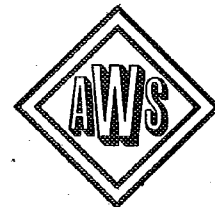
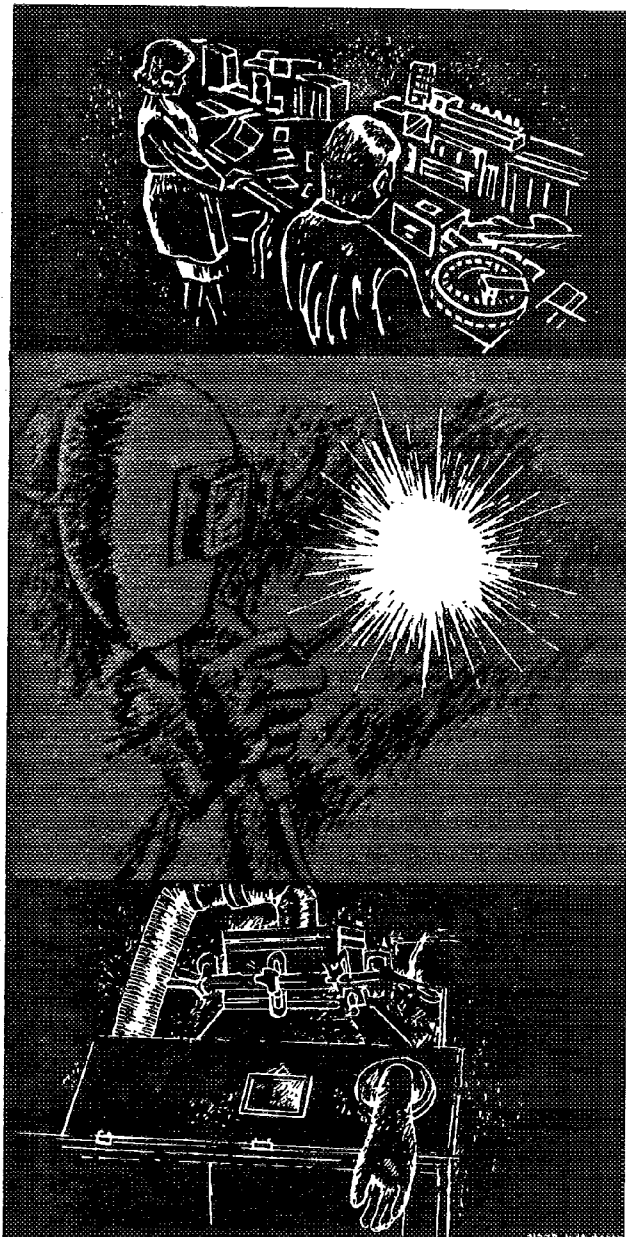


Toxicity of Welding Fume in Rats



AMERICAN WELDING SOCIETY

Key Words — welding fume,
toxicity, inhalation, research,
Hazleton Laboratories

Toxicity of Welding Fume in Rats (Complete Report)

Research performed by the Hazleton Laboratories America, Incorporated, Vienna, Virginia, under contract with the American Welding Society and supported by industry contributions.

Performed By:

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August, 1985

Abstract

This report contains results of a study made on the toxicity of welding fumes in rats. Six welding fumes were administered to rats by inhalation to determine relative ranking of toxicity. Fumes used were generated from E6010, E7018, E70S-3, E70T-1, E308-16 and E5356 consumables. Results were evaluated in terms of acute inhalation toxicity, pulmonary pathologic and fibrogenic potential, *in vivo* cytogenetic potential and mutagenic potential of urinary excretions. Sampling in the chamber included measurement of particle concentration and size, ozone, carbon monoxide, and the oxides of nitrogen.

The Summary Report contains text of the study findings and selected tabular data. The Complete Report contains the same text, with the tabular data in its entirety.

