

**Experiment Number:** 56348-01

**Test Type:** 90-DAY

**Species/Strain:** Rat/F 344/N

**P18: INCIDENCE RATES OF NON-NEOPLASTIC LESIONS BY ANATOMIC SITE (a) WITH AVERAGE SEVERITY GRADES[b]**

**Test Compound:** Citral

**CAS Number:** 5392-40-5

**Date Report Requested:** 10/23/2014

**Time Report Requested:** 05:10:57

**First Dose M/F:** NA / NA

**Lab:** BAT

**C Number:** C56348A  
**Lock Date:** 01/02/1996  
**Cage Range:** All  
**Date Range:** All  
**Reasons For Removal:** All  
**Removal Date Range:** All  
**Treatment Groups:** All  
**Study Gender:** Both  
**PWG Approval Date:** NONE

Experiment Number: 56348-01

Test Type: 90-DAY

Species/Strain: Rat/F 344/N

**P18: INCIDENCE RATES OF NON-NEOPLASTIC LESIONS BY ANATOMIC SITE (a) WITH AVERAGE SEVERITY GRADES[b]**

Test Compound: Citral

CAS Number: 5392-40-5

Date Report Requested: 10/23/2014

Time Report Requested: 05:10:57

First Dose M/F: NA / NA

Lab: BAT

| F 344/N Rat MALE                 | UNTREAT CONTROL | VEHICLE CONTROL | 3900 PPM | 7800 PPM | 15600 PPM | 31300 PPM |
|----------------------------------|-----------------|-----------------|----------|----------|-----------|-----------|
| <b>Disposition Summary</b>       |                 |                 |          |          |           |           |
| Animals Initially In Study       | 10              | 10              | 10       | 10       | 10        | 10        |
| Early Deaths                     |                 |                 |          |          |           |           |
| Moribund Sacrifice               |                 |                 |          |          |           | 10        |
| Survivors                        |                 |                 |          |          |           |           |
| Terminal Sacrifice               | 10              | 10              | 10       | 10       | 10        |           |
| Animals Examined Microscopically | 10              | 10              | 10       | 10       | 10        | 10        |
| <b>ALIMENTARY SYSTEM</b>         |                 |                 |          |          |           |           |
| Esophagus                        | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Intestine Large, Cecum           | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Intestine Large, Colon           | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Parasite Metazoan                |                 |                 |          |          | 1         |           |
| Intestine Large, Rectum          | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Parasite Metazoan                |                 | 2               |          |          |           |           |
| Intestine Small, Duodenum        | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Intestine Small, Ileum           | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Intestine Small, Jejunum         | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Liver                            | (10)            | (10)            | (1)      | (0)      | (10)      | (10)      |
| Hepatodiaphragmatic Nodule       | 1               | 1               | 1        |          |           |           |
| Inflammation, Chronic            | 8 [1.0]         | 7 [1.0]         |          |          | 5 [1.0]   | 2 [1.0]   |
| Pancreas                         | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Atrophy                          |                 |                 |          |          | 1 [1.0]   |           |
| Salivary Glands                  | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Stomach, Forestomach             | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Epithelium, Hyperplasia          |                 |                 |          |          |           | 2 [2.0]   |
| Hyperkeratosis                   |                 |                 |          |          |           | 2 [1.0]   |
| Inflammation, Chronic Active     |                 |                 |          |          |           | 1 [1.0]   |
| Stomach, Glandular               | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |

a - Number of animals examined microscopically at site and number of animals with lesion

b - Average severity grade (1-minimal; 2-mild; 3-moderate; 4-marked)

