|--|--|--|--|---|--|--|--|--|--|--|--|---|-----|-----|
| Cornea, Mineralization | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 | |
| Cornea, Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 1.7 |
| Cornea, Epithelium, Ulcer | | | | | | | | 1 | | | | | | | | | 2 | | | | | | | | | 4 | 1.3 |
| Iris, Inflammation, Acute | | | | | | | | 1 | | | | | | | | | | | | | | | | | | 3 | 1.0 |
| Lens, Cataract | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | 1.3 |
| Retina, Degeneration | | | | | | | | | | | | | | | | | | | | | | | | | | 11 | 2.5 |
| Unilateral, Phthisis Bulbi | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 3.7 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---|-----|
| Harderian Gland Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 1 | 1.0 |
|-----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---|-----|

URINARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|-----|-----|
| Kidney | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Calculus Micro Observation Only | | | X | | | | | | | | | | | | | | | | | | | | | | | 2 | | |
| Fibrosis, Focal | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 | |
| Infarct | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 | |
| Infiltration Cellular, Lymphoid | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 | |
| Nephropathy | | | | | | | | | | | | | | | | | | | | | | | | | | 41 | 1.6 | |
| Thrombosis | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 | |
| Cortex, Cyst | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 1.0 | |
| Pelvis, Dilatation | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 2.5 | |
| Pelvis, Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 1.8 | |
| Urinary Bladder Hemorrhage | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 1 | 3.0 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | ANIMAL ID | |
|--------------------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----------|--|
| | 0731 | 0738 | 0742 | 0754 | 0772 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000601 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000602 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000603 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000604 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000605 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000606 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000607 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000608 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000609 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000610 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000611 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000612 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000613 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000614 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000615 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000616 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000617 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000618 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000619 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000620 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000621 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000622 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000623 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000624 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000625 | |

males (cont...)

ALIMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Esophagus | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Cecum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Colon | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Rectum Metaplasia, Squamous | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Small, Duodenum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Small, Ileum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Small, Jejunum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Liver | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Angiectasis | | | | | | | | | | | | | | | 1 | | | | | | | | | | |
| Basophilic Focus | | | | | X | | | X | | | | | | | | | X | | | | | | | | |
| Clear Cell Focus | X | | | X | X | | | | | | X | | | | | X | | | | | | X | X | | |
| Eosinophilic Focus | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hematopoietic Cell Proliferation | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hepatodiaphragmatic Nodule | | | | | | | | | | | | | | | | | | | | X | | | | | |
| Infiltration Cellular, Mixed Cell | | | | | | | 1 | | 1 | | | | | | | | | | | | | | | | |
| Bile Duct, Cyst | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bile Duct, Dilatation | | | | | | | | | | | | | | | | | | | | 4 | | | | | |
| Bile Duct, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mesentery | | | | | | | | | | | | | | | | | | | | | | | | | + |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue

M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | males (cont...) | |
|--------------------------------|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--------------------|---|
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| | 7 | 5 | 7 | 6 | 7 | 7 | 7 | 6 | 7 | 6 | 5 | 7 | 7 | 5 | 4 | 7 | 7 | 6 | 7 | 5 | | 7 |
| | 3 | 8 | 2 | 4 | 2 | 3 | 2 | 1 | 3 | 2 | 4 | 2 | 3 | 8 | 9 | 2 | 3 | 1 | 6 | 3 | 9 | |
| | 1 | 6 | 9 | 2 | 9 | 1 | 9 | 9 | 0 | 8 | 1 | 9 | 1 | 9 | 9 | 9 | 0 | 0 | 9 | 0 | 9 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| ANIMAL ID | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | |

| | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fat, Necrosis | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Pancreas | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Atrophy | | | 1 | | | | | | | 1 | | | | | | | | | | | | | |
| Inflammation | | | | | | | | | | | | | | | | | 1 | | | | | | |
| Salivary Glands | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Basophilic Focus | | | | | | | | | | | | | | | | | | | | | | | |
| Stomach, Forestomach | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | |
| Stomach, Glandular | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |

CARDIOVASCULAR SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Blood Vessel | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Inflammation | | | 1 | | | | | | | | | | | 1 | | | | | | | | | |
| Heart | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Cardiomyopathy | | | | | 1 | 1 | | | 1 | | | | 1 | 2 | 2 | | 2 | | 2 | | 1 | | 1 |
| Epicardium, Fibrosis, Focal | 2 | | | | | | | | | | | | | | | | | | | | | | |

ENDOCRINE SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | |
|--------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Adrenal Cortex | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Degeneration, Cystic | | | | | 2 | | | | | | | | | | | | | | | | | | 1 |
| Infiltration Cellular, Lipocyte | | | | | | | | | | | | | | | | | | | | | | | |
| Bilateral, Necrosis, Multifocal | | | | | | | | | | | | | | | | | | | | | | | 3 |
| Zona Fasciculata, Hyperplasia, Focal | | | 1 | | | | | 1 | | | | | | | | | | | | | | | |
| Zona Fasciculata, Hypertrophy, Focal | | | | | | 1 | 3 | | | | | | 3 | | | | | 1 | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| Wistar Han Rats Male 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | males (cont...) |
|---|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------------------|
| | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | 0731 | |
| ANIMAL ID | 00601 | 00602 | 00603 | 00604 | 00605 | 00606 | 00607 | 00608 | 00609 | 00610 | 00611 | 00612 | 00613 | 00614 | 00615 | 00616 | 00617 | 00618 | 00619 | 00620 | 00621 | 00622 | 00623 | 00624 | 00625 | |
| Zona Fasciculata, Hypertrophy, Multifocal | 2 | | 3 | | | 2 | | | | 2 | | 2 | | | | 2 | | | | | | | | | | |
| Adrenal Medulla Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Islets, Pancreatic Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Parathyroid Gland | + | + | + | + | + | + | + | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Pituitary Gland Fibrosis Pars Distalis, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Thyroid Gland C-cell, Hyperplasia Follicular Cell, Hyperplasia Follicular Cell, Hypertrophy | | | 2 | | | | | | 1 | | | 1 | | | | | | 2 | | | 2 | | | | | |
| | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| | | | | | | | | | | | | | 2 | | | | | | | 3 | | 2 | | | | 1 |

GENERAL BODY SYSTEM

NONE

GENITAL SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Epididymis Inflammation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Preputial Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Prostate | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
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 2,3-Butanedione
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 Lab: BNW

| WISTAR HAN RATS MALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | males (cont...) |
|---|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
| | 0731 | 0738 | 0742 | 0746 | 0750 | 0754 | 0758 | 0762 | 0766 | 0770 | 0774 | 0778 | 0782 | 0786 | 0790 | 0794 | 0798 | 0802 | 0806 | 0810 | 0814 | 0818 | 0822 | 0826 | 0830 | |
| ANIMAL ID | 006001 | 006002 | 006003 | 006004 | 006005 | 006006 | 006007 | 006008 | 006009 | 006010 | 006011 | 006012 | 006013 | 006014 | 006015 | 006016 | 006017 | 006018 | 006019 | 006020 | 006021 | 006022 | 006023 | 006024 | 006025 | |
| Inflammation Epithelium, Ventral, Hyperplasia | | | 2 | | | | | | 1 | | | 1 | | | | | | 1 | 1 | | | | 2 | | 1 | |
| Seminal Vesicle | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Testes Germinal Epithelium, Degeneration Interstitial Cell, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |

HEMATOPOIETIC SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bone Marrow Myeloid Cell, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Lymph Node Deep Cervical, Infiltration Cellular, Plasma Cell Iliac, Infiltration Cellular, Plasma Cell Lumbar, Infiltration Cellular, Plasma Cell Popliteal, Infiltration Cellular, Plasma Cell Renal, Ectasia Renal, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | + | | + |
| Lymph Node, Bronchial Atrophy Inflammation, Suppurative | M | + | + | + | + | + | + | + | + | + | M | + | + | + | M | + | + | + | + | + | + | + | + | + | + |
| Lymph Node, Mandibular Ectasia Hyperplasia, Lymphoid Infiltration Cellular, Plasma Cell | + | + | + | + | + | + | + | + | + | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
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 2,3-Butanedione
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 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

| WISTAR HAN RATS MALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | ANIMAL ID | males (cont...) | | | |
|--|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----------|--------------------|------|------|------|
| | 0731 | 0738 | 0742 | 0746 | 0771 | 0777 | 0777 | 0777 | 0766 | 0777 | 0766 | 0755 | 0777 | 0777 | 0755 | 0744 | 0777 | 0766 | 0777 | 0755 | | | 0777 | 0755 | 0755 |
| Lymph Node, Mediastinal Atrophy Inflammation | + | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| | | | | | | | | 3 | | | | | | | | | | | | | | | | | |
| Lymph Node, Mesenteric | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Spleen Hematopoietic Cell Proliferation | 2 | 3 | | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | | | | 2 | 1 | 2 | 1 | | 1 | 2 | 1 |
| Pigmentation, Hemosiderin | | | 1 | 1 | | 2 | 1 | | | | | | 1 | 1 | | 1 | | 1 | 1 | | 1 | 1 | | 1 | |
| Lymphoid Follicle, Atrophy | | | | | | | | 2 | | | | | | | 2 | 3 | 1 | | 2 | | | 2 | | | |
| Thymus Atrophy | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| | 1 | 3 | 1 | 2 | 1 | 2 | 2 | 4 | 3 | 2 | 4 | 3 | 4 | | 2 | 2 | 3 | 4 | 2 | 2 | 4 | 4 | 2 | 1 | 3 |
| INTEGUMENTARY SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mammary Gland Galactocele | + | + | + | M | M | M | + | M | M | + | M | + | M | M | M | M | + | M | M | + | M | M | + | + | |
| Skin Cyst Epithelial Inclusion | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Foot, Inflammation, Acute | | | | | | | | | | | | | | | | | | | | | | | | | |
| Foot, Inflammation, Chronic Active | | | 3 | | 3 | | | | 3 | | | 4 | | 3 | | | 3 | | 3 | 3 | | | | 2 | |
| Foot, Ulcer | | | 3 | | | | | 3 | | | 3 | | 2 | | | 3 | | 3 | 3 | | | | | 3 | |
| MUSCULOSKELETAL SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bone Osteosclerosis | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | ANIMAL ID | males (cont...) |
|----------------------|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----------|--------------------|
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 50 ppm | 7 | 5 | 7 | 6 | 7 | 7 | 7 | 6 | 7 | 6 | 5 | 7 | 7 | 5 | 4 | 7 | 7 | 6 | 7 | 7 | 5 | 7 | 5 | 5 | 5 | 0 | |
| | 3 | 8 | 2 | 4 | 2 | 3 | 2 | 1 | 3 | 2 | 4 | 2 | 3 | 8 | 9 | 2 | 3 | 1 | 2 | 3 | 1 | 6 | 3 | 9 | 7 | 0 | |
| | 1 | 6 | 9 | 2 | 9 | 1 | 9 | 9 | 0 | 8 | 1 | 9 | 1 | 9 | 9 | 9 | 0 | 0 | 9 | 0 | 9 | 0 | 9 | 1 | 1 | 0 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 0 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 0 | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 0 | | |

Skeletal Muscle +

NERVOUS SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Brain | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Cerebrum, Gray Matter, Hemorrhage, Focal | | | | | | | 2 | | | | | | | | | | | | | | | | | |
| Peripheral Nerve | | | | | | | | | | | | | | | | | | | | | | | | |
| Axon, Degeneration | | | | | | | | | | | | | | | | | | | | | | | | |
| Spinal Cord | | | | | | | | | | | | | | | | | | | | | | | | |

RESPIRATORY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Larynx | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Inflammation, Chronic Active | 1 | 1 | 1 | 1 | | 1 | | 1 | | 1 | 2 | 1 | | 1 | | 1 | | 1 | 1 | 2 | 3 | 2 | | 1 | |
| Respiratory Epithelium, Metaplasia, Squamous | 2 | 3 | 2 | 2 | 3 | 2 | 1 | 2 | 3 | 3 | 2 | 2 | 3 | 1 | | 1 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 1 | 3 |
| Squamous Epithelium, Hyperplasia | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | | 2 | 2 | 1 | | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 |
| Squamous Epithelium, Ulcer, Focal | 1 | 1 | | | | | | | | | | | | | | | | | | | 1 | | | 1 | 1 |
| Squamous Epithelium, Ulcer, Multifocal | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lung | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Inflammation, Suppurative | | | 2 | | 2 | | | | | | | | | | | | | | | | | | | | |
| Inflammation, Granulomatous | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alveolar Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alveolar Epithelium, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alveolus, Edema | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alveolus, Infiltration Cellular, Histiocyte | 1 | | 1 | | 2 | | 1 | | 2 | 1 | | 1 | 1 | | 1 | 3 | | 1 | | 2 | | 1 | 2 | | |
| Bronchiole, Epithelium, Hyperplasia | 1 | 1 | 2 | 1 | 2 | | | 2 | 1 | 1 | 1 | 1 | 2 | | | | 1 | 2 | | 1 | 3 | 1 | | 2 | |
| Bronchus, Epithelium, Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| Wistar Han Rats Male 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | males (cont...) |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|--------------------|
| | 0 7 3 1 | 0 5 8 6 | 0 7 2 9 | 0 6 4 2 | 0 7 2 9 | 0 7 3 1 | 0 7 2 9 | 0 6 1 9 | 0 7 3 0 | 0 6 2 8 | 0 5 4 1 | 0 7 2 9 | 0 7 3 1 | 0 5 8 9 | 0 4 9 9 | 0 7 2 0 | 0 6 7 6 | 0 7 3 0 | 0 7 1 0 | 0 5 6 9 | 0 7 3 1 | 0 5 9 9 | 0 5 7 1 | | | |
| ANIMAL ID | 0 0 6 0 1 | 0 0 0 0 2 | 0 0 6 0 3 | 0 0 6 0 4 | 0 0 6 0 5 | 0 0 6 0 6 | 0 0 6 0 7 | 0 0 6 0 8 | 0 0 6 0 9 | 0 0 6 1 0 | 0 0 6 1 1 | 0 0 6 1 1 | 0 0 6 1 1 | 0 0 6 1 1 | 0 0 6 1 1 | 0 0 6 1 1 | 0 0 6 1 1 | 0 0 6 1 1 | 0 0 6 2 1 | 0 0 6 2 1 | 0 0 6 2 2 | 0 0 6 2 2 | 0 0 6 2 3 | 0 0 6 2 4 | 0 0 6 2 5 | |
| Bronchus, Epithelium, Hyperplasia | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 3 | 1 | | 2 | | |
| Bronchus, Epithelium, Metaplasia, Squamous | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| Bronchus, Epithelium, Regeneration | 1 | | | | | | | 1 | | | | 1 | | | | 1 | | | | | | | 1 | | | |
| Bronchus, Submucosa, Fibrosis | | | | | | | | 1 | | | | | | | | | | 1 | | | | | | | | |
| Interstitial, Fibrosis | | 1 | | | | | | | 1 | | | | 1 | | | | 1 | | | | 1 | | | | | |
| Peribronchial, Inflammation, Chronic Active | | | | | | 2 | | | | 1 | 1 | | | | | 2 | 2 | 2 | | 1 | | | | | | |
| Pleura, Fibrosis | | | | | 1 | | | | | | | | | | | | | | | | | | | | | |
| Nose | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Inflammation, Suppurative | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | | |
| Lamina Propria, Fibrosis | | | | | | | | 1 | | 1 | 1 | | 1 | 1 | 2 | 1 | 1 | 1 | | 1 | 1 | 1 | 2 | 1 | | |
| Olfactory Epithelium, Accumulation, Hyaline Droplet | | | | | | | 1 | | | | | | | | 1 | | | | | | | | | 2 | | |
| Olfactory Epithelium, Atrophy | | | | 1 | | 1 | 1 | | | 1 | 1 | | | | | | | | | | | | | 2 | | |
| Olfactory Epithelium, Metaplasia, Respiratory | 4 | 4 | 3 | 4 | 2 | 3 | 3 | 3 | 4 | 2 | 3 | 1 | 1 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 3 | 2 | 4 | |
| Olfactory Epithelium, Necrosis | | | | | | | | | | | 2 | | | 1 | | | | | 1 | | | | | 1 | | |
| Respiratory Epithelium, Hyperplasia | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 2 | 2 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 4 | 3 | 4 | |
| Respiratory Epithelium, Metaplasia, Squamous | 4 | 1 | 1 | | 2 | | 1 | 1 | 1 | 1 | 2 | | | | 1 | 1 | 1 | 4 | | | 4 | 2 | 1 | | | |
| Respiratory Epithelium, Necrosis | | | | | | | | | | | | | | 1 | | | | | | | | | | | | |
| Turbinate, Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Turbinate, Hyperostosis | 1 | | | | | | 1 | | | | 1 | | | | 1 | | 1 | | 1 | 3 | | | | | | |
| Trachea | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Inflammation, Chronic Active | 1 | | 1 | 1 | | 2 | | | 1 | | | | | | | | | | | | | | | | | |
| Epithelium, Atrophy | | | | | | | | | | | | | | | 1 | 1 | | 1 | | | | | | | | |
| Epithelium, Hyperplasia | 1 | 1 | 2 | | 1 | 1 | | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 2 | 1 | 1 | 2 | 2 | | | | | |
| Epithelium, Metaplasia, Squamous | 1 | | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | |
| Epithelium, Necrosis | | | | 1 | 1 | | | | | | | | | | | | | | 1 | 1 | | | | | | |
| Epithelium, Regeneration | 1 | | | 2 | | | | | | | | 1 | 1 | | 1 | 1 | | | 1 | 1 | 1 | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue

M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | males (cont...) |
|----------------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|--------------------|
| WISTAR HAN RATS MALE | DAY ON TEST | 7 | 5 | 7 | 6 | 7 | 7 | 7 | 6 | 7 | 6 | 5 | 7 | 7 | 5 | 4 | 7 | 7 | 6 | 7 | 7 | 7 | 5 | 7 | 5 | 5 | 5 | | |
| | ANIMAL ID | 31 | 86 | 29 | 42 | 29 | 31 | 29 | 19 | 30 | 28 | 41 | 29 | 19 | 09 | 09 | 23 | 83 | 10 | 23 | 10 | 00 | 00 | 16 | 33 | 99 | 71 | | |
| 50 ppm | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | | | |
| Urinary Bladder | | + | | | | | | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

Experiment Number: 20725 - 03
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 2,3-Butanedione
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 First Dose M/F: 08/17/09 / 08/17/09
 Lab: BNW

| WISTAR HAN RATS MALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | |
|--------------------------------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|--------|--------|
| | 071226 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | | 066757 | 066757 |
| ANIMAL ID | 006267 | 006667 | 006667 | 006667 | 006667 | 006667 | 006667 | 006667 | 006667 | 006667 | 006667 | 006667 | 006667 | 006667 | 006667 | 006667 | 006667 | 006667 | 006667 | 006667 | 006667 | 006667 | 006667 |
| | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

ALIMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|
| Esophagus | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Intestine Large, Cecum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Intestine Large, Colon | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Intestine Large, Rectum Metaplasia, Squamous | + | + | + | + | + | + | 2 | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Intestine Small, Duodenum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Intestine Small, Ileum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Intestine Small, Jejunum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Liver | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Angiectasis | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Basophilic Focus | | | | | | | | | | | | | | | X | | | | | | | | | 4 |
| Clear Cell Focus | | | | | | X | | | | X | | | | X | | | | | | X | X | | | 12 |
| Eosinophilic Focus | | | | | | | | | | X | | | | | | | | | | | | | | 1 |
| Hematopoietic Cell Proliferation | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Hepatodiaphragmatic Nodule | | | | | X | | | | | | | | | | | | | | | | X | | | 3 |
| Infiltration Cellular, Mixed Cell | | | | | | | | | | | | | | | | | | | | | | | | 4 |
| Bile Duct, Cyst | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Bile Duct, Dilatation | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Bile Duct, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Mesentery | | | | | | | | | | | | | | | | | | | | | | | | + |
| | | | | | | | | | | | | | | | | | | | | | | | | 2 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
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P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 2,3-Butanedione
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 Lab: BNW

| WISTAR HAN RATS MALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | | |
|---|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|--------|--------|-------------------------|
| | 071226 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | | 066757 | 066757 | |
| ANIMAL ID | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | | |
| Fat, Necrosis | | | | | | | | | | | | | | | | | | | | | | 2 | 2 1.5 | |
| Pancreas Atrophy Inflammation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 4 1.0 1 1.0 |
| Salivary Glands Basophilic Focus | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 1 1.0 |
| Stomach, Forestomach Epithelium, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 1 3.0 |
| Stomach, Glandular | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| CARDIOVASCULAR SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | |
| Blood Vessel Inflammation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 2 1.0 |
| Heart Cardiomyopathy Epicardium, Fibrosis, Focal | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 25 1.2 1 2.0 |
| ENDOCRINE SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | |
| Adrenal Cortex Degeneration, Cystic Infiltration Cellular, Lipocyte Bilateral, Necrosis, Multifocal | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 2 1.5 1 3.0 1 3.0 |
| Zona Fasciculata, Hyperplasia, Focal | 2 | | | | | | | | | | | | | | | | | | | | | | 6 | 1.3 |
| Zona Fasciculata, Hypertrophy, Focal | | | | | | | | | | | | | | | | | | | | | | | 6 | 1.7 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| Wistar Han Rats Male 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS |
|---|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|
| | 071226 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | |
| ANIMAL ID | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 |
| Zona Fasciculata, Hypertrophy, Multifocal | | | | 2 | | | | | | 2 | 1 | | | | 2 | | | | | | | 1 | | | |
| Adrenal Medulla Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Islets, Pancreatic Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Parathyroid Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | M | + | M | + | + | + | + | + | + | + | + |
| Pituitary Gland Fibrosis | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Pars Distalis, Hyperplasia | | | | 4 | 1 | | | | | 4 | | | | | 1 | | | | | | 1 | | | | |
| Thyroid Gland C-cell, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Follicular Cell, Hyperplasia | | | | | | 2 | | | | | 1 | | | | | 2 | | | | | | | | | |
| Follicular Cell, Hypertrophy | | | | | | | | | | | | | | | | | | | | | | | 2 | | |