Prepared for
SAFETY AND HEALTH COMMITTEE
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Foreword

(This foreword is not part of the *Toxicity of Welding Fume in Rats* but is included for information purposes only.)

The health of workers in the welding environment is a major concern of the American Welding Society. As part of a continuing health effects research program, contract research projects have included studies of fumes and gases, ventilation, radiation and noise associated with various processes.

One area of concern has been the inadequate information reported in welding fume toxicity studies where laboratory animals are used. This report represents a contractual effort to rank relative toxicities of fume from six commonly used welding consumables. The results, while not definitely conclusive, indicate a need for more extensive studies of this kind.

Acknowledgments

Dr. Richard Parent, Consultox, Ltd., Baton Rouge, Louisiana, developed the test protocol and provided consultant services during the toxicity testing.

Funds for this project were provided by the American Welding Society.

The American Welding Society gratefully acknowledges the financial support of the program by industry contributions.

Supporting Organizations

Air Products and Chemicals, Incorporated
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Truck Trailer Manufacturers Association
Walker Stainless Equipment Company
Weld Tooling Corporation

Many other organizations have made contributions to support the ongoing program from May 1979 to the present.

AWS Safety and Health Research Committee Study Objective

The following study objective was prepared by the AWS Safety & Health Research Committee. It summarizes the study purpose and explains the technical problems encountered.

The objective of the study was to assess the relative toxicity to rats of six welding fumes in common usage. The toxicity potential was evaluated in terms of:

- Acute inhalation effects
- Lung fibrogenicity
- Cytogenetic effects
- Pulmonary pathology
- Mutagenic effects

In a study of acute toxicity, the relevance of the findings to a welder population with chronic fume exposure at much lower levels can be questioned. The issue is raised: should there be a chronic lifetime exposure study at more realistic fume levels? This might be the next logical step, taking into account cost and technical difficulties to be encountered. Also, a further investigation into the toxicity of E308-16 fume may be in order.

Future studies, if any, should be designed with more consideration given toward extrapolation to humans, as well as prospective epidemiological investigations of the general welding population.

Subject: Toxicity Study of Welding Fumes in Rats
Project No. 2236-100/101
Hazleton Laboratories

We, the undersigned, hereby declare that the work was performed under our supervision, according to the procedures herein described.

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Toxicity of Welding Fume in Rats

Summary and Conclusions

Mutagenicity, fibrogenicity, cytotoxicity, and general histopathological manifestations were evaluated in a series of *in vivo* and *in vitro* tests in Sprague-Dawley rats subsequent to a single exposure to various welding fumes. Forty rats per sex per group were placed in a 1.0 m³ chamber which housed the welding unit used for the generation of the specific welding fumes. The fumes were exhausted into the animal exposure chamber at an airflow rate of approximately 200 liters per minute. Target concentration for each fume was 0.6 mg per liter, averaged over a single 6-hour exposure period. Homogeneity, total particulate/gravimetric concentration, particle size distribution, temperature, relative humidity, and the concentration of atmospheric gasses were monitored.

Histopathological evidence of exposure to the toxic welding fumes were noted primarily in the lungs as perivascular and intra-alveolar edema and a seropurulent or fibrinopurulent pneumonitis. Pigmented alveolar macrophages were indicative of fume/particle deposition in the airspaces with subsequent phagocytosis and clearance from the lung. Based on histopathological data from lungs exposed to these fumes, E308-16 demonstrated the most severe morphological changes as displayed by vascular damage and inflammatory cell infiltration. These findings were supported by analysis of lavage fluids obtained from another subgroup of rats exposed to E308-16. Lavagates appeared turbid and contained an appreciable number of red blood cells which rendered these samples inappropriate for macrophage assessment. Generally, animals exposed to the other fumes demonstrated a mild to moderate increase in alveolar macrophages, many of which were pigmented. Although the histopathology from these animals was fairly nonremarkable, other indications of pulmonary toxicity were present. This was especially true of cell recovery and percent macrophages obtained from bronchoalveolar lavage

fluids. In contrast to light microscopic evidence of a mild histiocytosis, lavage fluids from all males and females exposed to fumes E7018 and E70T-1 contained a significantly decreased number of macrophages. However, further characterization of the macrophages which were present indicated that macrophage viability was not influenced by the welding fumes. Although the phagocytic ability of the macrophages was apparently decreased following exposure to all fumes except E5356, the nature of the test makes it less sensitive than the exclusion of trypan blue in the viability test.