Experiment Number: 56348-01

Test Type: 90-DAY

Species/Strain: Rat/F 344/N

**P18: INCIDENCE RATES OF NON-NEOPLASTIC LESIONS BY ANATOMIC SITE (a) WITH  
AVERAGE SEVERITY GRADES[b]**

Test Compound: Citral

CAS Number: 5392-40-5

Date Report Requested: 10/23/2014

Time Report Requested: 05:10:57

First Dose M/F: NA / NA

Lab: BAT

| F 344/N Rat MALE             | UNTREAT CONTROL | VEHICLE CONTROL | 3900 PPM | 7800 PPM | 15600 PPM | 31300 PPM |
|------------------------------|-----------------|-----------------|----------|----------|-----------|-----------|
| Artery, Mineralization       |                 | 1 [1.0]         |          |          |           |           |
| Mineralization               | 1 [1.0]         |                 |          |          |           |           |
| <b>CARDIOVASCULAR SYSTEM</b> |                 |                 |          |          |           |           |
| Blood Vessel                 | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Heart                        | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Cardiomyopathy               | 8 [1.1]         | 8 [1.0]         |          |          | 8 [1.0]   | 1 [1.0]   |
| <b>ENDOCRINE SYSTEM</b>      |                 |                 |          |          |           |           |
| Adrenal Cortex               | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Adrenal Medulla              | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Islets, Pancreatic           | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Parathyroid Gland            | (10)            | (7)             | (0)      | (0)      | (9)       | (10)      |
| Pituitary Gland              | (9)             | (9)             | (0)      | (0)      | (10)      | (10)      |
| Thyroid Gland                | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| <b>GENERAL BODY SYSTEM</b>   |                 |                 |          |          |           |           |
| None                         |                 |                 |          |          |           |           |
| <b>GENITAL SYSTEM</b>        |                 |                 |          |          |           |           |
| Epididymis                   | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Inflammation                 |                 | 1 [1.0]         |          |          |           |           |
| Preputial Gland              | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Hyperplasia                  |                 |                 |          |          | 1 [3.0]   |           |
| Inflammation                 | 2 [1.0]         | 4 [1.0]         |          |          | 2 [1.0]   |           |
| Prostate                     | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Inflammation                 |                 | 2 [1.5]         |          |          | 2 [1.0]   | 1 [2.0]   |
| Seminal Vesicle              | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Testes                       | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Aspermia                     |                 |                 |          |          |           | 10 [4.0]  |

a - Number of animals examined microscopically at site and number of animals with lesion

b - Average severity grade (1-minimal; 2-mild; 3-moderate; 4-marked)

Experiment Number: 56348-01

Test Type: 90-DAY

Species/Strain: Rat/F 344/N

**P18: INCIDENCE RATES OF NON-NEOPLASTIC LESIONS BY ANATOMIC SITE (a) WITH  
AVERAGE SEVERITY GRADES[b]**

Test Compound: Citral

CAS Number: 5392-40-5

Date Report Requested: 10/23/2014

Time Report Requested: 05:10:57

First Dose M/F: NA / NA

Lab: BAT

| F 344/N Rat MALE                            | UNTREAT CONTROL | VEHICLE CONTROL | 3900 PPM | 7800 PPM | 15600 PPM | 31300 PPM |
|---|-----------------|-----------------|----------|----------|-----------|-----------|
| <b>HEMATOPOIETIC SYSTEM</b>                 |                 |                 |          |          |           |           |
| Bone Marrow                                 | (10)            | (10)            | (0)      | (10)     | (10)      | (10)      |
| Atrophy                                     |                 |                 |          |          | 7 [1.0]   | 10 [1.9]  |
| Hemorrhage                                  |                 |                 |          |          |           | 10 [1.9]  |
| Lymph Node, Mandibular                      | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Lymph Node, Mesenteric                      | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Spleen                                      | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Thymus                                      | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Atrophy                                     |                 |                 |          |          |           | 5 [2.8]   |
| <b>INTEGUMENTARY SYSTEM</b>                 |                 |                 |          |          |           |           |
| Mammary Gland                               | (9)             | (8)             | (0)      | (0)      | (10)      | (8)       |
| Skin  | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| <b>MUSCULOSKELETAL SYSTEM</b>               |                 |                 |          |          |           |           |
| Bone  | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| <b>NERVOUS SYSTEM</b>                       |                 |                 |          |          |           |           |
| Brain                                       | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| <b>RESPIRATORY SYSTEM</b>                   |                 |                 |          |          |           |           |
| Lung  | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Alveolus, Infiltration Cellular, Histiocyte | 2 [1.0]         | 3 [1.0]         |          |          |           |           |
| Inflammation, Chronic                       |                 | 2 [1.0]         |          |          | 1 [1.0]   |           |
| Nose  | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Inflammation                                | 9 [1.0]         | 7 [1.0]         |          |          | 2 [1.0]   |           |
| Trachea                                     | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Inflammation                                | 3 [1.0]         | 2 [1.0]         |          |          |           | 1 [1.0]   |
| <b>SPECIAL SENSES SYSTEM</b>                |                 |                 |          |          |           |           |
| None  |                 |                 |          |          |           |           |