GENERAL BODY SYSTEM

NONE

GENITAL SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Epididymis Inflammation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Preputial Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Prostate | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | |
|---|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|--------|--------|
| | 071226 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | | 066757 | 066757 |
| ANIMAL ID | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 | 006267 |
| Inflammation Epithelium, Ventral, Hyperplasia | 2 | | | | | | 1 | | | | | | | 1 | 1 | | | | 1 | | | 1 | |
| | | | | 1 | | | 1 | | | | | | | 1 | 1 | | | | 3 | | | 1 | |
| Seminal Vesicle | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Testes | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Germinal Epithelium, Degeneration | | | | | | | | | | | | | | 1 | | | | | | | | | 3 |
| Interstitial Cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | |
| HEMATOPOIETIC SYSTEM | | | | | | | | | | | | | | | | | | | | | | | |
| Bone Marrow | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Myeloid Cell, Hyperplasia | 4 | 2 | 2 | | 4 | 4 | 3 | | | 2 | | | 2 | 4 | 3 | 4 | | | 3 | 4 | 3 | 3 | |
| Lymph Node | + | | + | | | + | | | | | | | | | + | | | | | | | | |
| Deep Cervical, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | 7 |
| Iliac, Infiltration Cellular, Plasma Cell | 4 | | | | | | | | | | | | | | | | | | | | | | |
| Lumbar, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | 4 | | | | | 4 | | | |
| Popliteal, Infiltration Cellular, Plasma Cell | 3 | | | | | | | | | | | | | | 4 | | | | | | | | |
| Renal, Ectasia | | | | 2 | | | | | | | | | | | | | | | | | | | |
| Renal, Infiltration Cellular, Plasma Cell | | | 2 | | | 3 | | | | | | | | 2 | | | | | | 3 | | | |
| Lymph Node, Bronchial | + | + | + | + | M | + | + | + | + | + | + | + | + | + | M | + | M | + | M | + | + | M | + |
| Atrophy | | | | | | | | | | | | | | | | | | | | | | | |
| Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | |
| Lymph Node, Mandibular | + | + | M | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Ectasia | | | | | | | | | | | | | | | | | | | | | | | |
| Hyperplasia, Lymphoid | | | | | | | | | | | | 2 | | | | | | | | | | | |
| Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | 2 | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
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Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | | | | | |
|---|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|---|--------|--------|--------|-------|-------|
| | 071226 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | | | 066757 | | | | |
| ANIMAL ID | 006266 | 006266 | 006266 | 006266 | 006266 | 006266 | 006266 | 006266 | 006266 | 006266 | 006266 | 006266 | 006266 | 006266 | 006266 | 006266 | 006266 | 006266 | 006266 | 006266 | 006266 | | | | | | |
| Lymph Node, Mediastinal Atrophy Inflammation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | M | M | + | + | 47 | 1 3.0 | | |
| Lymph Node, Mesenteric | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | |
| Spleen Hematopoietic Cell Proliferation Pigmentation, Hemosiderin Lymphoid Follicle, Atrophy | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 37 1.8 | | |
| | 2 | | 1 | 1 | 2 | 3 | 2 | | | 2 | 2 | 1 | 2 | 1 | 4 | | | 3 | 1 | 2 | | 1 | 2 | 20 1.2 | | | |
| | | 2 | | 1 | | | | | | | 1 | | 1 | | 1 | | 1 | | | 2 | 1 | | | 12 2.2 | | | |
| Thymus Atrophy | + | M | + | + | + | + | + | + | + | + | + | + | + | + | + | M | + | + | + | + | + | + | + | 48 | 47 2.5 | | |
| | 3 | | 2 | 2 | 2 | 2 | 4 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | | |
| INTEGUMENTARY SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mammary Gland Galactocele | M | + | + | M | + | M | + | + | M | M | M | M | M | M | + | + | + | + | + | M | M | + | M | M | + | 22 | 1 2.0 |
| | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| Skin Cyst Epithelial Inclusion Foot, Inflammation, Acute Foot, Inflammation, Chronic Active Foot, Ulcer | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 2 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4 | 2 | 4 | | 3 | 3 | 3 | 4 | | | | 3 | | 3 | 2 | 1 | | 4 | 3 | 4 | 2 | | | | 23 3.0 | | |
| | 4 | 1 | 3 | | 3 | 3 | 3 | 3 | | | | 3 | | 3 | 2 | 2 | | 4 | 3 | 3 | | | | | 22 2.9 | | |
| MUSCULOSKELETAL SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bone Osteosclerosis | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 1 2.0 | |
| | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | ANIMAL ID | * TOTALS | | | |
|----------------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----------|----------|----|----|----|
| | 07 | 06 | 06 | 07 | 05 | 07 | 06 | 05 | 05 | 07 | 07 | 07 | 06 | 07 | 07 | 06 | 07 | 05 | 06 | 07 | | | 06 | 07 | 07 |
| 50 ppm | 1 | 2 | 0 | 3 | 7 | 2 | 8 | 4 | 4 | 3 | 2 | 3 | 7 | 2 | 2 | 1 | 5 | 3 | 7 | 3 | 3 | 4 | 2 | 3 | 6 |
| | 2 | 6 | 1 | 1 | 0 | 4 | 5 | 9 | 5 | 0 | 9 | 0 | 4 | 9 | 5 | 6 | 9 | 0 | 0 | 3 | 1 | 9 | 9 | 1 | 2 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 |
| | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |

Skeletal Muscle + + + + + 6

NERVOUS SYSTEM

Brain + 50
 Cerebrum, Gray Matter, Hemorrhage, Focal 1 2.0

Peripheral Nerve + + + + + 6
 Axon, Degeneration 1 1.0

Spinal Cord + + + + + 6

RESPIRATORY SYSTEM

Larynx + 50
 Inflammation, Chronic Active 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 33 1.2
 Respiratory Epithelium, Metaplasia, Squamous 4 1 3 3 4 3 3 4 1 1 3 2 3 3 1 3 2 3 2 2 1 45 2.3
 Squamous Epithelium, Hyperplasia 3 1 3 2 2 1 3 1 3 2 1 2 3 3 2 2 3 3 1 3 3 3 3 3 46 2.4
 Squamous Epithelium, Ulcer, Focal 1 1 2 1 2 1 1 2 2 15 1.3
 Squamous Epithelium, Ulcer, Multifocal 2 3 2.7

Lung + 50
 Inflammation, Suppurative 2 2 3 3 2 2 3 15 2.4
 Inflammation, Granulomatous 1 1 4 1.0
 Alveolar Epithelium, Hyperplasia 1 2 1 1 8 1.1
 Alveolar Epithelium, Hyperplasia, Focal 1 1 1 1.0
 Alveolus, Edema 1 3.0
 Alveolus, Infiltration Cellular, Histiocyte 2 1 2 2 1 1 1 1 2 1 1 1 1 2 2 1 1 1 1 1 34 1.4
 Bronchiole, Epithelium, Hyperplasia 1 1 2 2 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 33 1.3
 Bronchus, Epithelium, Atrophy 1 23 1.0

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically M .. Missing tissue
 X .. Lesion present A .. Autolysis precludes evaluation
 I .. Insufficient tissue BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS MALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | | | | |
|---|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|---|--------|-----|-----|-----|
| | 071226 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | | | 066757 | | | |
| ANIMAL ID | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | | | | | |
| Bronchus, Epithelium, Hyperplasia | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 47 | 1.2 | | |
| Bronchus, Epithelium, Metaplasia, Squamous | | | | 1 | | | | | | | | | | | | | | | | | | | 2 | 1.0 | | |
| Bronchus, Epithelium, Regeneration | | | | | | | | | | | | 1 | | | | | | 1 | | | | | 9 | 1.0 | | |
| Bronchus, Submucosa, Fibrosis | | 1 | | 1 | | | | | | | 1 | | | | | | | | | | | | 5 | 1.0 | | |
| Interstitial, Fibrosis | 1 | | | 1 | | | 2 | | | | | | | 1 | | | 2 | | | 2 | | | 11 | 1.3 | | |
| Peribronchial, Inflammation, Chronic Active | | | | 1 | 1 | 2 | | | | | | 1 | 1 | | | | 2 | | | | | | 13 | 1.5 | | |
| Pleura, Fibrosis | | | | | | 1 | | | | | | | | | | | | | | | | | 2 | 1.0 | | |
| Nose | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | |
| Inflammation, Suppurative | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 50 | 3.9 | |
| Lamina Propria, Fibrosis | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 2 | 1 | 2 | 1 | 1 | 38 | 1.2 |
| Olfactory Epithelium, Accumulation, Hyaline Droplet | | | | | | | | | | | | | | 1 | | | | | | | | | | 4 | 1.3 | |
| Olfactory Epithelium, Atrophy | 1 | | | 1 | | 1 | | | | | | 1 | 2 | 2 | 1 | 1 | 1 | 2 | | | 3 | 2 | 1 | 1 | 22 | 1.3 |
| Olfactory Epithelium, Metaplasia, Respiratory | 3 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 4 | 4 | 3 | 4 | 2 | 4 | 3 | 4 | 3 | 3 | 3 | 2 | 4 | 4 | 2 | 50 | 3.2 |
| Olfactory Epithelium, Necrosis | | | | | | | 2 | | 1 | | | | | | | | | | | | | | | | 6 | 1.3 |
| Respiratory Epithelium, Hyperplasia | 4 | 3 | 4 | 3 | 4 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 50 | 3.7 |
| Respiratory Epithelium, Metaplasia, Squamous | 2 | 4 | 3 | 1 | 3 | 2 | 3 | 1 | 3 | | | | 2 | 3 | | | 1 | 2 | | 3 | 2 | 1 | 3 | | 34 | 2.0 |
| Respiratory Epithelium, Necrosis | | | | | | | | | 1 | | | | | | | | | | | | | | | | 2 | 1.0 |
| Turbinate, Atrophy | | | | | | | | | | | | | | | 2 | | | | | | | | | | 1 | 2.0 |
| Turbinate, Hyperostosis | | | | | | 1 | 1 | | | | | | | | | | | | | | 1 | | | | 10 | 1.2 |
| Trachea | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Inflammation, Suppurative | | | | | | | | | | | | | | | | | 2 | | | | | | | | 1 | 2.0 |
| Inflammation, Chronic Active | | | | 2 | | | | | | | 1 | 1 | | | | | | | | | | | | | 8 | 1.3 |
| Epithelium, Atrophy | | | | | | | 2 | | | 1 | | | | | 1 | | | | | 1 | | | | | 7 | 1.1 |
| Epithelium, Hyperplasia | | | 1 | | | 1 | 1 | 1 | | 1 | 1 | 1 | | 1 | 1 | | 2 | 1 | | 1 | 1 | | 1 | | 32 | 1.2 |
| Epithelium, Metaplasia, Squamous | | | | | | | | | | | | 1 | | | | | | 1 | | | | 1 | | | 12 | 1.2 |
| Epithelium, Necrosis | | | | | | | | | | 1 | | 1 | | | | | | | | | | | | | 6 | 1.0 |
| Epithelium, Regeneration | | | 1 | | | | 1 | | | | | 1 | | | | | | | | | | | | | 12 | 1.1 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
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 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
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Experiment Number: 20725 - 03
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| WISTAR HAN RATS MALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | |
|--------------------------------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|--------|--------|
| | 071226 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | 066757 | | 066757 | |
| ANIMAL ID | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | 00626 | | |
| Submucosa, Fibrosis | 1 | | 2 | | 1 | 1 | | 1 | 1 | | 1 | | 1 | | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 27 1.1 |

SPECIAL SENSES SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--------|
| Eye | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 49 |
| Anterior Chamber, Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | 3 2.0 |
| Cornea, Inflammation, Chronic Active | 3 | 1 | | 2 | | 1 | 1 | | 1 | | | | | 1 | 1 | 1 | 2 | | 1 | | 1 | 2 | 28 1.3 |
| Cornea, Necrosis | 1 | | | | | | | | | | | | | | | | | | | | 1 | | 2 1.0 |
| Cornea, Epithelium, Hyperplasia | 1 | | | 1 | | | | | | | | | | | | 1 | | | | | | | 6 1.2 |
| Cornea, Epithelium, Ulcer | 1 | | | | | 1 | | | | | | | | | | 1 | | | | | 3 | | 6 1.5 |
| Iris, Inflammation, Acute | | | | 2 | | | | | | | | | | | | | | | | | | | 1 2.0 |
| Lens, Cataract | | 2 | | | | | | | 2 | 1 | | | | | | | | | | | | | 3 1.7 |
| Retina, Degeneration | | | | | | | | | | | | | | | | | | | | 3 | | | 6 1.8 |
| Unilateral, Inflammation, Pyogranulomatous | | | | | | | | | | | | 4 | | | | | | | | | | | 1 4.0 |
| Unilateral, Phthisis Bulbi | | | | | | | | | | | | | | | | | | | | | | | 1 3.0 |
| Harderian Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Hyperplasia | | | | 2 | | | | | 1 | | | | | | | | | | | 1 | | | 3 1.3 |
| Lacrimal Gland | | | | | | | | | | | | | | | | | | | | | | 1 | 1 |
| Metaplasia | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 |

URINARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--------|
| Kidney | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Calculus Micro Observation Only | | | | | | X | | | | | X | | | | | | | | X | | X | | 7 |
| Nephropathy | | 1 | | 1 | | 1 | 1 | | 1 | | | 1 | 2 | 1 | | 3 | 1 | | | 2 | 1 | 3 | 30 1.4 |
| Cortex, Cyst | | | | | | | | | | | 3 | | | | | | | | | | | | 1 3.0 |
| Pelvis, Dilatation | | | | 1 | | | | | | | | | | | | | | | | | | | 1 1.0 |
| Pelvis, Inflammation | | | | | 2 | | | | | | | 1 | | | | | 1 | 2 | | | 1 | | 14 1.5 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|----------------------|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----------------|---|
| DAY ON TEST | | 7 | 6 | 6 | 7 | 5 | 7 | 6 | 5 | 5 | 7 | 7 | 7 | 6 | 7 | 7 | 6 | 6 | 7 | 5 | 6 | 7 | 6 | 7 | 7 | 5 |
| WISTAR HAN RATS MALE | | 1 | 2 | 0 | 3 | 7 | 2 | 8 | 4 | 4 | 3 | 2 | 3 | 7 | 2 | 2 | 1 | 5 | 3 | 7 | 3 | 3 | 4 | 2 | 3 | 6 |
| 50 ppm | | 2 | 6 | 1 | 1 | 0 | 4 | 5 | 9 | 5 | 0 | 9 | 0 | 4 | 9 | 5 | 6 | 9 | 0 | 0 | 3 | 3 | 9 | 1 | 2 | |
| ANIMAL ID | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 |
| | | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| | | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS | |
| Urinary Bladder | | + | | | | | | | | | | | | | | | | | | | | | | | 50 | |

*** END OF MALE DATA ***

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
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 Lab: BNW

| DAY ON TEST | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|-------------------------------|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--------------------------|---|
| WISTAR HAN RATS FEMALE | 7 | 7 | 7 | 6 | 7 | 7 | 7 | 6 | 7 | 5 | 7 | 6 | 7 | 7 | 7 | 7 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | 3 | 3 | 3 | 1 | 3 | 3 | 0 | 3 | 3 | 4 | 1 | 8 | 3 | 3 | 3 | 3 | 7 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Control | 2 | 3 | 1 | 4 | 3 | 1 | 2 | 5 | 2 | 7 | 0 | 3 | 3 | 1 | 2 | 3 | 9 | 3 | 3 | 2 | 1 | 1 | 1 | 2 |
| | ANIMAL ID | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 |
| | | | | | | | | | | | | | | | | | | | | | | | females (cont...) | |

ALIMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Esophagus | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Cecum Inflammation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Colon | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Rectum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Small, Duodenum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Small, Ileum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Small, Jejunum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Liver | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Angiectasis | | | | | | | | | | | | | | | | | | | | | | | |
| Basophilic Focus | X | | X | X | | X | | X | X | X | | X | X | | X | | X | X | | X | | X | |
| Clear Cell Focus | X | | | | | | | | X | | | X | | | | | | | | | | | |
| Eosinophilic Focus | | | | | | | | | | | | | | | | | | | X | | | | |
| Fatty Change, Diffuse | | | | | | | | | | | | | | | | | | | | | | | |
| Hematopoietic Cell Proliferation | | | | | | | | 1 | | | | | | | | | | | 1 | | | | |
| Hepatodiaphragmatic Nodule | | X | | | | | | | | | | | | | | | | | | | | | |
| Infiltration Cellular, Mixed Cell Pigmentation, Hemosiderin | | | | | 1 | | | | | | | | | 1 | 1 | | | | | | 1 | | |
| Bile Duct, Cyst | X | | | X | | | | | | | | | | | | | | | | | | | |
| Bile Duct, Hyperplasia | | | | | | | | | | | | | | 2 | 1 | | | | | | | | 2 |
| Mesentery | | | | + | | | | | | | | | | | | | | | | | + | + | + |

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 + .. Tissue examined microscopically
 X .. Lesion present
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Experiment Number: 20725 - 03
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 Species/Strain: RATS/Wistar Han

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 2,3-Butanedione
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 Lab: BNW

| Wistar Han Rats Female Control | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | females (cont...) |
|---|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----------------------|
| | 0732 | 0733 | 0731 | 0674 | 0773 | 0777 | 0676 | 0775 | 0777 | 0577 | 0776 | 0777 | 0777 | 0777 | 0777 | 0577 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | |
| ANIMAL ID | 0010 | 0001 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | |
| Fat, Necrosis | | | | 2 | | | | | | | | | | | | 2 | | 1 | 1 | | | | | | |
| Pancreas Atrophy | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Salivary Glands | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Stomach, Forestomach Inflammation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Ulcer Epithelium, Hyperplasia | | | | | | | 1 | | | | | 2 | | | | | | | | | | | | | |
| Stomach, Glandular | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| CARDIOVASCULAR SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | |
| Blood Vessel | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Heart Cardiomyopathy | | 1 | 1 | 1 | | 2 | | | | 1 | 1 | 1 | 1 | | | | | | | | | 1 | | | |
| ENDOCRINE SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | |
| Adrenal Cortex Degeneration, Cystic | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Hematopoietic Cell Proliferation | | 1 | | | | | | | | | | | 2 | 1 | | | | | | | 1 | | 1 | | |
| Zona Fasciculata, Hyperplasia, Focal | | | 1 | | | | | | | | | | | | | | | | | | | | | | |
| Zona Fasciculata, Hyperplasia, Multifocal | | | | | | 1 | | | | | | | | | | | | | | | 2 | | | | |
| Zona Fasciculata, Hypertrophy | | | | | | | | | | | | | | | | | | 2 | | | | | | | |
| Zona Fasciculata, Hypertrophy, Focal | | 2 | | | 1 | 1 | | | | | 1 | 2 | | 2 | 3 | | | | | 2 | 1 | 2 | | 1 | |
| Zona Fasciculata, Hypertrophy, Multifocal | | | | | | | 1 | 1 | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
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 Lab: BNW

| Wistar Han Rats Female Control | DAY ON TEST | | | | | | | | | | | | | | | | | | | | females (cont...) | |
|---|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----------------------|---|
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| | 7 | 7 | 7 | 6 | 7 | 7 | 7 | 6 | 7 | 5 | 7 | 6 | 7 | 7 | 7 | 7 | 5 | 7 | 7 | 7 | | 7 |
| | 3 | 3 | 3 | 1 | 3 | 3 | 0 | 3 | 3 | 4 | 1 | 8 | 3 | 3 | 3 | 3 | 7 | 3 | 3 | 3 | 3 | |
| | 2 | 3 | 1 | 4 | 3 | 1 | 2 | 5 | 2 | 7 | 0 | 3 | 3 | 1 | 2 | 3 | 9 | 3 | 3 | 2 | 1 | |
| ANIMAL ID | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | |
| Adrenal Medulla Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Islets, Pancreatic Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Parathyroid Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | M | + | M | + | + | + | + | |
| Pituitary Gland Pars Distalis, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| | | | | | 4 | | | | | | 3 | | 2 | 1 | 4 | 1 | | 1 | 1 | | 1 | |
| Thyroid Gland C-cell, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| | | 1 | | | 1 | 1 | | | | | | | 1 | | 1 | 4 | | | | 1 | 1 | |
| Follicular Cell, Hyperplasia | | | | | | | | | | | | | | | | | | 2 | | | | |

GENERAL BODY SYSTEM

NONE

GENITAL SYSTEM

| | | | | | | | | | | | | | | | | | | | | | |
|------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clitoral Gland Ectasia | + | + | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Ovary Atrophy | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| | | 2 | 3 | | | 2 | 2 | | 2 | 2 | 2 | | | | | 2 | | | 1 | 2 | 1 |
| Cyst | | X | | | X | | | | X | X | X | | X | | | | | X | | X | X |
| Thecal Cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | |
| Uterus Adenomyosis, Focal | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |

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 + .. Tissue examined microscopically
 X .. Lesion present
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| WISTAR HAN RATS FEMALE Control | DAY ON TEST | | | | | | | | | | | | | | | | | | | | ANIMAL ID | females (cont...) | |
|-----------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-----------|-----------------------|--|
| | 0 7 3 2 | 0 7 3 3 | 0 7 3 1 | 0 6 1 4 | 0 7 3 3 | 0 7 3 1 | 0 7 3 2 | 0 6 5 2 | 0 7 3 3 | 0 5 4 7 | 0 7 1 0 | 0 6 8 3 | 0 7 3 3 | 0 7 3 1 | 0 5 7 9 | 0 7 3 3 | 0 7 3 3 | 0 7 3 2 | 0 7 3 3 | 0 7 3 3 | | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 0 1 0 1 | |
| Cervix, Hyperplasia, Squamous | | | | | | | | | | | 2 | 2 | | | | | | | | | 2 | | |
| Endometrium, Hyperplasia, Cystic | 2 | 1 | | | | | | | | | 2 | 1 | | 1 | | | | | | 3 | 2 | 3 | |
| Endometrium, Metaplasia, Squamous | | | | | 1 | | | | | 1 | 1 | | | | | | | | | | | | |
| Serosa, Cyst Multilocular | | | | | | | | | | | | | | | | | | | | | | | |

HEMATOPOIETIC SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bone Marrow | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Myeloid Cell, Hyperplasia | | | | | | | | 4 | 4 | | | | | | | 2 | 2 | | | 4 | 3 | 2 | |
| Lymph Node | | + | | | | | | | | | | | | | | | | | | | | | |
| Lumbar, Ectasia | | 2 | | | | | | | | | | | | | | | | | | | | | |
| Lymph Node, Bronchial | + | + | + | + | + | + | + | + | + | M | M | + | + | + | + | + | + | + | + | + | + | + | |
| Lymph Node, Mandibular | M | + | + | + | + | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | |
| Lymph Node, Mediastinal | + | + | + | + | + | M | + | + | + | M | + | + | + | + | + | + | M | + | + | + | + | M | + |
| Lymph Node, Mesenteric | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Fibrosis, Focal | | | | | | | | | | | | | | | | | | | | | | | |
| Hyperplasia, Lymphoid | | | | | | | | | | | | | | | | | | | | | | | |
| Inflammation | | | | | | | | | | | | | | | | | | | | | | | |
| Spleen | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Hematopoietic Cell Proliferation | | | | 2 | 2 | 2 | 4 | 1 | 2 | | | 2 | 2 | 2 | 1 | 3 | 2 | 2 | 2 | 3 | | 2 | 2 |
| Pigmentation, Hemosiderin | 1 | 2 | 1 | 1 | 1 | 2 | | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 1 | |
| Lymphoid Follicle, Atrophy | | | | 1 | | | | 2 | | | 1 | 1 | | | | | | | 1 | | | | |
| Thymus | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Atrophy | 2 | 3 | 2 | 3 | 1 | 1 | | 4 | 1 | 2 | | 3 | 2 | 1 | | 1 | 2 | 1 | 2 | 2 | 2 | 2 | |

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 Lab: BNW

| WISTAR HAN RATS FEMALE Control | DAY ON TEST | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ANIMAL ID | |
|---------------------------------------|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----------|----------------------|
| | 7 | 7 | 7 | 6 | 7 | 7 | 7 | 6 | 7 | 5 | 7 | 6 | 7 | 7 | 7 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | | |
| | 3 | 3 | 3 | 1 | 3 | 3 | 0 | 3 | 3 | 4 | 1 | 8 | 3 | 3 | 3 | 7 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | |
| | 2 | 3 | 1 | 4 | 3 | 1 | 2 | 5 | 2 | 7 | 0 | 3 | 3 | 1 | 2 | 3 | 9 | 3 | 3 | 2 | 1 | 1 | 1 | 3 | 2 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | | females (cont...) |

INTEGUMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|--|
| Mammary Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Galactocele | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Skin | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Cyst Epithelial Inclusion | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dermis, Thrombosis | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ear, Inflammation, Acute | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Epidermis, Ulcer, Multifocal | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Neck, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Neck, Ulcer, Diffuse | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Other, Inflammation, Multifocal | | | | | | | | | | | | | | | | | | | | | | | | | | |

MUSCULOSKELETAL SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|--|
| Bone | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Skeletal Muscle | | | | | | | | | | | | | | | | | | | | | | | | | | |

NERVOUS SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|--|
| Brain | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Peripheral Nerve | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Spinal Cord | | | | | | | | | | | | | | | | | | | | | | | | | | |

RESPIRATORY SYSTEM

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue

M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS FEMALE Control | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | ANIMAL ID | females (cont...) |
|---|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----------|----------------------|
| | 0732 | 0733 | 0731 | 0674 | 0773 | 0777 | 0776 | 0675 | 0772 | 0754 | 0777 | 0676 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0001 | females (cont...) |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 | |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0001 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 2 | 2 | 2 | 0001 | |
| Larynx | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Inflammation, Chronic Active | | | 1 | | | | | | | | 1 | | | | | | | | | | | | | | | | |
| Squamous Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lung | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Inflammation, Granulomatous | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | |
| Inflammation, Chronic Active | | | | | | 1 | | | | | 1 | | | | | | | | | | | | | | 1 | | |
| Alveolar Epithelium, Hyperplasia | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| Alveolar Epithelium, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alveolus, Infiltration Cellular, Histiocyte | 1 | | | 1 | | | | | | | 1 | 2 | | | | | | | | | | | | | 1 | | |
| Interstitial, Fibrosis | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Peribronchial, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nose | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Inflammation, Suppurative | | | | | | | | | | | 4 | 1 | 1 | | | | | | | | | | | | | | |
| Lamina Propria, Fibrosis | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | |
| Olfactory Epithelium, Accumulation, Hyaline Droplet | | | | | | | 3 | | | | 2 | | | | | | | | | | | | | | 1 | | |
| Olfactory Epithelium, Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Olfactory Epithelium, Metaplasia, Respiratory | | | | | | | | | | | | 4 | | | | | | | | | | | | | | | |
| Respiratory Epithelium, Hyperplasia | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | |
| Respiratory Epithelium, Metaplasia, Squamous | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | |
| Trachea | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| SPECIAL SENSES SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Eye | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Anterior Chamber, Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Cornea, Inflammation, Chronic Active | | | | | | | | | | | | 2 | | | | | | | | | | | | | | 1 | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

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 2,3-Butanedione
 CAS Number: 431-03-8

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 Lab: BNW

| | | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------------------------------|------|
| WISTAR HAN RATS FEMALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | females (cont...) | |
| | 0732 | 0733 | 0731 | 0674 | 0773 | 0777 | 0776 | 0775 | 0772 | 0771 | 0768 | 0767 | 0765 | 0764 | 0763 | 0762 | 0759 | 0757 | 0756 | 0753 | 0751 | 0747 | | 0743 |
| | 0011 | 0010 | 0009 | 0008 | 0007 | 0006 | 0005 | 0004 | 0003 | 0002 | 0001 | 0000 | 0034 | 0033 | 0032 | 0031 | 0030 | 0029 | 0028 | 0027 | 0026 | 0025 | | 0024 |

| | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|---|
| Lens, Cataract | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Retina, Degeneration | | | | | | | | | | | | | | | | | | | | | | | 2 |
| Harderian Gland | | | | | | | | | | | | | | | | | | | | | | | + |

URINARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------|---|---|---|--|--|---|---|--|--|---|---|---|---|--|--|---|--|--|---|--|---|---|---|
| Kidney | | | | | | | | | | | | | | | | | | | | | | | |
| Calculus Micro Observation Only | X | X | X | | | X | X | | | X | X | X | X | | | X | | | X | | X | X | X |
| Infarct | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Nephropathy | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Cortex, Cyst | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Pelvis, Inflammation | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Urinary Bladder | | | | | | | | | | | | | | | | | | | | | | | + |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
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 M .. Missing tissue
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Experiment Number: 20725 - 03
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 Lab: BNW

| WISTAR HAN RATS FEMALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS |
|------------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----|----------|
| | 0732 | 0647 | 0413 | 0733 | 0733 | 0733 | 0674 | 0722 | 0654 | 0573 | 0773 | 0773 | 0773 | 0667 | 0773 | 0773 | 0773 | 0773 | 0579 | 0733 | 0678 | 0733 | 0673 | | |
| Control | 0012 | 0012 | 0022 | 0022 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 50 | |
| ANIMAL ID | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 0011 | 50 | |
| | 67 | 78 | 89 | 90 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0 | |

ALIMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-------|-------|
| Esophagus | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Intestine Large, Cecum Inflammation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 1 3.0 |
| Intestine Large, Colon | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Intestine Large, Rectum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Intestine Small, Duodenum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Intestine Small, Ileum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Intestine Small, Jejunum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Liver | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Angiectasis | | | | | | | | | | | | | | | | | | | | | | 1 | | 1 1.0 | |
| Basophilic Focus | X | | X | X | X | | X | X | | X | X | X | | X | X | | X | X | X | X | | X | | 34 | |
| Clear Cell Focus | | | | X | | | X | | | | | | | | | | | X | | | | | | 6 | |
| Eosinophilic Focus | | | | | | X | | | | | | | | | | | | X | | | | | | 3 | |
| Fatty Change, Diffuse | | 3 | | | | | | | | | | | | | | | | | | | | | | 1 3.0 | |
| Hematopoietic Cell Proliferation | | | | | | | | | | | | | | | | | | | | | | | | 2 1.0 | |
| Hepatodiaphragmatic Nodule | | X | | | | | | X | | | | | | | | | | | | | | | | 3 | |
| Infiltration Cellular, Mixed Cell Pigmentation, Hemosiderin | | | | | | | | | | | | | | | | 1 | | 1 | | | | | | 6 1.0 | |
| Bile Duct, Cyst | | | | | | | | | | | | | | | | | | | | | | | | 2 | |
| Bile Duct, Hyperplasia | | 1 | | 1 | | 2 | | | | | | | | 1 | 2 | | | | | | | | | 8 1.5 | |
| Mesentery | | | | + | | | | + | | | | | + | | | | | | | | | | | 8 | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
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Experiment Number: 20725 - 03
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| WISTAR HAN RATS FEMALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS | | | | | | |
|---|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----------|----|-----|-----|-----|----|-----|
| | 0732 | 0647 | 0417 | 0773 | 0773 | 0776 | 0767 | 0227 | 0654 | 0577 | 0777 | 0777 | 0777 | 0667 | 0773 | 0773 | 0773 | 0773 | 0773 | 0579 | 0773 | 0676 | 0777 | | | | | | | | |
| Control | ANIMAL ID | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0012 | 0002 | 0002 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | | | | | | | |
| | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | | | | | | |
| Fat, Necrosis | | | | 1 | | | | 1 | | | | 1 | | | | | | | | | 1 | | | | | 8 | 1.3 | | | | |
| Pancreas Atrophy | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 1 | 1.0 | | | |
| Salivary Glands | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | | | |
| Stomach, Forestomach Inflammation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 3 | 3.3 | | | |
| Ulcer Epithelium, Hyperplasia | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | 2 | 3.5 | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 3 | 2.0 | | |
| Stomach, Glandular | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | | | |
| CARDIOVASCULAR SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Blood Vessel | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | | | |
| Heart Cardiomyopathy | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 21 | 1.1 | | | |
| | 1 | | 1 | 1 | 2 | | | 1 | | | | | 1 | | | | 1 | | 1 | | 1 | | 1 | | | | | | | | |
| ENDOCRINE SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Adrenal Cortex Degeneration, Cystic | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 12 | 1.1 | | | | |
| | 1 | 1 | | | | | | 1 | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 | |
| Hematopoietic Cell Proliferation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 |
| Zona Fasciculata, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 1.0 |
| Zona Fasciculata, Hyperplasia, Multifocal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | 1.8 |
| Zona Fasciculata, Hypertrophy | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 |
| Zona Fasciculata, Hypertrophy, Focal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 17 | 1.6 |
| Zona Fasciculata, Hypertrophy, Multifocal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | 1.6 |
| | | | 2 | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | 2 | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
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|--|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|-----|-----|
| | 0732 | 0647 | 0417 | 0733 | 0733 | 0734 | 0672 | 0723 | 0253 | 0647 | 0571 | 0732 | 0732 | 0731 | 0677 | 0732 | 0733 | 0733 | 0733 | 0733 | 0593 | 0731 | 0677 | 0677 | | | |
| ANIMAL ID | 001267 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | 000117 | | | |
| Adrenal Medulla Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 1 | 1.0 |
| Islets, Pancreatic Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 4 | 1.5 |
| Parathyroid Gland | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | M | + | + | + | + | + | 46 | | | |
| Pituitary Gland Pars Distalis, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 18 | 2.0 | |
| Thyroid Gland C-cell, Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 20 | 1.8 | |
| Follicular Cell, Hyperplasia | 2 | 3 | 2 | | | 1 | 2 | | | | | | | 1 | | | | 4 | 1 | 1 | 3 | | 4 | 1 | 2 | 1.5 | |
| GENERAL BODY SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NONE | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| GENITAL SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Clitoral Gland Ectasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 49 | 1 | 2.0 | |
| Ovary Atrophy | 3 | | | | 1 | 3 | 2 | 2 | | | | 2 | 2 | | | 2 | | | 2 | | | 2 | | 50 | 27 | 2.0 | |
| Ovary Cyst | X | | | X | | X | X | X | | | | X | | | | | X | X | | | | | X | 18 | 1 | 3.0 | |
| Ovary Thecal Cell, Hyperplasia | | | | | | 3 | | | | | | | | | | | | | | | | | | 1 | 1 | 3.0 | |
| Uterus Adenomyosis, Focal | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 2 | 1.0 | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| Wistar Han Rats Female Control | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | * TOTALS | |
|-----------------------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|------|
| | 0732 | 0647 | 0417 | 0732 | 0733 | 0733 | 0674 | 0723 | 0263 | 0265 | 0733 | 0733 | 0733 | 0677 | 0733 | 0677 | 0733 | 0733 | 0579 | 0733 | 0677 | | 0732 |
| ANIMAL ID | 00126 | 00017 | 00017 | 00011 | 00011 | 00011 | 00012 | 00013 | 00014 | 00015 | 00016 | 00017 | 00018 | 00019 | 00020 | 00021 | 00022 | 00023 | 00024 | 00025 | 00026 | 00027 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| | 3 | 4 | 1 | 3 | 3 | 3 | 1 | 3 | 5 | 4 | 6 | 3 | 3 | 3 | 6 | 3 | 3 | 3 | 3 | 9 | 3 | 8 | 24 |
| | 2 | 7 | 7 | 2 | 1 | 3 | 4 | 2 | 3 | 7 | 1 | 3 | 2 | 1 | 7 | 2 | 3 | 2 | 1 | 3 | 9 | 7 | 5 |

| | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------------|---|--|--|---|--|--|--|---|---|--|---|---|---|---|---|---|--|--|---|---|---|---|---|----|
| Cervix, Hyperplasia, Squamous | | | | | | | | | | | | | 2 | | | | | | | | | | 7 | |
| Endometrium, Hyperplasia, Cystic | 3 | | | 2 | | | | 2 | 1 | | 1 | | 1 | 1 | 1 | 1 | | | 1 | 1 | 2 | 1 | 1 | 24 |
| Endometrium, Metaplasia, Squamous | | | | | | | | 2 | | | | | | | | 2 | | | | | | | 5 | |
| Serosa, Cyst Multilocular | | | | | | | | | | | | X | | | | | | | | | | | 1 | |

HEMATOPOIETIC SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|----|
| Bone Marrow | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Myeloid Cell, Hyperplasia | 3 | | | 2 | | | | 3 | | | | 3 | | | | | | | | | | 3 | 12 | |
| Lymph Node Lumbar, Ectasia | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Lymph Node, Bronchial | + | + | + | + | + | M | + | + | + | M | + | M | + | M | + | + | + | + | + | + | M | + | + | 43 |
| Lymph Node, Mandibular | + | + | M | + | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | + | + | 46 |
| Lymph Node, Mediastinal | M | + | + | + | + | + | + | + | + | + | + | + | + | + | + | M | + | + | + | + | + | + | + | 44 |
| Lymph Node, Mesenteric Fibrosis, Focal | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Hyperplasia, Lymphoid Inflammation | 3 | | | | | | | | | | | | | | | | | | | | | 2 | 1 | |
| Spleen Hematopoietic Cell Proliferation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Pigmentation, Hemosiderin | 2 | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 37 | |
| Lymphoid Follicle, Atrophy | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | | 1 | 1 | 2 | 1 | 2 | 1 | | 1 | 1 | | 42 | |
| | | 3 | | | | | | 1 | 1 | 2 | 1 | | | | 3 | | | | | | | 1 | 12 | |
| Thymus Atrophy | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 49 | |
| | 2 | 3 | 3 | 3 | 2 | 1 | 3 | 1 | 3 | 3 | 3 | 2 | 1 | | 2 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 45 | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
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Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

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 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

| WISTAR HAN RATS FEMALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS |
|------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|---|--|----------|
| | 0 7 3 2 | 0 6 4 7 | 0 4 1 7 | 0 7 3 2 | 0 7 3 1 | 0 7 3 3 | 0 6 1 4 | 0 7 2 3 | 0 2 5 3 | 0 6 4 7 | 0 5 3 1 | 0 7 3 2 | 0 7 3 1 | 0 6 6 7 | 0 7 3 2 | 0 7 3 3 | 0 7 3 3 | 0 7 3 3 | 0 5 9 9 | 0 7 3 1 | 0 6 8 7 | 0 7 3 2 | | | |
| Control | ANIMAL ID | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | | |
| | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | | |

INTEGUMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-------|
| Mammary Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Galactoceles | | | | | | | 2 | 2 | | | | | | | | | | | | | 2 | | | 4 2.5 |
| Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | 1 1.0 |
| Skin | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Cyst Epithelial Inclusion | | | | | | | | | | | | | | | | | | | | | | X | | 1 |
| Dermis, Thrombosis | | | | | | | | | | | | | | | | | | | | | 1 | | | 1 1.0 |
| Ear, Inflammation, Acute | | | | | | | | | | | | | | | | | | | | | 1 | | | 1 1.0 |
| Epidermis, Ulcer, Multifocal | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 1.0 |
| Neck, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | 1 3.0 |
| Neck, Ulcer, Diffuse | | | | | | | | | | | | | | | | | | | | | | | | 1 4.0 |
| Other, Inflammation, Multifocal | | | | | | | | | | | | | | | | | | | | | | | 2 | 1 2.0 |

MUSCULOSKELETAL SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|
| Bone | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Skeletal Muscle | | | | | | | | | | | | | | + | + | | | | | | | | | 3 |

NERVOUS SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|
| Brain | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Peripheral Nerve | | | | | | | | | | | | | | + | + | | | | | | | | | 3 |
| Spinal Cord | | | | | | | | | | | | | | + | + | | | | | | | | | 3 |

RESPIRATORY SYSTEM

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
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 2,3-Butanedione
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| WISTAR HAN RATS FEMALE Control | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS |
|---|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--|----------|
| | 0732 | 0647 | 0413 | 0733 | 0773 | 0776 | 0077 | 0022 | 0066 | 0055 | 0077 | 0077 | 0077 | 0066 | 0077 | 0077 | 0077 | 0077 | 0055 | 0077 | 0066 | 0077 | | | |
| ANIMAL ID | 00126 | 00078 | 00079 | 00002 | 00001 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | | | |
| Larynx | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Inflammation, Chronic Active | | | | | | 1 | | | | | | | 1 | | | | | | | | | | 4 1.0 | | |
| Squamous Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | 1 1.0 | | |
| Lung | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Inflammation, Granulomatous | | | | | | | | | | | | | | | | | | | | | | | 2 1.0 | | |
| Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | 2 1.0 | | |
| Alveolar Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | 1 1.0 | | |
| Alveolar Epithelium, Hyperplasia, Focal | | | | | | | | | | 1 | | | | | | | | | | | | | 1 1.0 | | |
| Alveolus, Infiltration Cellular, Histiocyte | | | | | | 1 | | 1 | | | | | 1 | | | 1 | | 1 | | 1 | 1 | | 13 1.1 | | |
| Interstitial, Fibrosis | | | | | | | | | | | | | | | | | | | | | | | 1 1.0 | | |
| Peribronchial, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | 1 1.0 | | |
| Nose | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Inflammation, Suppurative | | | | | | | | | | 1 | | | | | | | | | | | | | 4 1.8 | | |
| Lamina Propria, Fibrosis | | | | | | | | | | | | | | | | | | | | | | | 1 1.0 | | |
| Olfactory Epithelium, Accumulation, Hyaline Droplet | | | | | | | 2 | | | | | | | | | 1 | | | | | | | 5 1.8 | | |
| Olfactory Epithelium, Atrophy | | | | | | | | | | | | | | | 1 | | | | | | | | 1 1.0 | | |
| Olfactory Epithelium, Metaplasia, Respiratory | | | | | | | | | | | | | | | | | | | | | | | 1 4.0 | | |
| Respiratory Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | | |
| Respiratory Epithelium, Metaplasia, Squamous | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | | |
| Trachea | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| SPECIAL SENSES SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | |
| Eye | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Anterior Chamber, Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | 1 1.0 | | |
| Cornea, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | 2 1.5 | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
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 Lab: BNW

| WISTAR HAN RATS FEMALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS |
|------------------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|----------|
| | 07 | 06 | 04 | 07 | 07 | 07 | 06 | 07 | 02 | 06 | 05 | 07 | 07 | 07 | 06 | 07 | 07 | 07 | 07 | 07 | 05 | 07 | 06 | 07 | | |
| Control | 3 | 4 | 1 | 3 | 3 | 3 | 1 | 3 | 5 | 4 | 6 | 3 | 3 | 3 | 6 | 3 | 3 | 3 | 3 | 3 | 9 | 3 | 8 | 3 | | |
| | 2 | 7 | 7 | 2 | 1 | 3 | 4 | 2 | 3 | 7 | 1 | 3 | 2 | 1 | 7 | 2 | 3 | 2 | 1 | 3 | 3 | 9 | 1 | 7 | 2 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | | |
| | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|---|--|--|--|--|--|---|---|--|---|----|-----|
| Lens, Cataract | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 |
| Retina, Degeneration | | | | | | | | | | | | | | | 3 | | | | | | 1 | 1 | | 2 | 10 | 1.7 |