Comparisons between pulmonary histopathology and *in vitro* viability EC₅₀ data demonstrated good correlations in regard to the relative cytotoxicities. The viability EC₅₀ of the welding fumes showed that E7018 was only slightly more cytotoxic than E308-16 to alveolar macrophages and that E70T-1 and E6010 also possessed relatively low EC₅₀ viabilities. In contrast, the viability EC₅₀ of E5356 and E70S-3 were relatively high which indicated that the two fumes were virtually nontoxic. Histopathological assessment of lungs exposed to these welding fumes illustrated the cytotoxic effects *in vivo*. Pulmonary irritation, as displayed by edema and pneumonitis, was seen in animals exposed to E308-16, whereas clinical observations disclosed some obvious respiratory tract effects with exposure to E7018, E70T-1, and E6010. It should be noted however, that the *in vitro* tests evaluated the cytotoxicity of welding fumes on macrophages and their functional capabilities. The *in vivo* exposures resulted principally in edematous changes which could actually be an evaluation of the relative toxicities of the welding fumes on the vascular endothelium, which are perhaps less resistant to the fumes.

Therefore, in ranking the relative toxicological potentials of the welding fumes, histopathology and *in vitro* macrophage assessment permits classification into three categories: highly toxic, moderately toxic, and non-toxic. Welding fume E308-16, due to its ability to cause

irritation in the deep lung and its relatively low EC_{50} , may be regarded as highly toxic. E7018, E6010, and E70T-1 also possess the potential of causing respiratory tract irritation, albeit in the upper respiratory tract, and had relatively low EC_{50} viability values; therefore, these fumes may be considered moderately toxic. Based on histopathologic evaluations and EC_{50} data of animals exposed to the welding fumes designated E5356 and E70S-3, these may be regarded as nontoxic at the concentrations tested in this study.

Lastly, no mutagenic or cytogenic effects were found as a result of exposure to any of the fumes. In addition, the relative fibrogenic potential of these fumes could not be assessed.

Introduction

This project, sponsored by the American Welding Society, was designed to determine the relative ranking of fumes generated from six different welding electrodes (three different arc welding processes), in terms of their acute inhalation toxicity, pulmonary fibrogenic potential¹, *in vivo* cytogenetic² potential, pulmonary pathologic potential, and mutagenic³ potential of urinary excretions from exposed rats. To this end, a representative of each of six types of electrodes was used in manual or semiautomatic mode by skilled welders to provide comparable particulate concentrations (gravimetrically determined) of fresh fume over a six-hour period in an inhalation chamber containing 40 rats per fume. Fume was generated on one chamber and pulled through a fume scavenger by negative pressure into the inhalation chamber. In addition to sampling to determine fume particulate concentration, aerodynamic particle size distribution, ozone, nitrogen oxides, and carbon monoxide concentrations were measured in the inhalation chamber.

This project permits a direct ranking of the toxicity of the fumes to rats (at the same particulate concentrations) and a ranking of the potential hazards given knowledge of the total fume concentrations produced under standardized simulated welding conditions. This knowledge may be contained in AWS F1.2, *Laboratory Method for Measuring Fume Generation Rates and Total Emission for Welding and Allied Processes*, a publication of the American Welding Society.

1. Fibrogenic potential: ability for growth of white fibrous connective tissue in organ or part in excess of that naturally present.
2. Cytogenetic: structure, behavior, growth and reproduction of cells and their relation to genetics.
3. Mutagenic: causing abrupt change in the make up of an organism not resulting from recombination.