a - Number of animals examined microscopically at site and number of animals with lesion

b - Average severity grade (1-minimal; 2-mild; 3-moderate; 4-marked)

Experiment Number: 56348-01

Test Type: 90-DAY

Species/Strain: Rat/F 344/N

**P18: INCIDENCE RATES OF NON-NEOPLASTIC LESIONS BY ANATOMIC SITE (a) WITH  
AVERAGE SEVERITY GRADES[b]**

Test Compound: Citral

CAS Number: 5392-40-5

Date Report Requested: 10/23/2014

Time Report Requested: 05:10:57

First Dose M/F: NA / NA

Lab: BAT

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| <b>F 344/N Rat MALE</b>      | <b>UNTREAT<br/>CONTROL</b> | <b>VEHICLE CONTROL</b> | <b>3900 PPM</b> | <b>7800 PPM</b> | <b>15600 PPM</b> | <b>31300 PPM</b> |
|------------------------------|----------------------------|------------------------|-----------------|-----------------|------------------|------------------|
| <hr/>                        |                            |                        |                 |                 |                  |                  |
| URINARY SYSTEM               |                            |                        |                 |                 |                  |                  |
| Kidney                       | (10)                       | (10)                   | (10)            | (10)            | (10)             | (10)             |
| Developmental Malformation   |                            | 1                      |                 |                 |                  |                  |
| Mineralization               | 6 [1.0]                    | 5 [1.0]                |                 |                 | 6 [1.0]          |                  |
| Nephropathy                  |                            |                        | 3 [1.0]         | 10 [1.0]        | 8 [1.0]          |                  |
| Renal Tubule, Casts Granular |                            |                        | 3 [1.0]         | 10 [1.2]        | 10 [1.5]         |                  |
| Renal Tubule, Regeneration   | 8 [1.0]                    | 10 [1.0]               | 7 [1.0]         |                 | 5 [1.0]          |                  |
| Urinary Bladder              | (10)                       | (10)                   | (0)             | (0)             | (10)             | (10)             |
| Inflammation                 |                            | 1 [1.0]                |                 |                 |                  |                  |

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\*\*\*END OF MALE DATA\*\*\*

a - Number of animals examined microscopically at site and number of animals with lesion

b - Average severity grade (1-minimal; 2-mild; 3-moderate; 4-marked)