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|
| Harderian Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
|-----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|

URINARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|----|-----|
| Kidney | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Calculus Micro Observation Only | X | | | X | | X | X | X | | | | X | | | X | X | X | X | | | | X | X | X | 27 | |
| Infarct | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 |
| Nephropathy | 1 | | | | | | 1 | | | | 1 | 1 | 1 | | | | | | | 1 | | | | 1 | 12 | 1.0 |
| Cortex, Cyst | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 |
| Pelvis, Inflammation | | 1 | 1 | | | | | 1 | | | | | | | | | | | | | | | | | 5 | 1.0 |
| Urinary Bladder | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
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 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
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 Lab: BNW

| | | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------------------|--|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--------------------------|
| WISTAR HAN RATS FEMALE | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | | 7 | 6 | 7 | 5 | 6 | 7 | 7 | 6 | 7 | 7 | 7 | 7 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | | 7 |
| 12.5 ppm | | 3 | 6 | 3 | 1 | 5 | 3 | 3 | 3 | 3 | 3 | 3 | 0 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | |
| | | 3 | 1 | 3 | 9 | 4 | 2 | 3 | 0 | 2 | 3 | 1 | 3 | 0 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 5 | 8 | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | females (cont...) |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | | |

ALIMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Esophagus | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Cecum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Colon | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Large, Rectum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Small, Duodenum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Small, Ileum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Intestine Small, Jejunum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Liver | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Angiectasis | | | | | | | | | | | | | | | | | | | | | | | |
| Basophilic Focus | | | X | X | X | X | X | | | | X | X | X | X | | X | X | X | X | X | | X | |
| Clear Cell Focus | | | | | | X | X | | | | | | | | X | X | | | X | | X | | |
| Eosinophilic Focus | | | | | | | | | | X | | | | | | | X | | | | | | X |
| Fatty Change, Diffuse | | | | | | | | | | | | | | | | | | | | | | | |
| Hematopoietic Cell Proliferation | | | | | | | | | | | | | | | | | | | | | | | |
| Infiltration Cellular, Lymphoid | | | | | | | | | | | | | | | | | | | | | | | |
| Infiltration Cellular, Mixed Cell | | | | 1 | | 1 | | | | 1 | 1 | | | | 1 | | | | | | | | |
| Mixed Cell Focus | | | | | | | | | | X | | | | | | | | | | | X | | |
| Necrosis, Multifocal | | | | | | | | | | | | | | | | | | | | | | | |
| Pigmentation, Hemosiderin | | | | | | | | | | | | | | | | | | | | | | | |
| Bile Duct, Cyst | | | | X | | | | | | | | | | | | | | | | | | | |
| Bile Duct, Dilatation | | | | | | | | | | | | | | | | | | | | | | | 2 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS FEMALE 12.5 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | ANIMAL ID | | |
|------------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-----------|---|------------------|
| | 0 7 3 3 | 0 6 6 1 | 0 7 3 3 | 0 5 1 9 | 0 6 5 4 | 0 7 3 2 | 0 7 3 3 | 0 6 3 0 | 0 7 3 2 | 0 7 3 3 | 0 7 3 1 | 0 7 3 3 | 0 6 0 3 | 0 6 1 0 | 0 7 3 2 | 0 7 3 2 | 0 7 3 2 | 0 7 3 3 | 0 7 3 2 | 0 7 3 2 | 0 7 3 2 | 0 7 3 3 | | | 0 7 1 5 |
| Bile Duct, Hyperplasia | 3 | | | | | 1 | | | | 1 | 1 | | | | | | | 1 | 2 | | | | | | |
| Centrilobular, Degeneration | | | | | | | | | | | | | | | | | | | | | | | | | |
| Oval Cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mesentery | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fat, Necrosis | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pancreas | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | |
| Basophilic Focus | | | | 1 | | | | | | | | | | | | | | | | | | | | | |
| Salivary Glands | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | |
| Stomach, Forestomach | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Inflammation | | | | | | 4 | | | | | | | | | | | | | | | | | 1 | | |
| Ulcer | | | | | 4 | | | | | | | | | | | | | | | | | | | | |
| Epithelium, Erosion | | | | | | | | | | | | | | | | | | | | | | | | | |
| Epithelium, Hyperplasia | | | | | 3 | | | | | | | | | | | | | | | | | | | | 2 |
| Stomach, Glandular | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |

females
(cont...)

CARDIOVASCULAR SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Blood Vessel | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Heart | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Cardiomyopathy | 1 | 1 | 2 | | 1 | | | | | | | 1 | | 1 | 1 | | | | | 1 | 1 | | | | 2 |

ENDOCRINE SYSTEM

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

Experiment Number: 20725 - 03

Test Type: CHRONIC

Route: RESPIRATORY EXPOSURE WHOLE BODY

Species/Strain: RATS/Wistar Han

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL

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

| WISTAR HAN RATS FEMALE 12.5 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | ANIMAL ID | females (cont...) | | | | |
|---|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-----------|----------------------|------------------|------------------|------------------|------------------|
| | 0 7 3 3 | 0 6 6 1 | 0 7 3 3 | 0 5 1 9 | 0 6 5 4 | 0 7 3 2 | 0 7 3 3 | 0 6 3 0 | 0 7 3 2 | 0 7 3 3 | 0 7 3 1 | 0 7 3 3 | 0 7 3 3 | 0 6 0 3 | 0 6 1 0 | 0 7 3 2 | 0 7 3 2 | 0 7 3 2 | 0 7 3 3 | 0 7 3 2 | | | 0 7 3 2 | 0 7 3 2 | 0 7 3 5 | 0 7 4 1 |
| Adrenal Cortex | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Angiectasis | | | | 2 | | | | 4 | | | | | | | | | | | | | | | | | | |
| Degeneration, Cystic | | | | | | | | | | | | | | | | | | | | | | | | 3 | 1 | |
| Hematopoietic Cell Proliferation | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Zona Fasciculata, Hyperplasia, Focal | | | | | | | | | | | | | 1 | | | | | | | | | | | | | |
| Zona Fasciculata, Hyperplasia, Multifocal | | | | | | | | | | | | | | | | | | | | | 1 | | | | | |
| Zona Fasciculata, Hypertrophy, Focal | | | | | | | | | | | | | | | | | | 2 | | | | | 2 | 2 | | |
| Zona Fasciculata, Hypertrophy, Multifocal | | | | | | | | | | | | | | | | | | | | 2 | | | | | | |
| Adrenal Medulla | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Islets, Pancreatic | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Hyperplasia | | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| Parathyroid Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Pituitary Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Pars Distalis, Hyperplasia | | | | | | | | | 3 | 4 | | 2 | | | | | | | | 2 | | 3 | 2 | | | |
| Thyroid Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| C-cell, Hyperplasia | 1 | 1 | 1 | 2 | | 1 | 2 | 1 | | | | 2 | | | 1 | | 2 | 1 | 1 | | 1 | | 1 | | | |
| Follicular Cell, Hyperplasia | | | | | | | | | | | 1 | | | | | | | | | | | | | | | |

GENERAL BODY SYSTEM

NONE

GENITAL SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clitoral Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Ectasia | | | | | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
+ .. Tissue examined microscopically
X .. Lesion present
I .. Insufficient tissue
M .. Missing tissue
A .. Autolysis precludes evaluation
BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
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Experiment Number: 20725 - 03
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 Route: RESPIRATORY EXPOSURE WHOLE BODY
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 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

| Wistar Han Rats Female 12.5 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | females (cont...) |
|------------------------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----------------------|
| | 0733 | 0661 | 0733 | 0519 | 0674 | 0772 | 0673 | 0770 | 0672 | 0773 | 0773 | 0773 | 0773 | 0666 | 0667 | 0773 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | |
| ANIMAL ID | 0030 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 | 0033 |

| Inflammation | | | | | | | | | | | | | | | | | | | | | | | | |
|---|-------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Ovary | + | | | | | | | | | | | | | | | | | | | | | | | |
| Atrophy | 1 2 2 2 1 1 1 1 2 2 2 1 | | | | | | | | | | | | | | | | | | | | | | | |
| Cyst | X X X X X X X X | | | | | | | | | | | | | | | | | | | | | | | |
| Uterus | + | | | | | | | | | | | | | | | | | | | | | | | |
| Adenomyosis | 3 | | | | | | | | | | | | | | | | | | | | | | | |
| Cervix, Cyst, Squamous | | | | | | | | | | | | | | | | | | | | | | | | |
| Cervix, Hyperplasia, Squamous | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| Endometrial Glands, Hyperplasia, Atypical | | | | | | | | | | | | | | | | | | | | | | | | |
| Endometrium, Hyperplasia, Cystic | 1 2 1 1 1 1 2 1 | | | | | | | | | | | | | | | | | | | | | | | |
| Endometrium, Metaplasia, Squamous | | | | | | | | | | | | | | | | | | | | | | | | |
| Vagina | + | | | | | | | | | | | | | | | | | | | | | | | |

| HEMATOPOIETIC SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------------------------|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Bone Marrow | + | | | | | | | | | | | | | | | | | | | | | | | |
| Myeloid Cell, Hyperplasia | 3 4 4 3 2 3 4 | | | | | | | | | | | | | | | | | | | | | | | |
| Lymph Node | + | | | | | | | | | | | | | | | | | | | | | | | |
| Popliteal, Inflammation | 3 | | | | | | | | | | | | | | | | | | | | | | | |
| Lymph Node, Bronchial | + + + M + + + + + + + + + + + + + + + + + + M | | | | | | | | | | | | | | | | | | | | | | | |
| Lymph Node, Mandibular | + | | | | | | | | | | | | | | | | | | | | | | | |
| Hyperplasia, Atypical | 3 | | | | | | | | | | | | | | | | | | | | | | | |
| Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | |
| Lymph Node, Mediastinal | + + + + + + + + M + + + M + + + + M + + + + + + | | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically M .. Missing tissue 1-4 .. Lesion qualified as:
 X .. Lesion present A .. Autolysis precludes evaluation 1) Minimal 3) Moderate
 I .. Insufficient tissue BLANK .. Not examined microscopically 2) Mild 4) Marked

Experiment Number: 20725 - 03
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 2,3-Butanedione
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| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|-------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|--|--|--|--|--|--|--|
| WISTAR HAN RATS FEMALE 12.5 ppm | DAY ON TEST | 0 7 3 3 | 0 6 6 1 | 0 7 3 3 | 0 5 1 9 | 0 6 3 4 | 0 7 3 2 | 0 7 3 0 | 0 6 3 2 | 0 7 3 3 | 0 7 3 1 | 0 7 3 3 | 0 6 3 0 | 0 6 1 3 | 0 7 3 2 | 0 7 3 2 | 0 7 3 3 | 0 7 3 3 | 0 7 3 2 | 0 7 3 2 | 0 7 3 1 | 0 7 3 2 | 0 7 3 4 | 0 7 3 5 | 0 7 3 8 | 0 7 3 9 | 0 7 3 0 | 0 7 3 1 | 0 7 3 2 | 0 7 3 3 | 0 7 3 4 | 0 7 3 5 | | | | | | | | | |
| | ANIMAL ID | 0 0 3 0 1 | 0 0 3 0 2 | 0 0 3 0 3 | 0 0 3 0 4 | 0 0 3 0 5 | 0 0 3 0 6 | 0 0 3 0 7 | 0 0 3 0 8 | 0 0 3 0 9 | 0 0 3 1 0 | 0 0 3 1 1 | 0 0 3 1 1 | 0 0 3 1 1 | 0 0 3 1 1 | 0 0 3 1 2 | 0 0 3 1 2 | 0 0 3 1 2 | 0 0 3 1 2 | 0 0 3 1 2 | 0 0 3 1 2 | 0 0 3 1 2 | 0 0 3 1 2 | 0 0 3 1 2 | 0 0 3 1 2 | 0 0 3 1 2 | 0 0 3 1 2 | 0 0 3 1 2 | 0 0 3 1 2 | 0 0 3 1 2 | 0 0 3 1 2 | 0 0 3 1 2 | 0 0 3 1 2 | 0 0 3 1 2 | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|
| Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lymph Node, Mesenteric Atrophy | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | | |
| Hyperplasia, Lymphoid | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | |
| Spleen | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Hematopoietic Cell Proliferation | 2 | 1 | 3 | 1 | | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 1 | 2 | 2 | 3 | | | | | | | | | | | | | | |
| Pigmentation, Hemosiderin | 1 | 2 | | 1 | 2 | 2 | 1 | | | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | | | 1 | 1 | 1 | 2 | 2 | | | | | | | | | | | | | | 1 | |
| Capsule, Thrombosis | | | | | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lymphoid Follicle, Atrophy | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 2 | | | | | | | | | | | | |
| Lymphoid Follicle, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Thymus | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Atrophy | 2 | 3 | 3 | 3 | 3 | 1 | 2 | 4 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | | | | | | | | | | | | | 3 | |
| Hyperplasia, Lymphoid | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

INTEGUMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|
| Mammary Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Galactocele | | | | | 2 | | | | | | | | | | | | 3 | | | | | | | | | | 3 | | | | | | | | | | | | |
| Hyperplasia | | | | | | | | | | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Skin | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Cyst Epithelial Inclusion | | | | | | | | | | | | | | | X | | | | | | | | | | | | | | | | | | | | | | | | |
| Ear, Inflammation, Acute | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | 1 | | | | | | | | | | | | |
| Ear, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ear, Ulcer, Multifocal | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | |
| Ear, Epidermis, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Epidermis, Hyperplasia | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | |
| Inguinal, Inflammation, Pyogranulomatous | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
+ .. Tissue examined microscopically
X .. Lesion present
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2,3-Butanedione

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| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------------|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WISTAR HAN RATS FEMALE | DAY ON TEST | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ANIMAL ID | 7 | 6 | 7 | 5 | 6 | 7 | 7 | 6 | 7 | 7 | 7 | 7 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 12.5 ppm | | 3 | 6 | 3 | 1 | 5 | 3 | 3 | 3 | 3 | 3 | 3 | 0 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | | 3 | 1 | 3 | 9 | 4 | 2 | 3 | 0 | 2 | 3 | 1 | 3 | 1 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

females (cont...)

- Lateral, Inflammation, Acute
- Lateral, Ulcer, Focal
- Subcutaneous Tissue, Abscess
- Tail, Inflammation, Chronic Active
- Tail, Ulcer, Multifocal

3
2

MUSCULOSKELETAL SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bone | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Skeletal Muscle | | + | | + | | | | | | | | | + | | | | | | | | | | | | | | | | | | | | | + |

NERVOUS SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Brain | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Compression | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| Hemorrhage | | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Peripheral Nerve | | + | | M | | | | | | | | | | + | | | | | | | | | | | | | | | | | | | | + |
| Spinal Cord | | + | | + | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Gliosis | | | | | | | | | | | | | | | | + | | | | | | | | | | | | | | | | | | + |

RESPIRATORY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|
| Larynx | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Squamous Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lung | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Inflammation, Granulomatous | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
+ .. Tissue examined microscopically
X .. Lesion present
I .. Insufficient tissue

M .. Missing tissue
A .. Autolysis precludes evaluation
BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
1) Minimal 3) Moderate
2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| DAY ON TEST | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|--|-------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WISTAR HAN RATS FEMALE | | 7 | 6 | 7 | 5 | 6 | 7 | 7 | 6 | 7 | 7 | 7 | 7 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 12.5 ppm | | 3 | 6 | 3 | 1 | 5 | 3 | 3 | 3 | 3 | 3 | 3 | 0 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 |
| ANIMAL ID | | 3 | 1 | 3 | 9 | 4 | 2 | 3 | 0 | 2 | 3 | 1 | 3 | 1 | 3 | 0 | 2 | 2 | 2 | 3 | 3 | 2 | 5 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 |
| | | females (cont...) | | | | | | | | | | | | | | | | | | | | | |
| Alveolar Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | |
| Alveolar Epithelium, Hyperplasia, Focal | | | | | | | 1 | | | | | | | | | | | | | | | | |
| Alveolus, Infiltration Cellular, Histiocyte | | 1 | | | | | 1 | | 1 | | | | | | | | | | 1 | | 1 | | |
| Interstitial, Fibrosis | | | | | | | | | | | | | | | | | | | | | | | |
| Peribronchial, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | |
| Nose | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Inflammation, Suppurative | | | | | 1 | | | | | | | | | | | | | | | | | | |
| Lamina Propria, Fibrosis | | | | | | | | | | | | | | | | | | | | | | | |
| Olfactory Epithelium, Accumulation, Hyaline Droplet | | 2 | | | | | | | | | | 2 | | 2 | | | | | | 2 | | | 1 |
| Olfactory Epithelium, Atrophy | | | | | | | | | | | | | | | | | | 1 | | | | | |
| Trachea | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| SPECIAL SENSES SYSTEM | | | | | | | | | | | | | | | | | | | | | | | |
| Eye | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | |
| Cornea, Inflammation, Chronic Active | | | | | | 2 | | | | | | | | 2 | | | | | | | | | 2 |
| Cornea, Mineralization | | | | | | | | | | | | | | | | | | | | | | | |
| Cornea, Endothelium, Rupture | | | | | | | | | | | | | | | | | | | | | | | |
| Cornea, Epithelium, Hyperplasia | | | | | 1 | | | | | | | | | 2 | | | | | | | | | |
| Cornea, Epithelium, Ulcer | | | | | | | | | | | | | | | | | | | | | | | |
| Lens, Cataract | | | | | | | | | | | | | | | | | | | | | | | 3 |
| Retina, Degeneration | | | | | | 1 | | | | 1 | 3 | 3 | | | | 1 | | | | | | | |
| Unilateral, Phthisis Bulbi | | | | | | | | | | | | | | | | | | | | | | | 2 |
| Harderian Gland | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |

URINARY SYSTEM

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| | | DAY ON TEST | | | | | | | | | | | | | | | | | | | | females (cont...) | |
|------------------------|---------------------------------|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------------------------------|---|
| WISTAR HAN RATS FEMALE | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| 12.5 ppm | | 7 | 6 | 7 | 5 | 6 | 7 | 7 | 6 | 7 | 7 | 7 | 7 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | | 7 |
| ANIMAL ID | | 3 | 6 | 3 | 1 | 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 0 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | | 3 |
| | | 3 | 1 | 3 | 9 | 4 | 2 | 3 | 0 | 2 | 3 | 1 | 3 | 1 | 3 | 0 | 2 | 2 | 2 | 3 | 3 | | 2 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | |
| | Kidney | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| | Accumulation, Hyaline Droplet | | | | | | | | | | | | | | | | | | | | | | |
| | Calculus Gross Observation | | | | | | | | | | | | | | | | | | | | | | |
| | Calculus Micro Observation Only | | | X | X | X | X | | | X | X | X | | X | X | X | X | X | | | X | X | |
| | Nephropathy | 1 | | | | | 1 | | | | | | | 1 | | | 1 | | | | | 2 | |
| | Thrombosis | | | | | | | | | | | | | | | | | | | | | | |
| | Papilla, Necrosis | | | | | | | | | | | | | | | | | | | | | | |
| | Pelvis, Dilatation | | | | | | | | | | | | | | | | | | | | | | |
| | Pelvis, Inflammation | | | | | | | | | | | | | | | | | | | | | | |
| | Renal Tubule, Dilatation | | | | | | | | | | | | | | | | | | | | | | |
| | Urinary Bladder | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| | Calculus Gross Observation | | | | | | | | | | | | | | | | | | | | | | |
| | Hemorrhage | | | | | | | | | | | 3 | | | | | | | | | | | |
| | Hyperplasia | | | | | | | | | | | | | | | | | | | | | | |
| | Inflammation | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

| WISTAR HAN RATS FEMALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | | | | | | | | | | | | | |
|------------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 05771 | 07315 | 07723 | 07730 | 07732 | 07733 | 07737 | 07738 | 07742 | 07745 | 07752 | 07758 | 07773 | 07777 | 07783 | 07790 | 07792 | 07797 | 07802 | 07807 | | 07812 | 07817 | 07822 | 07827 | 07832 | 07837 | 07842 | 07847 | 07852 | 07857 | 07862 | | | |
| 12.5 ppm | 00326 | 00027 | 00028 | 00029 | 00030 | 00031 | 00032 | 00033 | 00034 | 00035 | 00036 | 00037 | 00038 | 00039 | 00040 | 00041 | 00042 | 00043 | 00044 | 00045 | 00046 | 00047 | 00048 | 00049 | 00050 | 00051 | 00052 | 00053 | 00054 | 00055 | 00056 | 00057 | 00058 | 00059 | 00060 |
| | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |

ALIMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|-----|-----|
| Esophagus | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Intestine Large, Cecum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Intestine Large, Colon | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Intestine Large, Rectum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Intestine Small, Duodenum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Intestine Small, Ileum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Intestine Small, Jejunum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Liver | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Angiectasis | | 1 | | | | | | | | | | | 1 | | | | | | | | | 1 | | | | | | | | | | | | | 3 | 1.0 | |
| Basophilic Focus | | X | | | X | | | | X | X | | | X | | X | | X | X | | | X | X | X | X | | | | | | | | | | | 30 | | |
| Clear Cell Focus | | | | | X | | | | | | | | | | | X | | | | | | | | | | | | | | | | | | | | 8 | |
| Eosinophilic Focus | | | | | | | | | | | | | X | | | | | | | | | | X | | | | | | | | | | | | | 5 | |
| Fatty Change, Diffuse | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | 1 | 2.0 | |
| Hematopoietic Cell Proliferation | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | 2 | 1.5 | |
| Infiltration Cellular, Lymphoid | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 | |
| Infiltration Cellular, Mixed Cell | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | 6 | 1.0 | |
| Mixed Cell Focus | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | |
| Necrosis, Multifocal | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 |
| Pigmentation, Hemosiderin | | | | | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3.0 |
| Bile Duct, Cyst | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Bile Duct, Dilatation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS FEMALE 12.5 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | | |
|------------------------------------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|--------|-----|-----|
| | 057715 | 077232 | 077303 | 077303 | 077303 | 077303 | 077303 | 077303 | 077303 | 077303 | 077303 | 077303 | 077303 | 077303 | 077303 | 077303 | 077303 | 077303 | 077303 | 077303 | | 077303 | | |
| ANIMAL ID | 00326 | 00327 | 00328 | 00329 | 00330 | 00331 | 00332 | 00333 | 00334 | 00335 | 00336 | 00337 | 00338 | 00339 | 00340 | 00341 | 00342 | 00343 | 00344 | 00345 | 00346 | | | |
| Bile Duct, Hyperplasia | | | | | | | 2 | | 1 | | | | | | 2 | 1 | | | | 1 | 1 | 12 | 1.4 | |
| Centrilobular, Degeneration | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 |
| Oval Cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 |
| Mesentery | | | | | | | | | | | | | | | | | | | | | | | 10 | |
| Fat, Necrosis | | | | | | | | | | | | | | | | | | | | | | | 8 | 1.5 |
| Pancreas | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Atrophy | | | | | | | | | | | | | | | | | | | | | | | 2 | 2.0 |
| Basophilic Focus | | | | | | | | | | | | | | | | | | | | | | | 2 | 1.0 |
| Salivary Glands | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Inflammation | | | | | | | | | | | | | | | | | | | | | | | 1 | 3.0 |
| Stomach, Forestomach | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Inflammation | | | | | | | | | | | | | | | | | | | | | | | 5 | 2.2 |
| Ulcer | | | | | | | | | | | | | | | | | | | | | | | 1 | 4.0 |
| Epithelium, Erosion | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 |
| Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | 6 | 2.0 |
| Stomach, Glandular | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| CARDIOVASCULAR SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | |
| Blood Vessel | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Heart | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Cardiomyopathy | | | | | | | | | | | | | | | | | | | | | | | 28 | 1.3 |
| ENDOCRINE SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
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 2,3-Butanedione
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 Lab: BNW

| WISTAR HAN RATS FEMALE 12.5 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | |
|---|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|----------|
| | 05771 | 07712 | 07713 | 07714 | 07715 | 07716 | 07717 | 07718 | 07719 | 07720 | 07721 | 07722 | 07723 | 07724 | 07725 | 07726 | 07727 | 07728 | 07729 | 07730 | | |
| ANIMAL ID | 00326 | 00327 | 00328 | 00329 | 00330 | 00331 | 00332 | 00333 | 00334 | 00335 | 00336 | 00337 | 00338 | 00339 | 00340 | 00341 | 00342 | 00343 | 00344 | 00345 | | |
| Adrenal Cortex | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Angiectasis | | | | | | | | | | | | | | | | | | | | | 2 3.0 | |
| Degeneration, Cystic | | 2 | | | | | | | 1 | | | | | 2 | | | | 1 | | | 1 7 1.6 | |
| Hematopoietic Cell Proliferation | | | | 2 | | | | | | | | | | | | | | 3 | | | 2 2.5 | |
| Zona Fasciculata, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | 2 | | 2 1.5 | |
| Zona Fasciculata, Hyperplasia, Multifocal | | | | | | | | | | | | | | | | | | | | | 1 1.0 | |
| Zona Fasciculata, Hypertrophy, Focal | | | | 1 | | | | | 2 | | | | | 4 | | | 2 | 3 | | | 2 9 2.2 | |
| Zona Fasciculata, Hypertrophy, Multifocal | | | 2 | | | | | | | | | | | | | | | | 2 | | 3 2.0 | |
| Adrenal Medulla | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Islets, Pancreatic | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Hyperplasia | | | | | | | | | | | | | | | | | | | | 2 | 2 1.5 | |
| Parathyroid Gland | + | M | + | + | + | M | M | + | + | + | + | + | M | + | + | + | + | + | M | M | 44 | |
| Pituitary Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Pars Distalis, Hyperplasia | | | | | 3 | | 4 | | 1 | | 4 | | | 4 | | | 4 | 4 | | 4 | 2 | 4 16 3.1 |
| Thyroid Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| C-cell, Hyperplasia | | 3 | | 1 | 2 | | 1 | | 2 | | 1 | | 2 | | 4 | | | | 3 | 1 | 1 1 1 | |
| Follicular Cell, Hyperplasia | | | | | | | | | | | | 1 | | | | 1 | | | | | 1 4 1.0 | |

GENERAL BODY SYSTEM

NONE

GENITAL SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | |
|----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-------|
| Clitoral Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Ectasia | | | | | | | | | 2 | | | | | | 3 | | | | | | | 2 2.5 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade

+ .. Tissue examined microscopically

M .. Missing tissue

1-4 .. Lesion qualified as:

X .. Lesion present

A .. Autolysis precludes evaluation

1) Minimal 3) Moderate

I .. Insufficient tissue

BLANK .. Not examined microscopically

2) Mild 4) Marked

Experiment Number: 20725 - 03

Test Type: CHRONIC

Route: RESPIRATORY EXPOSURE WHOLE BODY

Species/Strain: RATS/Wistar Han

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL

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

| WISTAR HAN RATS FEMALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | * TOTALS | |
|---|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----------|-----|
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 5 | 7 | 7 | 7 | 7 | 6 | 7 | 1 | 7 | 7 | 7 | 5 | 7 | 7 | 7 | 4 | 7 | 7 | 6 | 7 | 7 | 7 | 7 | | |
| 12.5 ppm | 7 | 3 | 1 | 2 | 3 | 0 | 3 | 3 | 3 | 1 | 3 | 8 | 1 | 3 | 3 | 0 | 3 | 3 | 8 | 2 | 3 | 3 | 3 | | |
| | 1 | 1 | 5 | 3 | 2 | 3 | 3 | 7 | 2 | 5 | 2 | 5 | 8 | 3 | 2 | 9 | 2 | 3 | 7 | 1 | 2 | 1 | 3 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | |
| | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | | |
| | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| Inflammation | 2 | | | | | | | | | | | 1 | | | | | | | | | | | 2 | 1.5 | |
| Ovary | + | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Atrophy | 1 | 2 | | 2 | | 2 | 2 | | 2 | | 2 | 2 | 1 | | 2 | 3 | | 2 | | | | | 2 | | |
| Cyst | X | X | | | | | X | | | X | X | X | | | | | | X | | | | | X | | |
| Uterus | + | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Adenomyosis | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3.0 |
| Cervix, Cyst, Squamous | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Cervix, Hyperplasia, Squamous | | | | | | | | | | | | | | | | | | | | | | | | 5 | 1.4 |
| Endometrial Glands, Hyperplasia, Atypical | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 |
| Endometrium, Hyperplasia, Cystic | | 1 | | 2 | | 2 | | 2 | | 2 | | 1 | | 1 | | 2 | | | | | 1 | | | | |
| Endometrium, Metaplasia, Squamous | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 |
| Vagina | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| HEMATOPOIETIC SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bone Marrow | + | | | | | | | | | | | | | | | | | | | | | | | 50 | |
| Myeloid Cell, Hyperplasia | 4 | 3 | 3 | 4 | | | | 3 | | | 2 | | | 2 | 3 | 3 | 3 | 4 | | | | | 3 | | |
| Lymph Node | | | | | | | | | | | | | | | | | | | | | | | | 3 | |
| Popliteal, Inflammation | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3.0 |
| Lymph Node, Bronchial | + | + | + | M | + | + | + | + | + | M | + | M | + | + | + | + | + | M | + | + | + | + | + | | |
| Lymph Node, Mandibular | M | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Hyperplasia, Atypical | | | | | | | | | | | | | | | | | | | | | | | | 48 | |
| Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 |
| Lymph Node, Mediastinal | + | | | | | | | | | | | | | | | | | | | | | | | 47 | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade

+ .. Tissue examined microscopically

X .. Lesion present

I .. Insufficient tissue

M .. Missing tissue

A .. Autolysis precludes evaluation

BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:

1) Minimal 3) Moderate

2) Mild 4) Marked

Experiment Number: 20725 - 03

Test Type: CHRONIC

Route: RESPIRATORY EXPOSURE WHOLE BODY

Species/Strain: RATS/Wistar Han

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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

| WISTAR HAN RATS FEMALE 12.5 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | | | | | |
|--|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----------|---|---|----|--------|---|--|
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | | | | | |
| | 5 | 7 | 7 | 7 | 7 | 6 | 7 | 1 | 7 | 7 | 7 | 5 | 7 | 7 | 7 | 4 | 7 | 7 | 6 | 7 | | 7 | 7 | | | | |
| | 7 | 3 | 1 | 2 | 3 | 0 | 3 | 3 | 3 | 1 | 3 | 8 | 1 | 3 | 3 | 0 | 3 | 3 | 8 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | 1 | 1 | 5 | 3 | 2 | 3 | 3 | 7 | 2 | 5 | 2 | 5 | 8 | 3 | 2 | 9 | 2 | 3 | 7 | 1 | 2 | 1 | 1 | 3 | 3 | 2 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | | |
| Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | 2 | 1 2.0 | | |
| Lymph Node, Mesenteric Atrophy | + | | | | | | | | | | | | | | | | | | | | | | | 50 | 2 2.0 | | |
| Hyperplasia, Lymphoid | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | | |
| Spleen | + | | | | | | | | | | | | | | | | | | | | | | | 50 | | | |
| Hematopoietic Cell Proliferation | | | | | | | | | | | | | | | | | | | | | | | | | 40 2.0 | | |
| Pigmentation, Hemosiderin | | | | | | | | | | | | | | | | | | | | | | | | | 39 1.3 | | |
| Capsule, Thrombosis | | | | | | | | | | | | | | | | | | | | | | | | | 1 3.0 | | |
| Lymphoid Follicle, Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | 6 2.2 | | |
| Lymphoid Follicle, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | 3 | 1 3.0 | | |
| Thymus | + | | | | | | | | | | | | | | | | | | | | | | | 50 | | | |
| Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | 42 2.1 | | |
| Hyperplasia, Lymphoid | | | | | | | | | | | | | | | | | | | | | | | | 2 | 2 2.5 | | |
| INTEGUMENTARY SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mammary Gland | + | | | | | | | | | | | | | | | | | | | | | | | 50 | | | |
| Galactocele | | | | | | | | | | | | | | | | | | | | | | | | | 4 2.5 | | |
| Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | 2 | 2 3.5 | | |
| Skin | + | | | | | | | | | | | | | | | | | | | | | | | 50 | | | |
| Cyst Epithelial Inclusion | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | |
| Ear, Inflammation, Acute | | | | | | | | | | | | | | | | | | | | | | | | | 2 1.0 | | |
| Ear, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | 1 1.0 | | |
| Ear, Ulcer, Multifocal | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | | |
| Ear, Epidermis, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | | |
| Epidermis, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | | |
| Inguinal, Inflammation, Pyogranulomatous | | | | | | | | | | | | | | | | | | | | | | | | 4 | 1 4.0 | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade

+ .. Tissue examined microscopically

X .. Lesion present

I .. Insufficient tissue

M .. Missing tissue

A .. Autolysis precludes evaluation

BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:

1) Minimal 3) Moderate

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Experiment Number: 20725 - 03

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P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL

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

| Wistar Han Rats Female 12.5 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | * TOTALS |
|------------------------------------|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----------|
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| ANIMAL ID | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 |
| | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

| | | | |
|------------------------------------|---|---|-----|
| Lateral, Inflammation, Acute | 3 | 1 | 3.0 |
| Lateral, Ulcer, Focal | 4 | 1 | 4.0 |
| Subcutaneous Tissue, Abscess | 3 | 1 | 3.0 |
| Tail, Inflammation, Chronic Active | 3 | 1 | 3.0 |
| Tail, Ulcer, Multifocal | 3 | 1 | 2.0 |

MUSCULOSKELETAL SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---|
| Bone | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Skeletal Muscle | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 7 |

NERVOUS SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|--|---|-----|-----|
| Brain | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | | |
| Compression | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3.0 | |
| Hemorrhage | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3.0 | |
| Peripheral Nerve | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 5 | | | | |
| Spinal Cord | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 5 | | | | |
| Gliosis | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 1 | 3.0 |

RESPIRATORY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|--|---|---|-----|-----|
| Larynx | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | | | |
| Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | 2 | 1.0 |
| Squamous Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 1 | 2.0 | |
| Lung | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | | | |
| Inflammation, Granulomatous | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | 1.0 | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
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Lab: BNW

| WISTAR HAN RATS FEMALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | * TOTALS |
|---|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|----------|
| | 05771 | 07723 | 07732 | 07730 | 07733 | 07737 | 07733 | 07737 | 07733 | 07737 | 07733 | 07737 | 07733 | 07737 | 07733 | 07737 | 07733 | 07737 | 07733 | 07737 | 07733 | 07737 | |
| 12.5 ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| ANIMAL ID | 00326 | 00327 | 00328 | 00329 | 00330 | 00331 | 00332 | 00333 | 00334 | 00335 | 00336 | 00337 | 00338 | 00339 | 00340 | 00341 | 00342 | 00343 | 00344 | 00345 | 00346 | 00347 | |
| Alveolar Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | 1 | 1 1.0 | |
| Alveolar Epithelium, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | | 1 | 1 1.0 |
| Alveolus, Infiltration Cellular, Histiocyte | | 1 | | | | | | | | 1 | 1 | 1 | 1 | | | | | | | | 1 | 11 1.0 | |
| Interstitial, Fibrosis | | | | | | | | | | | | | | | | | | | | | 1 | 1 1.0 | |
| Peribronchial, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | 1 | | | | 1 | 2 1.0 | |
| Nose | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Inflammation, Suppurative | | | | | | | | | | | | | | | | | 1 | 1 | | | | 3 | 3 1.0 |
| Lamina Propria, Fibrosis | | | | | | | | 1 | | | | | | | | | | | | | | 1 | 1 1.0 |
| Olfactory Epithelium, Accumulation, Hyaline Droplet | | | 1 | | | | 1 | | | 2 | | | | | | | | 1 | | 2 | | 10 | 10 1.6 |
| Olfactory Epithelium, Atrophy | | | | | | | | | | | | | | | | | | | | | | 1 | 1 1.0 |
| Trachea | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| SPECIAL SENSES SYSTEM | | | | | | | | | | | | | | | | | | | | | | | |
| Eye | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Inflammation, Chronic Active | | | | | | | | 4 | | | | | | | | | | | | | | 1 | 1 4.0 |
| Cornea, Inflammation, Chronic Active | | | | | | | 4 | | 1 | | | | | | | 1 | | | | | | 6 | 6 2.0 |
| Cornea, Mineralization | | | | | 1 | | | | | | | | | | | | | | | | | 1 | 1 1.0 |
| Cornea, Endothelium, Rupture | | | | | | | 2 | | | | | | | | | | | | | | | 1 | 1 2.0 |
| Cornea, Epithelium, Hyperplasia | | | | | | | 3 | | | | | | | | | | | | | | | 3 | 3 2.0 |
| Cornea, Epithelium, Ulcer | | | | | | | 2 | | | | | | | | | | | | | | | 1 | 1 2.0 |
| Lens, Cataract | | | | | | | | | | | | | | | | | | | | | | 1 | 1 3.0 |
| Retina, Degeneration | | 2 | 2 | | | | | | | | | | | | | | | | | | | 7 | 7 1.9 |
| Unilateral, Phthisis Bulbi | | | | | | | | | | | | | | | | | | | | | | 1 | 1 2.0 |
| Harderian Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |

URINARY SYSTEM

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
+ .. Tissue examined microscopically
X .. Lesion present
I .. Insufficient tissue

M .. Missing tissue
A .. Autolysis precludes evaluation
BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
1) Minimal 3) Moderate
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 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

| WISTAR HAN RATS FEMALE 12.5 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS | | | |
|------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----|-----|-----|
| | 0 5 7 1 | 0 7 3 1 | 0 7 1 5 | 0 7 2 3 | 0 7 3 2 | 0 6 0 3 | 0 7 3 3 | 0 1 3 7 | 0 7 3 2 | 0 7 3 5 | 0 7 1 2 | 0 7 3 2 | 0 5 8 5 | 0 7 1 3 | 0 7 3 2 | 0 4 0 9 | 0 7 3 2 | 0 6 8 7 | 0 7 2 1 | 0 7 3 2 | 0 7 3 1 | 0 7 3 1 | 0 7 3 3 | 0 7 3 2 | | | | |
| ANIMAL ID | 0 0 3 2 6 | 0 0 3 2 7 | 0 0 3 2 8 | 0 0 3 2 9 | 0 0 3 3 0 | 0 0 3 3 1 | 0 0 3 3 2 | 0 0 3 3 3 | 0 0 3 3 4 | 0 0 3 3 5 | 0 0 3 3 6 | 0 0 3 3 7 | 0 0 3 3 8 | 0 0 3 3 9 | 0 0 3 3 0 | 0 0 3 3 1 | 0 0 3 3 2 | 0 0 3 3 3 | 0 0 3 3 4 | 0 0 3 3 5 | 0 0 3 3 6 | 0 0 3 3 7 | 0 0 3 3 8 | 0 0 3 3 9 | 0 0 3 3 0 | | | |
| Kidney | + | | | | | | | | | | | | | | | | | | | | | | | | 50 | | | |
| Accumulation, Hyaline Droplet | | | | | | | | | | | | | | | | | | | 2 | 1 | 2.0 | | | | | | | |
| Calculus Gross Observation | X | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | |
| Calculus Micro Observation Only | X | | X | | X | | X | | X | | X | | X | | X | | X | | X | | X | | X | | 29 | | | |
| Nephropathy | 4 | 2 | | 2 | 1 | | 1 | | | | | | | | | | | | | | | | | | | 1 | 1.5 | |
| Thrombosis | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 |
| Papilla, Necrosis | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 |
| Pelvis, Dilatation | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | 3 | 3.0 |
| Pelvis, Inflammation | 4 | | | 1 | | | 1 | 1 | | | 1 | 1 | | | 1 | 4 | | | | | | | | | 8 | 1.8 | | |
| Renal Tubule, Dilatation | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | 3 | 3.0 |
| Urinary Bladder | + | | | | | | | | | | | | | | | | | | | | | | | | 50 | | | |
| Calculus Gross Observation | X | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | |
| Hemorrhage | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3.0 | | |
| Hyperplasia | 2 | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 | | |
| Inflammation | | | | | | | | | | | | | | | 2 | 1 | 2.0 | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS FEMALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | females (cont...) | | | |
|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | 0 7 2 3 | 0 5 8 9 | 0 6 1 7 | 0 7 3 2 | 0 7 2 4 | 0 7 3 2 | 0 7 3 3 | 0 6 1 4 | 0 7 3 2 | 0 7 1 4 | 0 5 3 6 | 0 7 1 2 | 0 7 3 0 | 0 4 5 2 | 0 7 3 2 | 0 7 3 8 | 0 6 2 3 | 0 4 5 3 | 0 7 7 5 | 0 7 3 2 | | 0 6 9 5 | 0 4 4 2 | 0 5 2 8 |
| 25 ppm | 0 0 5 0 1 | 0 0 5 0 2 | 0 0 5 0 3 | 0 0 5 0 4 | 0 0 5 0 5 | 0 0 5 0 6 | 0 0 5 0 7 | 0 0 5 0 8 | 0 0 5 0 9 | 0 0 5 1 0 | 0 0 5 1 1 | 0 0 5 1 1 | 0 0 5 1 1 | 0 0 5 1 1 | 0 0 5 1 1 | 0 0 5 1 1 | 0 0 5 1 1 | 0 0 5 1 1 | 0 0 5 2 0 | 0 0 5 2 1 | 0 0 5 2 2 | 0 0 5 2 3 | 0 0 5 2 4 | 0 0 5 2 5 |

ALIMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Esophagus | + | | | | | | | | | | | | | | | | | | | |
| Intestine Large, Cecum | + | | | | | | | | | | | | | | | | | | | |
| Intestine Large, Colon | + | | | | | | | | | | | | | | | | | | | |
| Intestine Large, Rectum | + | | | | | | | | | | | | | | | | | | | |
| Intestine Small, Duodenum | + | | | | | | | | | | | | | | | | | | | |
| Intestine Small, Ileum Peyer's Patch, Hyperplasia, Lymphoid | + 3 | | | | | | | | | | | | | | | | | | | |
| Intestine Small, Jejunum | + | | | | | | | | | | | | | | | | | | | |
| Liver | + | | | | | | | | | | | | | | | | | | | |
| Angiectasis | | | | | | | | | | | | | | | | | | | | |
| Basophilic Focus | X | | | | | | | | | | | | | | | | | | | |
| Clear Cell Focus | X | | | | | | | | | | | | | | | | | | | |
| Eosinophilic Focus | X | | | | | | | | | | | | | | | | | | | |
| Fatty Change, Diffuse | | | | | | | | | | | | | | | | | | | | |
| Hematopoietic Cell Proliferation | 1 | | | | | | | | | | | | | | | | | | | |
| Infiltration Cellular, Mixed Cell | 1 | | | | | | | | | | | | | | | | | | | |
| Necrosis, Multifocal | 1 | | | | | | | | | | | | | | | | | | | |
| Bile Duct, Hyperplasia | 2 | | | | | | | | | | | | | | | | | | | |
| Kupffer Cell, Hyperplasia | 2 | | | | | | | | | | | | | | | | | | | |
| Mesentery | + | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
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Experiment Number: 20725 - 03
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 Lab: BNW

| WISTAR HAN RATS FEMALE 25 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | ANIMAL ID | females (cont...) | |
|---|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-----------|----------------------|------------------|
| | 0 7 2 3 | 0 5 8 9 | 0 6 1 7 | 0 7 3 2 | 0 7 2 4 | 0 7 3 2 | 0 7 3 3 | 0 6 1 4 | 0 7 3 2 | 0 7 2 4 | 0 5 7 6 | 0 7 3 1 | 0 7 3 2 | 0 4 5 2 | 0 7 3 2 | 0 7 3 2 | 0 6 2 8 | 0 4 5 3 | 0 7 2 3 | 0 5 7 3 | | | 0 7 3 2 |
| Amyloid Deposition | | | | | | | | | | | | | | | | | | | | | 2 | | |
| Angiectasis | | | | | | | | | | | | | | | | | | | | | | | |
| Degeneration, Cystic | | | | | | | | | | | | | | | | | | | | | 1 | 1 | |
| Hematopoietic Cell Proliferation | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Zona Fasciculata, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | | 3 | |
| Zona Fasciculata, Hypertrophy, Focal | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Zona Fasciculata, Hypertrophy, Multifocal | | | | | | | | | | | | | | | | | | | | | 2 | 3 | |
| Adrenal Medulla | | | | | | | | | | | | | | | | | | | | | | | |
| Islets, Pancreatic | | | | | | | | | | | | | | | | | | | | | | | |
| Hyperplasia | | | | | | | | | | | | | | | | | | | | | 1 | | |
| Parathyroid Gland | | | | | | | | | | | | | | | | | | | | | | | |
| Pituitary Gland | | | | | | | | | | | | | | | | | | | | | | | |
| Pars Distalis, Hyperplasia | | | | | | | | | | | | | | | | | | | | | 3 | 1 | |
| Pars Intermedia, Hyperplasia | | | | | | | | | | | | | | | | | | | | | 2 | 2 | |
| Thyroid Gland | | | | | | | | | | | | | | | | | | | | | | | |
| C-cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | 1 | 2 | |
| Follicular Cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | 3 | |
| Follicular Cell, Hypertrophy | | | | | | | | | | | | | | | | | | | | | | 3 | |

GENERAL BODY SYSTEM

NONE

GENITAL SYSTEM

Clitoral Gland +

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
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Experiment Number: 20725 - 03
 Test Type: CHRONIC
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P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 2,3-Butanedione
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Date Report Requested: 04/12/2016
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 Lab: BNW

| WISTAR HAN RATS FEMALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | females (cont...) | | | | |
|------------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----------------------|------|------|------|------|
| | 0723 | 0758 | 0761 | 0773 | 0777 | 0777 | 0777 | 0766 | 0777 | 0777 | 0755 | 0777 | 0777 | 0744 | 0777 | 0777 | 0766 | 0744 | 0777 | 0777 | | 0766 | 0744 | 0755 | |
| 25 ppm | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | | |
| ANIMAL ID | 5001 | 5002 | 5003 | 5004 | 5005 | 5006 | 5007 | 5008 | 5009 | 5010 | 5011 | 5012 | 5013 | 5014 | 5015 | 5016 | 5017 | 5018 | 5019 | 5020 | 5021 | 5022 | 5023 | 5024 | 5025 |

Ectasia

2

Ovary

Atrophy
Cyst

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| | | 3 | | 2 | 2 | 2 | 2 | 3 | | 2 | | | 3 | | 2 | | | | 2 | 2 | 1 | | | | |
| X | | X | | | X | X | | X | X | | | | | | | | | | X | | X | | | | X |

Uterus

Inflammation, Chronic Active
 Cervix, Hyperplasia, Squamous
 Cervix, Hypertrophy, Stromal
 Endometrium, Decidual Reaction, Focal
 Endometrium, Hyperplasia, Cystic
 Endometrium, Hyperplasia, Focal
 Endometrium, Metaplasia, Squamous

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| | | | | | 2 | 2 | | 2 | | | | | 1 | | | | | | 2 | | | | | | 3 |
| | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| | | 2 | | 1 | 1 | 1 | | 2 | | | | 1 | | 1 | | | | | | | | | | | |
| | | | | 1 | 1 | | 2 | | | | | 2 | | 1 | | | | | | | | | | | |

Vagina

+

HEMATOPOIETIC SYSTEM

Bone Marrow
 Myeloid Cell, Hyperplasia

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| 3 | 4 | | | 3 | 2 | 2 | | | | 4 | | | 3 | | 3 | 2 | | 4 | | | 3 | 3 | 3 | 4 | |

Lymph Node
 Iliac, Infiltration Cellular, Plasma Cell
 Lumbar, Infiltration Cellular, Plasma Cell

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |

Lymph Node, Bronchial

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| + | M | + | + | + | + | + | + | + | + | + | + | + | + | M | + | + | + | + | M | + | + | + | M | + | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Lymph Node, Mandibular
 Ectasia

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M | + | + | + | + | + | + | + | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | + |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
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Experiment Number: 20725 - 03
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 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| Wistar Han Rats Female 25 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | ANIMAL ID | females (cont...) | | | | | |
|--|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----------|--------------------------|---|---|---|---------------------------|----------------------|
| | 0723 | 0758 | 0761 | 0773 | 0777 | 0777 | 0777 | 0766 | 0777 | 0777 | 0755 | 0777 | 0777 | 0744 | 0777 | 0777 | 0766 | 0744 | 0777 | 0777 | | | | | | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000000000000000000000000 | | | | | |
| | 7 | 5 | 6 | 7 | 7 | 7 | 7 | 6 | 7 | 7 | 5 | 7 | 7 | 4 | 7 | 7 | 6 | 4 | 7 | 5 | 7 | 7 | 6 | 4 | 5 | 000000000000000000000000 | |
| | 2 | 8 | 1 | 3 | 2 | 3 | 3 | 1 | 3 | 2 | 1 | 3 | 1 | 5 | 3 | 3 | 2 | 5 | 2 | 7 | 3 | 3 | 9 | 4 | 2 | 000000000000000000000000 | |
| | 3 | 9 | 7 | 2 | 4 | 2 | 3 | 4 | 2 | 4 | 6 | 2 | 0 | 2 | 2 | 2 | 8 | 3 | 3 | 5 | 3 | 2 | 5 | 2 | 8 | 000000000000000000000000 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000000000000000000000000 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 000000000000000000000000 | |
| | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 000000000000000000000000 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 000000000000000000000000 | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 1234567890123456789012345 | females (cont...) |
| Lymph Node, Mediastinal | + | + | + | + | + | + | + | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Lymph Node, Mesenteric Atrophy | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Hyperplasia, Lymphoid Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | |
| Spleen | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Hematopoietic Cell Proliferation | 3 | 4 | | 2 | 2 | 2 | 2 | | 2 | 3 | 4 | 2 | | 2 | 2 | 2 | 2 | 1 | 3 | 1 | 2 | 1 | 1 | 3 | 4 | | |
| Pigmentation, Hemosiderin | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | |
| Lymphoid Follicle, Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Thymus | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Atrophy | 4 | 2 | 3 | | 2 | 2 | 1 | | 1 | 3 | 4 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | | 1 | 2 | 2 | 4 | 2 | 3 | | |
| Cyst | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INTEGUMENTARY SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mammary Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Galactocele | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| Duct, Dilatation | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| Skin | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| MUSCULOSKELETAL SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bone | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Osteosclerosis | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| Tarsal, Tendon, Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
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 Lab: BNW

| WISTAR HAN RATS FEMALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | ANIMAL ID | females (cont...) | | | |
|------------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----------|----------------------|------|-------|------|
| | 0723 | 0758 | 0761 | 0773 | 0777 | 0777 | 0777 | 0766 | 0777 | 0777 | 0755 | 0777 | 0777 | 0744 | 0777 | 0777 | 0766 | 0744 | 0777 | 0777 | | | 0766 | 0744 | 0755 |
| 25 ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 00501 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 00502 | |
| | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 00503 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 00504 | |

Skeletal Muscle + + + +

NERVOUS SYSTEM

Brain +
 Choroid Plexus, Hyperplasia
 Peripheral Nerve + + + +
 Spinal Cord + + + +

RESPIRATORY SYSTEM

Larynx +
 Foreign Body
 Inflammation, Chronic Active 1 1
 Squamous Epithelium, Hyperplasia 1 1
 Lung +
 Inflammation, Granulomatous 1
 Alveolar Epithelium, Hyperplasia
 Alveolus, Infiltration Cellular, Histiocyte 1 1 1 1
 Bronchiole, Epithelium, Hyperplasia 1 1
 Bronchus, Epithelium, Regeneration 1
 Interstitium, Fibrosis
 Nose +
 Inflammation, Suppurative 1 1 1 1 2 2
 Lamina Propria, Fibrosis 1 1 1 1 1 1 1 1
 Olfactory Epithelium, Accumulation, Hyaline Droplet 1 2 1

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically M .. Missing tissue 1-4 .. Lesion qualified as:
 X .. Lesion present A .. Autolysis precludes evaluation 1) Minimal 3) Moderate
 I .. Insufficient tissue BLANK .. Not examined microscopically 2) Mild 4) Marked

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 Lab: BNW

| Wistar Han Rats Female 25 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | females (cont...) |
|---|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----------------------|
| | 0723 | 0758 | 0761 | 0773 | 0777 | 0777 | 0777 | 0766 | 0777 | 0777 | 0755 | 0777 | 0777 | 0744 | 0777 | 0777 | 0766 | 0744 | 0777 | 0755 | 0777 | 0777 | 0766 | 0744 | 0755 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 2 | 8 | 1 | 3 | 2 | 3 | 3 | 1 | 3 | 2 | 1 | 3 | 1 | 5 | 3 | 3 | 2 | 5 | 2 | 7 | 3 | 3 | 9 | 4 | 2 | |
| | 3 | 9 | 7 | 2 | 4 | 2 | 3 | 4 | 2 | 4 | 6 | 2 | 0 | 2 | 2 | 2 | 8 | 3 | 3 | 5 | 3 | 3 | 2 | 5 | 2 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | |
| Olfactory Epithelium, Atrophy | 2 | | 1 | | | | | | | | | | | | 1 | | | | | | 2 | | | | | |
| Olfactory Epithelium, Metaplasia, Respiratory | | 1 | 1 | | | 1 | | 2 | | 1 | | | 2 | | 1 | | 1 | 1 | | | | 1 | 1 | | | |
| Respiratory Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | 1 | | | | | | | | | |
| Respiratory Epithelium, Metaplasia, Squamous | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Trachea | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |

SPECIAL SENSES SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Eye | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | |
| Retinal Detachment | | | | | | | | | | | | | 3 | | | | | | | | | | | | |
| Anterior Chamber, Inflammation, Suppurative | | | | | | | | | | | | 1 | | | | | | | | | | 2 | | | |
| Cornea, Inflammation, Chronic Active | | | | | | 1 | 2 | 1 | | | 2 | 4 | | | | 1 | 3 | | | | 1 | | 1 | 1 | |
| Cornea, Necrosis | | | | | | | | | | | | 1 | | | | | | | | | | | | | |
| Cornea, Epithelium, Hyperplasia | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | |
| Cornea, Epithelium, Ulcer | | | | | | | | | | | | | 3 | | | | | | | | | | | | |
| Iris, Inflammation, Acute | | | | | | | | | | | | | 1 | | | | | | | | | | | | |
| Lens, Cataract | | | | | | | | | | | | | | | | | | | | | | | 1 | | |
| Retina, Degeneration | 1 | | 1 | | | 1 | | | | 3 | 3 | | | | | | | | | 2 | | | | | |
| Harderian Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |

URINARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kidney | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Accumulation, Hyaline Droplet | 2 | | | | | | | | | | | | 2 | | | | | | | | | | | | |
| Calculus Gross Observation | | | | | | | | | | | | X | | | | | | | | | | | | | |
| Calculus Micro Observation Only | X | | X | | X | X | X | X | | | | X | | X | X | X | X | | X | X | | X | X | X | |
| Infarct | | | | | | | | | | | 1 | | | | | | | | | | | | | | |
| Nephropathy | | | 1 | | | 1 | | | | 1 | | | | | | | 1 | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS FEMALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | | | |
|------------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|-------|-------|-------|-------|
| | 0731 | 0739 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | | 0772 | 0772 | | |
| 25 ppm | 00526 | 00527 | 00528 | 00529 | 00530 | 00531 | 00532 | 00533 | 00534 | 00535 | 00536 | 00537 | 00538 | 00539 | 00540 | 00541 | 00542 | 00543 | 00544 | 00545 | 00546 | 00547 | 00548 | 00549 | 00550 |

ALIMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|
| Esophagus | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Intestine Large, Cecum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Intestine Large, Colon | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Intestine Large, Rectum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Intestine Small, Duodenum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Intestine Small, Ileum Peyer's Patch, Hyperplasia, Lymphoid | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Intestine Small, Jejunum | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Liver | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Angiectasis | | | | | | | | | | | | | 1 | | | | | | | | | | | | | 2 |
| Basophilic Focus | X | | X | | X | X | | | | X | X | X | X | X | | X | | X | X | | X | X | X | X | | 29 |
| Clear Cell Focus | | | | | X | X | | | | | | | | | | | | | | | | | | | | 5 |
| Eosinophilic Focus | X | | | | | | X | | | X | | | | | X | X | | | | | | | | X | | 7 |
| Fatty Change, Diffuse | | | 2 | | | | | | 2 | | | | | | | | | | | | | | | | | 2 |
| Hematopoietic Cell Proliferation | | | | | | | | | | 1 | | | | | | | | | | | | | | | | 3 |
| Infiltration Cellular, Mixed Cell | | | | | | | | | | | | | | 1 | | | | | | | | 1 | | | | 3 |
| Necrosis, Multifocal | | | | | 2 | | | | | | | | | | | | | | | | | | | | | 2 |
| Bile Duct, Hyperplasia | 2 | | 2 | 1 | | | 1 | | | | | | 2 | | | 1 | 1 | | | | | | 1 | 2 | 1 | 15 |
| Kupffer Cell, Hyperplasia | | | | | 2 | | | | | | | | | | | | | | | | | | | | | 1 |
| Mesentery | | | + | | | | | | | | | + | | | | | | | | | | | | + | | 4 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
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Experiment Number: 20725 - 03
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 Species/Strain: RATS/Wistar Han

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 Time Report Requested: 16:27:54
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 Lab: BNW

| WISTAR HAN RATS FEMALE 25 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS |
|----------------------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|----------|
| | 0731 | 0739 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | 0772 | |
| ANIMAL ID | 00526 | 00527 | 00528 | 00529 | 00530 | 00531 | 00532 | 00533 | 00534 | 00535 | 00536 | 00537 | 00538 | 00539 | 00540 | 00541 | 00542 | 00543 | 00544 | 00545 | 00546 | 00547 | 00548 | 00549 | |
| Fat, Necrosis | 1 | | | | | | | | 2 | | | | | | | | | | | | | 1 | | | 4 1.3 |
| Pancreas | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |
| Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | 3 1.3 |
| Basophilic Focus | | | | | | | | | | | | | 2 | | | | | | | | | | | | 1 2.0 |
| Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | 2 1.5 |
| Salivary Glands | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Inflammation | | | | | | | | | | | | | | | | | | | | | | | 2 | 1 2.0 | |
| Stomach, Forestomach | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Inflammation | | 3 | | | | | | | | | | | | 4 | | | | | | | | | | 3 3.3 | |
| Mineralization | | | 1 | | | | | | | | | | | | | | | | | | | | | 1 1.0 | |
| Ulcer | | 3 | | | | | | | | | | | | | 3 | | | | | | | | | 2 3.0 | |
| Epithelium, Hyperplasia | | 3 | | | | | | | | | | | 2 | | | | | | | | | | | 3 2.7 | |
| Stomach, Glandular | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Mineralization | | | 1 | | | | | | | | | | | | | | | | | | | | | 1 1.0 | |
| CARDIOVASCULAR SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | |
| Blood Vessel | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Inflammation | | | | | | | | | | | | | | | | | | | | | | | | 1 1.0 | |
| Media, Hypertrophy | | | | | | | | | | | | | | | | | | | | | 3 | | | 1 3.0 | |
| Heart | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Cardiomyopathy | | | 1 | 1 | | | 1 | | | 1 | 1 | 1 | 2 | | | 1 | 1 | | | 1 | 1 | 1 | 2 | 24 1.2 | |
| ENDOCRINE SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | |
| Adrenal Cortex | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
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Experiment Number: 20725 - 03
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P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS FEMALE 25 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | | | | | |
|---|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------------|-------|
| | 07 31 | 05 09 | 07 02 | 07 02 | 07 02 | 07 01 | 05 00 | 03 01 | 06 08 | 07 01 | 06 07 | 07 02 | 06 04 | 05 05 | 07 01 | 07 03 | 07 03 | 07 03 | 06 04 | 07 03 | | 07 03 | 07 02 | 07 03 | 07 02 | 07 03 | |
| ANIMAL ID | 00526 | 00527 | 00528 | 00529 | 00530 | 00531 | 00532 | 00533 | 00534 | 00535 | 00536 | 00537 | 00538 | 00539 | 00540 | 00541 | 00542 | 00543 | 00544 | 00545 | 00546 | 00547 | 00548 | 00549 | 00550 | | |
| Amyloid Deposition | | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | |
| Angiectasis | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | 1 3.0 |
| Degeneration, Cystic | | | | | | | | | | | | 2 | | | 1 | 1 | 2 | | 1 | | 2 | | | 1 | | 12 1.3 | |
| Hematopoietic Cell Proliferation | | | | | | | | | | | 3 | | | | | | | | | | | | | | | 3 3.0 | |
| Zona Fasciculata, Hyperplasia, Focal | | | | | 1 | | | | | | | | | | | | | 3 | | 3 | 1 | 2 | 1 | | | 7 1.7 | |
| Zona Fasciculata, Hypertrophy, Focal | 1 | | | | | | | | 2 | 1 | | 1 | 3 | | | 1 | | | 4 | 3 | 2 | | 1 | | 13 2.2 | | |
| Zona Fasciculata, Hypertrophy, Multifocal | | | | | | | | | | | | | | | | | | | | | | | | | | 2 2.0 | |
| Adrenal Medulla | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 49 | |
| Islets, Pancreatic Hyperplasia | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 1 1.0 | |
| Parathyroid Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 46 | |
| Pituitary Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Pars Distalis, Hyperplasia | 1 | | 1 | | 4 | 1 | | | 3 | 2 | | | | | 2 | | | 4 | | | | 1 | 3 | 1 | 24 2.1 | | |
| Pars Intermedia, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | |
| Thyroid Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| C-cell, Hyperplasia | 1 | | 3 | 3 | | | | | 1 | | 2 | | | | 1 | | 2 | 2 | | 2 | | 4 | 1 | 4 | 1 | 22 2.0 | |
| Follicular Cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | 1 3.0 | |
| Follicular Cell, Hypertrophy | | | | | | | | | | | | | | | | | | | | | | | | | | 2 2.5 | |

GENERAL BODY SYSTEM

NONE

GENITAL SYSTEM

Clitoral Gland + 50

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically M .. Missing tissue 1-4 .. Lesion qualified as:
 X .. Lesion present A .. Autolysis precludes evaluation 1) Minimal 3) Moderate
 I .. Insufficient tissue BLANK .. Not examined microscopically 2) Mild 4) Marked

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|------------------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----------|------|------|------|------|
| | 0731 | 0731 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | | 0732 | 0732 | | |
| 25 ppm | 0026 | 0027 | 0028 | 0029 | 0030 | 0031 | 0032 | 0033 | 0034 | 0035 | 0036 | 0037 | 0038 | 0039 | 0040 | 0041 | 0042 | 0043 | 0044 | 0045 | 0046 | 0047 | 0048 | 0049 | 0050 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|----|---|-----|
| Ectasia | | | | | | | | | | | | | | | | | | | | | | | | 3 | 2 | 2.5 |
| Ovary | | | | | | | | | | | | | | | | | | | | | | | | 50 | | |
| Atrophy | | | | | | | | | | | | | | | | | | | | | | | | 25 | 2 | 2.2 |
| Cyst | | | | | | | | | | | | | | | | | | | | | | | | 20 | | |
| Uterus | | | | | | | | | | | | | | | | | | | | | | | | 50 | | |
| Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3 | 3.0 |
| Cervix, Hyperplasia, Squamous | | | | | | | | | | | | | | | | | | | | | | | | 8 | 1 | 1.8 |
| Cervix, Hypertrophy, Stromal | | | | | | | | | | | | | | | | | | | | | | | | 2 | 2 | 2.0 |
| Endometrium, Decidual Reaction, Focal | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | 1.0 |
| Endometrium, Hyperplasia, Cystic | | | | | | | | | | | | | | | | | | | | | | | | 17 | 1 | 1.5 |
| Endometrium, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | | | | 3 | 2 | 2.7 |
| Endometrium, Metaplasia, Squamous | | | | | | | | | | | | | | | | | | | | | | | | 7 | 1 | 1.3 |
| Vagina | | | | | | | | | | | | | | | | | | | | | | | | 2 | | |