Experiment Number: 56348-01

Test Type: 90-DAY

Species/Strain: Rat/F 344/N

**P18: INCIDENCE RATES OF NON-NEOPLASTIC LESIONS BY ANATOMIC SITE (a) WITH AVERAGE SEVERITY GRADES[b]**

Test Compound: Citral

CAS Number: 5392-40-5

Date Report Requested: 10/23/2014

Time Report Requested: 05:10:57

First Dose M/F: NA / NA

Lab: BAT

| F 344/N Rat FEMALE               | UNTREAT CONTROL | VEHICLE CONTROL | 3900 PPM | 7800 PPM | 15600 PPM | 31300 PPM |
|----------------------------------|-----------------|-----------------|----------|----------|-----------|-----------|
| <b>Disposition Summary</b>       |                 |                 |          |          |           |           |
| Animals Initially In Study       | 10              | 10              | 10       | 10       | 10        | 10        |
| Early Deaths                     |                 |                 |          |          |           |           |
| Moribund Sacrifice               |                 |                 |          |          |           | 10        |
| Survivors                        |                 |                 |          |          |           |           |
| Terminal Sacrifice               | 10              | 10              | 10       | 10       | 10        |           |
| Animals Examined Microscopically | 10              | 10              | 1        | 10       | 10        | 10        |
| <b>ALIMENTARY SYSTEM</b>         |                 |                 |          |          |           |           |
| Esophagus                        | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Intestine Large, Cecum           | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Intestine Large, Colon           | (10)            | (10)            | (0)      | (1)      | (10)      | (10)      |
| Intestine Large, Rectum          | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Parasite Metazoan                |                 |                 |          |          | 3         |           |
| Intestine Small, Duodenum        | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Intestine Small, Ileum           | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Intestine Small, Jejunum         | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Liver                            | (10)            | (10)            | (1)      | (0)      | (10)      | (10)      |
| Hepatodiaphragmatic Nodule       |                 | 1               |          |          |           | 1         |
| Inflammation, Chronic            | 9 [1.2]         | 9 [1.0]         |          |          | 5 [1.0]   | 2 [1.0]   |
| Pancreas                         | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Atrophy                          |                 |                 |          |          | 1 [1.0]   |           |
| Salivary Glands                  | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Stomach, Forestomach             | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Epithelium, Hyperplasia          |                 |                 |          |          |           | 4 [1.3]   |
| Hyperkeratosis                   |                 |                 |          |          |           | 4 [1.5]   |
| Stomach, Glandular               | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Mineralization                   |                 | 1 [2.0]         |          |          |           |           |

a - Number of animals examined microscopically at site and number of animals with lesion

b - Average severity grade (1-minimal; 2-mild; 3-moderate; 4-marked)

Experiment Number: 56348-01

Test Type: 90-DAY

Species/Strain: Rat/F 344/N

**P18: INCIDENCE RATES OF NON-NEOPLASTIC LESIONS BY ANATOMIC SITE (a) WITH  
AVERAGE SEVERITY GRADES[b]**

Test Compound: Citral

CAS Number: 5392-40-5

Date Report Requested: 10/23/2014

Time Report Requested: 05:10:58

First Dose M/F: NA / NA

Lab: BAT

| F 344/N Rat FEMALE           | UNTREAT CONTROL | VEHICLE CONTROL | 3900 PPM | 7800 PPM | 15600 PPM | 31300 PPM |
|------------------------------|-----------------|-----------------|----------|----------|-----------|-----------|
| <b>CARDIOVASCULAR SYSTEM</b> |                 |                 |          |          |           |           |
| Blood Vessel                 | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Heart                        | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Cardiomyopathy               | 3 [1.0]         | 3 [1.0]         |          |          | 4 [1.0]   |           |
| <b>ENDOCRINE SYSTEM</b>      |                 |                 |          |          |           |           |
| Adrenal Cortex               | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Adrenal Medulla              | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Islets, Pancreatic           | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Parathyroid Gland            | (10)            | (8)             | (0)      | (0)      | (10)      | (8)       |
| Pituitary Gland              | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Thyroid Gland                | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| <b>GENERAL BODY SYSTEM</b>   |                 |                 |          |          |           |           |
| None                         |                 |                 |          |          |           |           |
| <b>GENITAL SYSTEM</b>        |                 |                 |          |          |           |           |
| Clitoral Gland               | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Inflammation                 | 2 [1.0]         | 5 [1.0]         |          |          | 7 [1.0]   |           |
| Ovary                        | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Cyst                         | 2 [1.5]         |                 |          |          |           |           |
| Uterus                       | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| <b>HEMATOPOIETIC SYSTEM</b>  |                 |                 |          |          |           |           |
| Bone Marrow                  | (10)            | (10)            | (0)      | (10)     | (10)      | (10)      |
| Atrophy                      |                 |                 |          |          | 8 [1.0]   | 4 [1.5]   |
| Hemorrhage                   |                 |                 |          |          |           | 9 [2.1]   |
| Lymph Node, Mandibular       | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Lymph Node, Mesenteric       | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |
| Spleen                       | (10)            | (10)            | (0)      | (0)      | (10)      | (10)      |

a - Number of animals examined microscopically at site and number of animals with lesion

b - Average severity grade (1-minimal; 2-mild; 3-moderate; 4-marked)