HEMATOPOIETIC SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|----|---|-----|
| Bone Marrow | | | | | | | | | | | | | | | | | | | | | | | | 50 | | |
| Myeloid Cell, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | 20 | 3 | 3.0 |
| Lymph Node | | | | | | | | | | | | | | | | | | | | | | | | 2 | | |
| Iliac, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2 | 2.0 |
| Lumbar, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3 | 3.0 |
| Lymph Node, Bronchial | | | | | | | | | | | | | | | | | | | | | | | | 43 | | |
| Lymph Node, Mandibular | | | | | | | | | | | | | | | | | | | | | | | | 45 | | |
| Ectasia | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2 | 2.0 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
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 I .. Insufficient tissue
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|--|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| | 0 7 3 1 | 0 5 0 9 | 0 7 3 2 | 0 7 3 2 | 0 7 3 2 | 0 7 3 1 | 0 5 2 0 | 0 3 6 1 | 0 6 9 8 | 0 7 3 1 | 0 6 1 7 | 0 7 3 2 | 0 6 8 4 | 0 5 1 5 | 0 7 3 1 | 0 7 3 3 | 0 7 3 3 | 0 6 4 7 | 0 7 3 3 | 0 7 3 3 | | 0 7 2 3 | 0 7 2 7 | | | | |
| ANIMAL ID | 0 5 2 6 | 0 5 2 7 | 0 5 2 8 | 0 5 2 9 | 0 5 3 0 | 0 5 3 1 | 0 5 3 2 | 0 5 3 3 | 0 5 3 3 | 0 5 3 3 | 0 5 3 3 | 0 5 3 3 | 0 5 3 3 | 0 5 4 0 | 0 5 4 1 | 0 5 4 2 | 0 5 4 3 | 0 5 4 4 | 0 5 4 4 | 0 5 4 4 | 0 5 4 4 | 0 5 4 5 | 0 5 4 6 | 0 5 4 7 | 0 5 4 8 | 0 5 4 9 | 0 5 4 0 |
| Lymph Node, Mediastinal | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | M | + | + | + | 48 | |
| Lymph Node, Mesenteric Atrophy | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Hyperplasia, Lymphoid Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | | | 2 3.0 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | 1 3.0 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | |
| Spleen | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Hematopoietic Cell Proliferation | 2 | | 2 | 2 | | 1 | 3 | | 3 | 2 | | 2 | | | 2 | 3 | | 2 | 2 | | 3 | 1 | 2 | 2 | 38 2.2 | | |
| Pigmentation, Hemosiderin | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 38 1.3 | | |
| Lymphoid Follicle, Atrophy | | | | | | | | 2 | | | 2 | | | 3 | | | | | | | | | | | 5 2.0 | | |
| Thymus | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 49 | | |
| Atrophy | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 3 | 4 | 1 | 3 | 2 | 2 | 2 | | 1 | 2 | 1 | 1 | | 3 | 2 | 1 | 2 | 45 2.1 | | |
| Cyst | | | | | | | | | | | | | | | | | | | | | | | X | | 1 | | |
| INTEGUMENTARY SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mammary Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Galactocele | | | | | | | | | | | | | | | | | | | | | | | | | 2 2.0 | | |
| Hyperplasia | | | | | | | | | | | | | | | | | | 2 | | | | | | | 2 2.0 | | |
| Duct, Dilatation | | | | | | | | | | | | | | | | | | | | | | | | | 1 3.0 | | |
| Skin | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| MUSCULOSKELETAL SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bone | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Osteosclerosis | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | | |
| Tarsal, Tendon, Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | 1 3.0 | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS FEMALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | |
|------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|----------|------------------|------------------|
| | 0 7 3 1 | 0 5 0 9 | 0 7 3 2 | 0 7 3 2 | 0 7 3 2 | 0 7 3 1 | 0 5 2 0 | 0 3 6 1 | 0 6 9 8 | 0 7 3 1 | 0 6 1 7 | 0 7 3 2 | 0 6 8 4 | 0 5 1 5 | 0 7 3 1 | 0 7 3 3 | 0 7 3 3 | 0 6 4 7 | 0 7 3 3 | 0 7 3 3 | | 0 7 2 3 | 0 7 2 3 |
| 25 ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| ANIMAL ID | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | |
| 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | |

Skeletal Muscle + 5

NERVOUS SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---|-----|
| Brain | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Choroid Plexus, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | 3 | 1 | 3.0 |
| Peripheral Nerve | | | | | | | | | | | | | | | | | | | | | | | | + | 5 |
| Spinal Cord | | | | | | | | | | | | | | | | | | | | | | | | + | 5 |

RESPIRATORY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---|----|-----|----|-----|
| Larynx | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | | | |
| Foreign Body | | | | | | | | | | | | | | | | | | | | | | | X | 1 | | | | |
| Inflammation, Chronic Active | | | | 1 | | | | | | | | | | | | | | | | | | | 1 | 1 | 4 | 1.0 | | |
| Squamous Epithelium, Hyperplasia | | | | 1 | 1 | | | | | 1 | | | | | | | | | | | | | | | 6 | 1.0 | | |
| Lung | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | | | |
| Inflammation, Granulomatous | | | | | | | | | | | | | | | | | | | | | | | 1 | | 3 | 1.0 | | |
| Alveolar Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | 1.0 | | |
| Alveolus, Infiltration Cellular, Histiocyte | | | | 1 | | | | | | | | | | | | | | | | | | | 1 | 1 | 10 | 1.0 | | |
| Bronchiole, Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | 8 | 1.0 | | |
| Bronchus, Epithelium, Regeneration | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1.0 | | |
| Interstitialium, Fibrosis | | | | | | | | | | | | | | | | | | | | | | | 2 | | 1 | 2.0 | | |
| Nose | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | | | |
| Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | 1 | 2 | 3 | 1 | 11 | 1.5 |
| Lamina Propria, Fibrosis | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | 17 | 1.0 | | |
| Olfactory Epithelium, Accumulation, Hyaline Droplet | | | | | | | | | | | | | | | | | | | | | | | 1 | | 3 | 1.3 | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS FEMALE 25 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | |
|---|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|------|-----|
| | 0731 | 0731 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | 0732 | | 0732 | |
| ANIMAL ID | 00526 | 00527 | 00528 | 00529 | 00530 | 00531 | 00532 | 00533 | 00534 | 00535 | 00536 | 00537 | 00538 | 00539 | 00540 | 00541 | 00542 | 00543 | 00544 | 00545 | 00546 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 1.4 |
| Olfactory Epithelium, Atrophy | | | 1 | 1 | | 1 | | | | 1 | | 2 | | | | 1 | 2 | 2 | | 2 | 1 | 18 | 1.3 |
| Olfactory Epithelium, Metaplasia, Respiratory | 2 | | | | | | | 2 | 1 | 1 | | | | | | | | | 2 | | 1 | 2 | 1.0 |
| Respiratory Epithelium, Hyperplasia | | | | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 1 | 2.0 |
| Respiratory Epithelium, Metaplasia, Squamous | | | | | | | | | | | | | | | | | | | | 2 | | | |
| Trachea | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |

SPECIAL SENSES SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|-----|
| Eye | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | 1 | 4.0 |
| Retinal Detachment | | | | | | | | | | | | | | | | | | | | | | 1 | 3.0 |
| Anterior Chamber, Inflammation, Suppurative | | | | | 4 | | | | | | | | 3 | 2 | | | | | | | 3 | 6 | 2.5 |
| Cornea, Inflammation, Chronic Active | 2 | 1 | 2 | 2 | 1 | | | | | 1 | 2 | 1 | 2 | 3 | 4 | | | 4 | | | 1 | 23 | 1.9 |
| Cornea, Necrosis | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 |
| Cornea, Epithelium, Hyperplasia | | | | 1 | | 1 | | | | | | 1 | | 2 | | 1 | | 3 | | | | 8 | 1.4 |
| Cornea, Epithelium, Ulcer | | | | | | | | | | | | | | | | | | 2 | | | | 2 | 2.5 |
| Iris, Inflammation, Acute | | | 2 | | 3 | | | | | | | | 1 | | | | | 2 | | | | 5 | 1.8 |
| Lens, Cataract | | | 2 | | | | | | | | | | | 1 | 2 | | 1 | | | | | 6 | 1.5 |
| Retina, Degeneration | 2 | | 2 | | | | | | 1 | | | | | 3 | | 1 | | | | | | 11 | 1.8 |
| Harderian Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |

URINARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|-----|
| Kidney | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Accumulation, Hyaline Droplet | | | | | | | | | | | | | | | | | | | | | | 2 | 2.0 |
| Calculus Gross Observation | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Calculus Micro Observation Only | X | X | X | X | | X | X | | X | X | X | X | | X | X | X | | X | X | X | X | 35 | |
| Infarct | | | | | | | | | | | | | | | | | | | | | 1 | 2 | 1.0 |
| Nephropathy | | | | | | | | | | | 1 | 1 | | | | | | 3 | 1 | 1 | 1 | 10 | 1.2 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

Experiment Number: 20725 - 03
 Test Type: CHRONIC
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 Species/Strain: RATS/Wistar Han

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS FEMALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | ANIMAL ID | females (cont...) |
|---|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|---|-----------------------|----------------------|----------------------|
| | 0 7 3 1 | 0 7 3 2 | 0 7 3 1 | 0 5 4 4 | 0 7 3 1 | 0 7 3 7 | 0 5 7 1 | 0 7 2 5 | 0 6 3 3 | 0 7 3 9 | 0 6 2 5 | 0 4 3 1 | 0 7 3 1 | 0 7 3 1 | 0 7 3 3 | 0 7 3 2 | 0 7 3 2 | 0 7 3 4 | 0 7 3 2 | 0 4 3 5 | 0 7 3 2 | 0 7 3 2 | 0 7 3 2 | | | | |
| Pancreas | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 0 0 7 0 1 | females (cont...) | |
| Atrophy | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| Basophilic Focus | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Salivary Glands | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | | |
| Stomach, Forestomach | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | | |
| Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ulcer | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | |
| Stomach, Glandular | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | | |
| Epithelium, Necrosis | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | |
| CARDIOVASCULAR SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Blood Vessel | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Inflammation | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| Heart | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | | |
| Cardiomyopathy | 2 | 1 | | | 1 | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | | | 1 | | | | 1 | | | |
| ENDOCRINE SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Adrenal Cortex | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | | |
| Degeneration, Cystic | | | | | | | | | | 1 | 1 | | 1 | | | | | | | | 1 | 3 | | | | | |
| Hematopoietic Cell Proliferation | | | | | | | | | | | | | 3 | | | | | | | | | | | | | | |
| Zona Fasciculata, Hyperplasia, Focal | | | 1 | | 1 | | | | 1 | | | | | | | | | | 1 | | | | | | | | |
| Zona Fasciculata, Hyperplasia, Multifocal | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Zona Fasciculata, Hypertrophy, Focal | | | | | | 1 | | | 1 | | 1 | | 3 | 2 | | | | | | | 1 | | | 2 | 1 | 1 | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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 Lab: BNW

| WISTAR HAN RATS FEMALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | ANIMAL ID | females (cont...) | | |
|----------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-----------|----------------------|-----------------------|----------------------|
| | 0 7 3 1 | 0 7 3 2 | 0 7 3 1 | 0 5 4 4 | 0 7 3 1 | 0 7 3 1 | 0 5 7 1 | 0 7 2 5 | 0 6 3 3 | 0 7 3 9 | 0 6 2 5 | 0 4 3 1 | 0 7 3 1 | 0 7 3 1 | 0 7 3 3 | 0 7 3 2 | 0 7 3 2 | 0 4 3 5 | 0 7 3 2 | 0 7 3 2 | | | 0 7 3 2 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 0 7 0 1 | females (cont...) |

Zona Fasciculata, Hypertrophy, Multifocal

3

2

Adrenal Medulla
Hyperplasia

+ +

Islets, Pancreatic

+ +

Parathyroid Gland

+ + + + + + + + + + + + + + + M + + M + M + + +

Pituitary Gland
Pars Distalis, Angiectasis, Focal
Pars Distalis, Hyperplasia

+
 1 4
 2
 1 1 3 3 3 4 1 3

Thyroid Gland
C-cell, Hyperplasia
Follicular Cell, Hyperplasia

+
 1 3 2 1 2 3 3

GENERAL BODY SYSTEM

NONE

GENITAL SYSTEM

Clitoral Gland

+ + + + + + + + + + + + + + + + + M + + + + +

Ovary
Atrophy
Cyst
Germinal Epithelium, Hyperplasia

+
 2 2 2 1 2 2 3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3
 X
 2

Uterus

+ +

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

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| WISTAR HAN RATS FEMALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | ANIMAL ID | females (cont...) |
|----------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-----------------------|-----------|----------------------|
| | 0 7 3 1 | 0 7 3 2 | 0 7 3 1 | 0 5 4 4 | 0 7 3 1 | 0 7 3 1 | 0 5 7 5 | 0 7 2 3 | 0 6 3 3 | 0 7 6 9 | 0 6 3 5 | 0 4 9 1 | 0 7 3 1 | 0 7 3 1 | 0 7 3 3 | 0 7 3 2 | 0 7 3 2 | 0 7 3 4 | 0 7 3 2 | 0 4 3 5 | 0 7 3 2 | 0 7 3 2 | 0 7 3 2 | | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 0 7 0 1 | | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|--|---|--|---|--|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|---|---|---|--|---|---|---|---|---|---|--|---|---|---|---|---|--|--|--|--|--|--|--|--|--|--|--|--|---|--|--|--|--|---|---|--|--|--|--|--|---|---|--|--|--|--|--|--|--|--|--|--|--|
| Angiectasis, Focal | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fibrosis, Focal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cervix, Hyperplasia, Squamous | 2 | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2 | 2 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 2 | | | | | | | | | | | | | | | | | | |
| Cervix, Hypertrophy, Stromal | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Endometrial Glands, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Endometrium, Hyperplasia, Cystic | 2 | | 3 | | 2 | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3 | | 1 | 3 | 1 | 2 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 1 | | | | | | | | | | | |
| Endometrium, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Endometrium, Metaplasia, Squamous | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | |

HEMATOPOIETIC SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|---|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Bone Marrow | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Myeloid Cell, Hyperplasia | 3 | 4 | 3 | 2 | | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 4 | 3 | 4 | 3 | | 2 | | 3 | | | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lymph Node | | | | | | | | | | | | | | | | | | | | | | | | | + | + | | | | | | | | | | | | | | | | | | | | | | | | | |
| Axillary, Hyperplasia, Lymphoid | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Deep Cervical, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lumbar, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Renal, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lymph Node, Bronchial | + | M | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lymph Node, Mandibular | + | + | + | + | + | + | M | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ectasia | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lymph Node, Mediastinal | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hyperplasia, Lymphoid | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS FEMALE | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | ANIMAL ID | females (cont...) |
|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|--|-----------|----------------------|
| | 0 7 3 1 | 0 7 3 2 | 0 7 3 1 | 0 5 4 4 | 0 7 3 1 | 0 7 3 3 | 0 5 7 1 | 0 7 2 5 | 0 6 3 3 | 0 7 3 3 | 0 6 2 9 | 0 4 3 5 | 0 7 3 1 | 0 7 3 1 | 0 7 3 3 | 0 7 3 2 | 0 7 3 2 | 0 4 3 5 | 0 7 3 2 | 0 7 3 3 | 0 7 3 2 | 0 7 3 3 | 0 7 3 2 | | | | |
| 50 ppm | 0 0 7 0 1 | 0 0 7 0 2 | 0 0 7 0 3 | 0 0 7 0 4 | 0 0 7 0 5 | 0 0 7 0 6 | 0 0 7 0 7 | 0 0 7 0 8 | 0 0 7 0 9 | 0 0 7 1 0 | 0 0 7 1 1 | 0 0 7 1 1 | 0 0 7 1 1 | 0 0 7 1 1 | 0 0 7 1 1 | 0 0 7 1 1 | 0 0 7 1 1 | 0 0 7 1 2 | 0 0 7 1 2 | 0 0 7 2 2 | 0 0 7 2 3 | 0 0 7 2 2 | 0 0 7 2 3 | 0 0 7 2 4 | | | |

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lymph Node, Mesenteric Atrophy | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Spleen | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Hematopoietic Cell Proliferation | 1 | 1 | 2 | 2 | 1 | 2 | | 2 | 3 | 2 | 1 | 2 | 4 | 2 | 3 | | 1 | 2 | 2 | 3 | 2 | 2 | | 2 | 2 |
| Pigmentation, Hemosiderin | 1 | 2 | 1 | 2 | 2 | | 2 | 1 | 1 | 1 | 1 | | | 1 | | 2 | 1 | | 1 | | 2 | | 2 | | 1 |
| Lymphoid Follicle, Atrophy | | | | | | 1 | | | | 3 | | | | | 3 | | | | | | | | 1 | | |
| Thymus | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Atrophy | 2 | 1 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 3 | 3 | 2 | 2 | 2 | 3 | 1 | | 2 | 2 | 2 |

INTEGUMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mammary Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Galactocele | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | |
| Inflammation | | | | | | | | | | | | | | | | | | | | | | | | | |
| Skin | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Dorsal, Inflammation, Acute | | | | | | | | | | | | | | | | | | | | | | | | | |
| Epidermis, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | |
| Epidermis, Ulcer, Multifocal | | | | | | | | | | | | | | | | | | | | | | | | | |
| Foot, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | |
| Foot, Ulcer, Focal | | | | | | | | | | | | | | | | | | | | | | | | | |
| Inguinal, Inflammation, Pyogranulomatous | | | | | | | | | | | | | | | | | | | | | | | | | |
| Inguinal, Inflammation, Acute | | | | | | | | | | | | | | | | | | | | | | | | | |

MUSCULOSKELETAL SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bone | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
|------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
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Experiment Number: 20725 - 03
 Test Type: CHRONIC
 Route: RESPIRATORY EXPOSURE WHOLE BODY
 Species/Strain: RATS/Wistar Han

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS FEMALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | ANIMAL ID | females (cont...) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-----------|----------------------|------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|--|
| | 0 7 3 1 | 0 7 3 2 | 0 7 3 1 | 0 5 4 4 | 0 7 3 1 | 0 7 3 1 | 0 5 7 2 | 0 7 5 3 | 0 6 3 3 | 0 7 6 2 | 0 6 3 9 | 0 4 3 1 | 0 7 3 1 | 0 7 1 1 | 0 7 3 3 | 0 7 3 2 | 0 7 3 4 | 0 7 2 2 | 0 4 3 5 | 0 7 3 2 | | | 0 7 3 2 | 0 7 3 3 | 0 7 3 2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 0 7 0 1 | 0 0 7 0 1 | 0 0 7 0 2 | 0 0 7 0 3 | 0 0 7 0 4 | 0 0 7 0 5 | 0 0 7 0 6 | 0 0 7 0 7 | 0 0 7 0 8 | 0 0 7 0 9 | 0 0 7 0 0 | 0 0 7 0 1 | 0 0 7 0 2 | 0 0 7 0 3 | 0 0 7 0 4 | 0 0 7 0 5 | 0 0 7 0 6 | 0 0 7 0 7 | 0 0 7 0 8 | 0 0 7 0 9 | 0 0 7 0 0 | 0 0 7 0 1 | 0 0 7 0 2 | 0 0 7 0 3 | 0 0 7 0 4 | 0 0 7 0 5 | |

Osteosclerosis

1

Skeletal Muscle

+

+

NERVOUS SYSTEM

Brain

+ +

Peripheral Nerve

+

+

Spinal Cord

+

+

RESPIRATORY SYSTEM

Larynx

+ +

Inflammation, Chronic Active

1 1 1 1 2 2 1 1 1 1 3 3 1 3 3 1 3 3 1 3 3 1 3 4

Respiratory Epithelium, Hyperplasia

2 2 1 1

Respiratory Epithelium, Metaplasia, Squamous

3 4 3 2 1 1 3 1 1 3 1 3 4

Respiratory Epithelium, Regeneration

1

Squamous Epithelium, Hyperplasia

2 1 1 3 3 3 2 2 2 2 3 4 2 3 2 2 2 3 3 1 3 3 2 3

Squamous Epithelium, Ulcer, Focal

1 1 1 2

Squamous Epithelium, Ulcer, Multifocal

Lung

+ +

Inflammation, Suppurative

2

Inflammation, Granulomatous

1 1

Thrombus

1 1

Alveolar Epithelium, Hyperplasia

2 1 1

Alveolar Epithelium, Hyperplasia, Focal

2

Alveolus, Infiltration Cellular, Histiocyte

1 2 1 1 1 1 2 1 1 1 1 1 1 1 2 1 1 2 1 1 2 1 3

Bronchiole, Epithelium, Hyperplasia

2 1 2 1 1 1 1 2 1 2 1 1 2 1 1 1 2 1 1 1 1 1 1

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade

+ .. Tissue examined microscopically

M .. Missing tissue

1-4 .. Lesion qualified as:

X .. Lesion present

A .. Autolysis precludes evaluation

1) Minimal 3) Moderate

I .. Insufficient tissue

BLANK .. Not examined microscopically

2) Mild 4) Marked

Experiment Number: 20725 - 03
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 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

| Wistar Han Rats Female 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | ANIMAL ID | females (cont...) | | | |
|---|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-----------|----------------------|------------------|---|---|
| | 0 7 3 1 | 0 7 3 2 | 0 7 3 1 | 0 5 4 4 | 0 7 3 1 | 0 7 3 1 | 0 5 7 1 | 0 7 2 5 | 0 6 3 3 | 0 7 3 3 | 0 6 2 9 | 0 6 3 5 | 0 4 9 1 | 0 7 3 1 | 0 7 3 1 | 0 7 3 3 | 0 7 3 2 | 0 7 3 2 | 0 4 3 5 | 0 7 3 2 | | | 0 7 3 2 | | |
| Bronchus, Epithelium, Atrophy | | | | | | | | 1 | | | | | | | | | | | | | 1 | | | | |
| Bronchus, Epithelium, Hyperplasia | 1 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | |
| Bronchus, Epithelium, Metaplasia, Squamous | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bronchus, Epithelium, Necrosis | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bronchus, Epithelium, Regeneration | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bronchus, Submucosa, Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bronchus, Submucosa, Necrosis | | | | | | | | | | | | | | | | | | | | | | | | | |
| Interstitial, Fibrosis | | 1 | 1 | | | | | | | | 1 | | | | 1 | | | | 2 | | 1 | | | | |
| Peribronchial, Inflammation, Chronic Active | | | 3 | | 2 | 1 | | | | | 2 | 2 | 2 | | 2 | 2 | | | 1 | 2 | 2 | 1 | | 1 | |
| Pleura, Fibrosis | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Nose | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Foreign Body | | | | | | | | | | | | | | | | | | | | | | | | X | |
| Inflammation, Suppurative | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 |
| Lamina Propria, Fibrosis | 2 | 1 | | 1 | 1 | | 2 | 1 | 3 | 1 | 2 | | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | | |
| Olfactory Epithelium, Accumulation, Hyaline Droplet | | | | | | | | | | | | | | | | | | | | | | | | | |
| Olfactory Epithelium, Atrophy | | | 2 | 2 | | | 1 | 3 | 1 | | | | | | 2 | 1 | 1 | | 1 | 2 | | | | 2 | |
| Olfactory Epithelium, Metaplasia, Respiratory | 3 | 2 | 3 | 4 | 2 | 3 | 3 | 1 | 2 | 2 | | | 3 | 4 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 4 |
| Olfactory Epithelium, Necrosis | | | | | | | | | | | 4 | | | | | | | | | | | | | | |
| Respiratory Epithelium, Hyperplasia | 4 | 4 | 4 | 2 | 4 | 3 | | 3 | 4 | 4 | | | | 2 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | | 1 | 3 | 4 |
| Respiratory Epithelium, Metaplasia, Squamous | 1 | 3 | | 1 | 3 | 1 | 2 | 2 | 1 | 2 | 1 | | 1 | 1 | 1 | | 1 | 1 | 1 | 4 | 1 | 3 | 1 | 2 | 1 |
| Respiratory Epithelium, Necrosis | | | | | | | | | | | 4 | | | | | | | | | | | | | | |
| Turbinate, Hyperostosis | | | 1 | | | | 1 | | 1 | | | | | 1 | | | | | | 1 | | | | | |
| Trachea | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | |
| Inflammation, Suppurative | | | | | | | | | | | | 2 | | | | | | | | | | | | | |
| Inflammation, Chronic Active | 2 | | 2 | | | 1 | 1 | 2 | 2 | | | | | 2 | | | 1 | 1 | 3 | 2 | 2 | | | | |
| Epithelium, Atrophy | | | | | | | | | | | | | | | | | | | | | | | | | |
| Epithelium, Hyperplasia | 1 | | 2 | | | | 1 | 1 | 2 | | | | | | | 1 | | 2 | 1 | 2 | 1 | 1 | 1 | 2 | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
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 Lab: BNW

| WISTAR HAN RATS FEMALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | ANIMAL ID | females (cont...) | | | | | |
|----------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-----------|----------------------|------------------|---|--|--|---|
| | 0 7 3 1 | 0 7 3 2 | 0 7 3 1 | 0 5 4 4 | 0 7 3 1 | 0 7 3 1 | 0 5 7 2 | 0 7 6 3 | 0 6 7 3 | 0 6 6 2 | 0 4 9 3 | 0 7 7 1 | 0 7 7 1 | 0 7 3 3 | 0 7 3 2 | 0 7 3 2 | 0 7 2 4 | 0 4 3 5 | 0 7 3 2 | 0 7 3 2 | | | 0 7 3 2 | | | | |
| Epithelium, Metaplasia, Squamous | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | |
| Epithelium, Necrosis | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Epithelium, Regeneration | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Epithelium, Ulcer | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Submucosa, Fibrosis | 1 | | | | | | | | | | | 1 | 2 | 1 | 2 | 1 | | | | | | 3 | 2 | 2 | | | 2 |
| Submucosa, Necrosis | | | | | | | | | | | | | | | | | | | | | | | | | | | |

SPECIAL SENSES SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|--|---|
| Eye | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | | | | |
| Anterior Chamber, Inflammation, Suppurative | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cornea, Inflammation, Chronic Active | 3 | 3 | 1 | 1 | 3 | 1 | 2 | 3 | | | | | | 1 | 2 | 1 | 3 | 2 | 3 | | | | 3 | 2 | | | | |
| Cornea, Mineralization | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cornea, Endothelium, Rupture | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cornea, Epithelium, Hyperplasia | | | | | | | | | | | 2 | | | | | | | | | | | 2 | | | 1 | | | |
| Cornea, Epithelium, Ulcer | | | | | 1 | 2 | | | | 2 | 1 | | | | | 2 | 1 | 2 | 3 | | | | | 2 | | | | |
| Iris, Inflammation, Acute | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lens, Cataract | | | | | | | | | | | 2 | | | | | | | | | | | 1 | | | 3 | | | 1 |
| Retina, Degeneration | | | 2 | | | | | | 1 | 1 | | | | | 1 | 3 | 1 | 3 | 3 | 3 | 1 | 1 | | | | | | |
| Unilateral, Phthisis Bulbi | 4 | | | | | 3 | 3 | | | | | | | | | | | | | | | | 3 | | | | | |
| Harderian Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | | | | | |

URINARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kidney | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| Calculus Micro Observation Only | | | | X | X | | | | | | X | X | X | | | X | X | X | X | | | | | X |
| Nephropathy | | | | | | 1 | | | | | | | | | | | 1 | 1 | | | | | | |
| Pelvis, Dilatation | | | | | | | | | | | 2 | | | | | | | | | | | | | |
| Pelvis, Inflammation | | | | | | | | | | | 1 | | | | | | | | | | | 1 | | |

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 + .. Tissue examined microscopically
 X .. Lesion present
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 CAS Number: 431-03-8

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 Lab: BNW

| WISTAR HAN RATS FEMALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS |
|----------------------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|
| | 0697 | 0633 | 0731 | 0772 | 0773 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | 0777 | |
| ANIMAL ID | 00726 | 00727 | 00728 | 00729 | 00730 | 00731 | 00732 | 00733 | 00734 | 00735 | 00736 | 00737 | 00738 | 00739 | 00740 | 00741 | 00742 | 00743 | 00744 | 00745 | 00746 | 00747 | 00748 | 00749 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | |
| | 9 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | 7 | 3 | 1 | 2 | 2 | 3 | 2 | 3 | 3 | 1 | 1 | 7 | 2 | 9 | 3 | 3 | 1 | 5 | 5 | 2 | 7 | 3 | 2 | 2 | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|--|--|---|--|---|---|--|--|---|---|--|---|--|---|--|---|---|---|--|--|---|---|----|-----|------|
| Angiectasis, Focal | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 4.0 |
| Fibrosis, Focal | 1 | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 |
| Cervix, Hyperplasia, Squamous | | | | | | | | | | | | | | | | | | 2 | | | | | | | 2 | 10.0 |
| Cervix, Hypertrophy, Stromal | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 |
| Endometrial Glands, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3.0 |
| Endometrium, Hyperplasia, Cystic | 1 | | | 3 | | 2 | 2 | | | 1 | 2 | | 1 | | 1 | | 3 | | 2 | | | 1 | 2 | 25 | 1.8 | |
| Endometrium, Hyperplasia, Focal | | | | | | | | | | | | | | | | | | 2 | | | | | | | 1 | 2.0 |
| Endometrium, Metaplasia, Squamous | | | | | | | | | | 1 | | | | | | | | | | | | | 1 | 6 | 1.2 | |

HEMATOPOIETIC SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|-----|--|
| Bone Marrow | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Myeloid Cell, Hyperplasia | | 3 | 2 | | 2 | 3 | 3 | 2 | 2 | 3 | | 3 | | 3 | 3 | | | 2 | 3 | 3 | 3 | 3 | 2 | 4 | 36 | 2.9 | |
| Lymph Node | | | | | | | | | | | | | | | | | | | | | | | | | 5 | | |
| Axillary, Hyperplasia, Lymphoid | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 | |
| Deep Cervical, Infiltration Cellular, Plasma Cell | | | | | | | | | 2 | | | | | | | | | | | | | | | | 2 | 2.5 | |
| Lumbar, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | 2 | | 1 | 2.0 | |
| Renal, Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3.0 | |
| Lymph Node, Bronchial | M | + | + | M | + | + | M | + | + | + | + | + | + | + | M | + | M | M | + | + | + | M | + | + | 42 | | |
| Lymph Node, Mandibular | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | M | + | + | + | + | 48 | | |
| Ectasia | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 | |
| Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | 2 | | | | | | | | | | | | 2 | 2.0 | |
| Lymph Node, Mediastinal | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
| Atrophy | | | | | | | | | | | | | | | | | | 4 | | | | | | | 1 | 4.0 | |
| Hyperplasia, Lymphoid | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 | |
| Infiltration Cellular, Plasma Cell | | | | | | | | | | | | | | | 2 | | | | | | | | | | 1 | 2.0 | |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS FEMALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | | | |
|----------------------------------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|--------|--------|--------|--------|
| | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | | 06797 | | | |
| ANIMAL ID | 007266 | 007267 | 007268 | 007269 | 007270 | 007271 | 007272 | 007273 | 007274 | 007275 | 007276 | 007277 | 007278 | 007279 | 007280 | 007281 | 007282 | 007283 | 007284 | 007285 | 007286 | 007287 | 007288 | 007289 | 007290 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|-----|-----|-----|
| Lymph Node, Mesenteric Atrophy | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 5 | 3.2 |
| Spleen Hematopoietic Cell Proliferation | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 39 | 2.0 |
| Pigmentation, Hemosiderin | 2 | | 1 | 2 | | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | | 39 | 1.5 | | |
| Lymphoid Follicle, Atrophy | | | | | | | | | 2 | | | | | | | | 4 | 4 | | | | | | | 7 | 2.6 | | |
| Thymus Atrophy | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 49 | 2.2 | |

INTEGUMENTARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|-----|-----|
| Mammary Gland Galactocele | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 1 | 1.0 |
| Hyperplasia | | | | 2 | | | | | | | | | | | | | | | | | | | | | 1 | 2.0 | |
| Inflammation | | | | | | | | | | | | | | | | | | | | | | 3 | | | 1 | 3.0 | |
| Skin Dorsal, Inflammation, Acute | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | 1 | 2.0 |
| Epidermis, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | 2 | 1 | 2.0 | |
| Epidermis, Ulcer, Multifocal | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | 1.0 | |
| Foot, Inflammation, Chronic Active | | | | 3 | | | | | | | | | | | | | | | | | | 2 | | 3 | 4 | 2.8 | |
| Foot, Ulcer, Focal | | | | 3 | | | | | | | | | | | | | | | | | | 2 | | 4 | 4 | 3.0 | |
| Inguinal, Inflammation, Pyogranulomatous | | | | | 4 | | | | | | | | | | 3 | | | | | | | | | | 2 | 3.5 | |
| Inguinal, Inflammation, Acute | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3.0 | |

MUSCULOSKELETAL SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|--|--|
| Bone | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | |
|------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|--|--|

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically
 1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked

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

P09: NON-NEOPLASTIC LESIONS BY INDIVIDUAL ANIMAL
 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

| WISTAR HAN RATS FEMALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | | | | | |
|---|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|-------|---|---|---|--------|--------|
| | 0697 | 0633 | 0771 | 0772 | 0773 | 0774 | 0775 | 0776 | 0777 | 0778 | 0779 | 0770 | 0771 | 0772 | 0773 | 0774 | 0775 | 0776 | 0777 | 0778 | | 0779 | | | | | |
| ANIMAL ID | 00726 | 00707 | 00700 | 00700 | 00700 | 00700 | 00700 | 00700 | 00700 | 00700 | 00700 | 00700 | 00700 | 00700 | 00700 | 00700 | 00700 | 00700 | 00700 | 00700 | 00700 | | | | | | |
| Bronchus, Epithelium, Atrophy | | | | | 1 | 1 | 1 | | | | 1 | | | | | | | | 1 | | | 7 1.0 | | | | | |
| Bronchus, Epithelium, Hyperplasia | | | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | | 3 | 2 | 1 | 2 | 2 | 1 | 1 | 46 1.4 | |
| Bronchus, Epithelium, Metaplasia, Squamous | | | | | | | 1 | | | | | | | | | | | | | | | | | | | 1 1.0 | |
| Bronchus, Epithelium, Necrosis | | | | | | | | | | | | | | | | | | 3 | | | | | | | | 1 3.0 | |
| Bronchus, Epithelium, Regeneration | | 1 | | | | | 1 | | | | | | | | | | | | | | | | | | | 2 1.0 | |
| Bronchus, Submucosa, Inflammation, Suppurative | | | | | | | | | | | | | | | | | | 3 | | | | | | | | 1 3.0 | |
| Bronchus, Submucosa, Necrosis | | | | | | | | | | | | | | | | | | 2 | | | | | | | | 1 2.0 | |
| Interstitial, Fibrosis | | | | | | | | | | | 1 | | | | 2 | | | | | 1 | | | | | | 9 1.2 | |
| Peribronchial, Inflammation, Chronic Active | | | | | | | 1 | 1 | | 1 | 1 | | 2 | 1 | 1 | 1 | 1 | | | 2 | 1 | | 2 | 1 | 1 | 27 1.5 | |
| Pleura, Fibrosis | | | | | | | | | | | | | | | | | | | | | | | | | | 1 1.0 | |
| Nose | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Foreign Body | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| Inflammation, Suppurative | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 49 3.9 | |
| Lamina Propria, Fibrosis | 1 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 46 1.4 | |
| Olfactory Epithelium, Accumulation, Hyaline Droplet | | | | | | | 1 | | | | | | | | | | | | | | | | | | | 1 1.0 | |
| Olfactory Epithelium, Atrophy | | | 2 | | 2 | | | | 3 | 2 | 3 | | 2 | | | | | 1 | | 2 | 2 | 1 | | 2 | 2 | 4 | 24 1.9 |
| Olfactory Epithelium, Metaplasia, Respiratory | 1 | 2 | 4 | 3 | 3 | 3 | 4 | 2 | | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 4 | 2 | 1 | 4 | 4 | 3 | 3 | 3 | 2 | 46 2.8 | |
| Olfactory Epithelium, Necrosis | | | | | | | | | | | | | | | | 1 | | | 4 | 2 | | | | | | 4 2.8 | |
| Respiratory Epithelium, Hyperplasia | 3 | 4 | 4 | 3 | 4 | 4 | 4 | 1 | 3 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 2 | | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 44 3.4 | |
| Respiratory Epithelium, Metaplasia, Squamous | 2 | 3 | 1 | 4 | 1 | 1 | 2 | 1 | 1 | 2 | | 2 | 1 | 4 | 2 | 3 | 2 | 3 | 1 | 3 | | 1 | | 2 | 2 | 44 1.8 | |
| Respiratory Epithelium, Necrosis | | | | | | | | | | | | | | | | | | 4 | 2 | | | | | | | 3 3.3 | |
| Turbinate, Hyperostosis | | | | | 1 | | | | | 1 | | | | | | | | | | | 1 | | | | | 8 1.0 | |
| Trachea | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | | | | 1 2.0 | |
| Inflammation, Chronic Active | | | | | | | | 1 | | | 2 | 2 | | | | | | 3 | 4 | 1 | | 3 | 2 | | | 20 2.0 | |
| Epithelium, Atrophy | | 1 | | | 1 | | 1 | | | | | | | | | | | | | 1 | | | | | | 4 1.0 | |
| Epithelium, Hyperplasia | | | 1 | 2 | 1 | 2 | 1 | | 1 | 2 | | | | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | | 2 | 1 | 30 1.5 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade

+ .. Tissue examined microscopically

X .. Lesion present

I .. Insufficient tissue

M .. Missing tissue

A .. Autolysis precludes evaluation

BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:

1) Minimal 3) Moderate

2) Mild 4) Marked

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

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 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

| Wistar Han Rats Female | DAY ON TEST | | | | | | | | | | | | | | | | | | | | * TOTALS | | | | | | |
|----------------------------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----------|----|----|---|----------|----------|---------------|
| | 06 | 06 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | 07 | | 07 | 07 | | | | |
| 50 ppm | 9 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 4 | 8 | 3 | 4 | 3 | 3 | | |
| ANIMAL ID | 7 | 3 | 1 | 2 | 2 | 3 | 2 | 3 | 3 | 1 | 1 | 7 | 2 | 9 | 3 | 3 | 1 | 5 | 5 | 2 | 7 | 3 | 2 | 2 | 2 | | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | | |
| | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | | |
| | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 2 | 3 2.0 |
| Epithelium, Metaplasia, Squamous | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | 1 2.0 |
| Epithelium, Necrosis | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | 3 1.0 |
| Epithelium, Regeneration | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | 1 4.0 |
| Epithelium, Ulcer | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 1 | 19 1.8 |
| Submucosa, Fibrosis | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | 1 2.0 |
| Submucosa, Necrosis | | | | | | | | | | | | | | | | | | | | | | | | | | | |

SPECIAL SENSES SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----------|----------|----------|----------|----------|--------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|------------|------------|------------|
| Eye | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | | | | | | | | | | | | | | | | |
| Anterior Chamber, Inflammation, Suppurative | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | 1 | 3 | 2 | 5 1.8 | | | | | | | | | | | | | |
| Cornea, Inflammation, Chronic Active | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 2 | 2 | 3 | 1 | 2 | 1 | 2 | 3 | 2 | 3 | 2 | 2 | 31 | 2.0 | | |
| Cornea, Mineralization | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | 1 | | | | | 2 | 1.0 | | |
| Cornea, Endothelium, Rupture | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1.0 | |
| Cornea, Epithelium, Hyperplasia | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | 1 | | 1 | | | | 5 | 1.4 | |
| Cornea, Epithelium, Ulcer | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | | | | 2 | | 1 | 1 | | | 13 | 1.8 | |
| Iris, Inflammation, Acute | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | | | | | | | 1 | | 1 | | | | 4 | 1.0 | |
| Lens, Cataract | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 2 | | | | | | | | | 2 | | | 1 | 1 | 9 | 1.7 |
| Retina, Degeneration | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | | 1 | | 1 | | | | 3 | 15 | 1.6 |
| Unilateral, Phthisis Bulbi | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | 2 | | | | | 4 | 2 | | | | | | | | 8 | 3.1 |
| Harderian Gland | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | | | | | | | | | | | | | | | | | | |

URINARY SYSTEM

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------|----------|----------|----------|---|----------|---|---|---|---|---|----------|----------|----------|----------|----------|---|---|---|----------|---|---|----------|---|---|-----------|------------|
| Kidney | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 | |
| Calculus Micro Observation Only | X | X | | X | | X | X | | X | X | X | X | | | X | X | | X | X | X | X | X | X | X | 27 | |
| Nephropathy | | 1 | 1 | | 1 | | | | | | 1 | | 1 | 1 | 1 | | | | 1 | | | 1 | | | 11 | 1.0 |
| Pelvis, Dilatation | | 2 | | | | | | | | | | | | | | | | | | | | | | | 2 | 2.0 |
| Pelvis, Inflammation | 1 | | 1 | | | | | | | | | 1 | | | 2 | | | | | | | | | | 6 | 1.2 |

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
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 A .. Autolysis precludes evaluation
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 Lab: BNW

| WISTAR HAN RATS FEMALE 50 ppm | DAY ON TEST | | | | | | | | | | | | | | | | | | | | | | | | | * TOTALS | |
|----------------------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|-------|
| | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | 06797 | | |
| ANIMAL ID | 00726 | 00727 | 00728 | 00729 | 00730 | 00731 | 00732 | 00733 | 00734 | 00735 | 00736 | 00737 | 00738 | 00739 | 00740 | 00741 | 00742 | 00743 | 00744 | 00745 | 00746 | 00747 | 00748 | 00749 | 00750 | | |
| Renal Tubule, Necrosis | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | 1 4.0 |
| Urinary Bladder | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | 50 |

*** END OF REPORT ***

* .. Total animals with tissue examined microscopically; Total animals with lesion and mean severity grade
 + .. Tissue examined microscopically
 X .. Lesion present
 I .. Insufficient tissue
 M .. Missing tissue
 A .. Autolysis precludes evaluation
 BLANK .. Not examined microscopically

1-4 .. Lesion qualified as:
 1) Minimal 3) Moderate
 2) Mild 4) Marked