Experiment Number: 56348-01

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Species/Strain: Rat/F 344/N

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Test Compound: Citral

CAS Number: 5392-40-5

Date Report Requested: 10/23/2014

Time Report Requested: 05:10:58

First Dose M/F: NA / NA

Lab: BAT

| F 344/N Rat FEMALE  | UNTREAT CONTROL    | VEHICLE CONTROL    | 3900 PPM | 7800 PPM | 15600 PPM | 31300 PPM       |
|---|--------------------|--------------------|----------|----------|-----------|-----------------|
| Thymus Atrophy  | (10)               | (10)               | (0)      | (0)      | (10)      | (10)<br>4 [2.8] |
| <b>INTEGUMENTARY SYSTEM</b>                                       |                    |                    |          |          |           |                 |
| Mammary Gland   | (10)               | (10)               | (0)      | (0)      | (10)      | (8)             |
| Skin Inflammation   | (10)               | (10)               | (0)      | (0)      | (10)      | (10)<br>1 [1.0] |
| <b>MUSCULOSKELETAL SYSTEM</b>                                     |                    |                    |          |          |           |                 |
| Bone  | (10)               | (10)               | (0)      | (0)      | (10)      | (10)            |
| <b>NERVOUS SYSTEM</b>   |                    |                    |          |          |           |                 |
| Brain   | (10)               | (10)               | (0)      | (0)      | (10)      | (10)            |
| <b>RESPIRATORY SYSTEM</b>   |                    |                    |          |          |           |                 |
| Lung  | (10)               | (10)               | (0)      | (0)      | (10)      | (10)            |
| Alveolus, Infiltration Cellular, Histiocyte Inflammation, Chronic | 1 [1.0]<br>2 [1.0] | 1 [1.0]<br>4 [1.0] |          |          | 1 [1.0]   |                 |
| Nose  | (10)               | (10)               | (0)      | (0)      | (10)      | (10)            |
| Inflammation  | 4 [1.0]            | 3 [1.0]            |          |          | 2 [1.0]   | 1 [1.0]         |
| Trachea   | (10)               | (10)               | (0)      | (0)      | (10)      | (10)            |
| Inflammation  | 5 [1.0]            | 3 [1.0]            |          |          | 3 [1.0]   |                 |
| <b>SPECIAL SENSES SYSTEM</b>                                      |                    |                    |          |          |           |                 |
| None  |                    |                    |          |          |           |                 |
| <b>URINARY SYSTEM</b>   |                    |                    |          |          |           |                 |
| Kidney  | (10)               | (10)               | (0)      | (0)      | (10)      | (10)            |
| Mineralization  | 5 [1.0]            | 9 [1.0]            |          |          | 4 [1.0]   | 4 [1.0]         |
| Renal Tubule, Regeneration  | 3 [1.0]            | 2 [1.0]            |          |          | 1 [1.0]   |                 |
| Urinary Bladder   | (10)               | (10)               | (0)      | (0)      | (10)      | (10)            |
| Inflammation  |                    | 1 [1.0]            |          |          | 1 [1.0]   |                 |

a - Number of animals examined microscopically at site and number of animals with lesion

b - Average severity grade (1-minimal; 2-mild; 3-moderate; 4-marked)



**Experiment Number:** 56348-01

**Test Type:** 90-DAY

**Species/Strain:** Rat/F 344/N

**P18: INCIDENCE RATES OF NON-NEOPLASTIC LESIONS BY ANATOMIC SITE (a) WITH  
AVERAGE SEVERITY GRADES[b]**

**Test Compound:** Citral

**CAS Number:** 5392-40-5

**Date Report Requested:** 10/23/2014

**Time Report Requested:** 05:10:58

**First Dose M/F:** NA / NA

**Lab:** BAT

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**F 344/N Rat FEMALE**

**UNTREAT  
CONTROL**

**VEHICLE CONTROL**

**3900 PPM**

**7800 PPM**

**15600 PPM**

**31300 PPM**

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**\*\* END OF REPORT \*\***

a - Number of animals examined microscopically at site and number of animals with lesion

b - Average severity grade (1-minimal; 2-mild; 3-moderate; 4-marked)