Welding Processes and Test Materials

Three welding processes with one or more representative electrodes were used to generate fume for testing as listed:

Process	Electrodes	Shielding Gas
Shielded Metal Arc/ Covered Electrodes	E308-16; E6010; E7018	—
Gas Metal Arc/ Solid Wire	E5356 E70S-3	Argon CO ₂
Flux Cored Arc	E70T-1	CO ₂

Test Animals

Sprague-Dawley descended rats, approximately six weeks of age, were obtained in seven separate shipments of 55 or 65 per sex from Charles River Breeding Laboratories, Kingston, New York. They were quarantined for 12 days during which time they were culled of those showing physical defects or signs of disease. Only those found in good health by the staff veterinarian and of normal body weight were accepted for study. Of those found acceptable, 39 or 48 per sex were selected and 26 or 30 per sex were randomly assigned to seven subgroups and the remainder for *in vitro* tests as indicated on the following page. Upon assignment to subgroups, the animals were permanently identified by monel metal ear tag numbers. The unused rats from each shipment were destroyed.

Animal Husbandry

Upon receipt and throughout their laboratory stay, the rats were individually caged in stainless steel mesh cages with Purina #5001 Laboratory Chow® and with tap water, both provided *ad libitum* except during exposure. They were housed in environmentally controlled chambers provided with 12 or more air changes per hour and a timer-controlled 12-hour light/dark cycle. Temperature and relative humidity were maintained between 66–78°F and 32 and 86 percent, respectively.

Generation of Test Atmospheres

Each of the welding fumes tested was generated in a cubical 1-m³ glass and stainless steel open-front chamber by a skilled welder using manual or semiautomatic technique as appropriate to the electrode. The work piece of appropriate parent metal plate was sited under an 18 in. L × 15 in. W galvanized fume scavenger

with stainless steel skirt on three sides. The front opening of the skirt was 11 inches high above a grate floor on which the work piece rested at a 15 degree angle. The fume scavenger was connected to the turret top of a second 1-m³ glass and stainless steel exposure chamber. The exposure chamber was fitted with a perforated stainless steel diffusion ceiling, held 40 individual stainless steel mesh restraining cages for rats on a single tier, and was exhausted from the bottom at 200 liters per minute under negative pressure. Thus, the fume laden air captured by the fume scavenger was swept into and out of the exposure chamber at the calibrated rate of 200 liters

per minute. Unscavenged fume was exhausted from the top of the first (welding) chamber or escaped into the well-ventilated room. Figure 1 gives a schematic view of the experimental setup.

The welder, seated in front of the workpiece, was surrounded on three sides by a welder's screen and on the fourth by the welding chamber. The exposure chamber was covered with black plastic tape on the two sides nearest the welding chamber in order to shield the rats from indirect radiation from the arc. Additional cooling of the exposure chamber (as needed to maintain its internal temperature below 80°F) was provided by a

Electrode	Subgroup							<i>In Vitro</i> Test	Date of Test Exposure
	A	B	C	D	CCA	CCB	CCD		
E70S-3	5/5	5/5	5/5	5/5	2/2	2/2	2/2	13/13	10/17/83
E308-16	5/5	5/5	5/5	5/5	2/2	2/2	2/2	13/13	10/24/83
E7018	5/5	5/5	5/5	5/5	2/2	2/2	2/2	13/13	10/31/83
E6010	5/5	5/5	5/5	5/5	2/2	2/2	2/2	13/13	11/07/83
E70T-1	5/5	5/5	5/5	5/5	2/2	2/2	2/2	13/13	11/14/83
E5356	5/5	5/5	5/5	5/5	2/2	2/2	2/2	13/13	11/28/83
E308-16 ^a	5/5	5/5	5/5	5/5	5/5	5/5	5/5	13/13	1/09/84

^a. Additional test at concentration selected for minimal lethality.

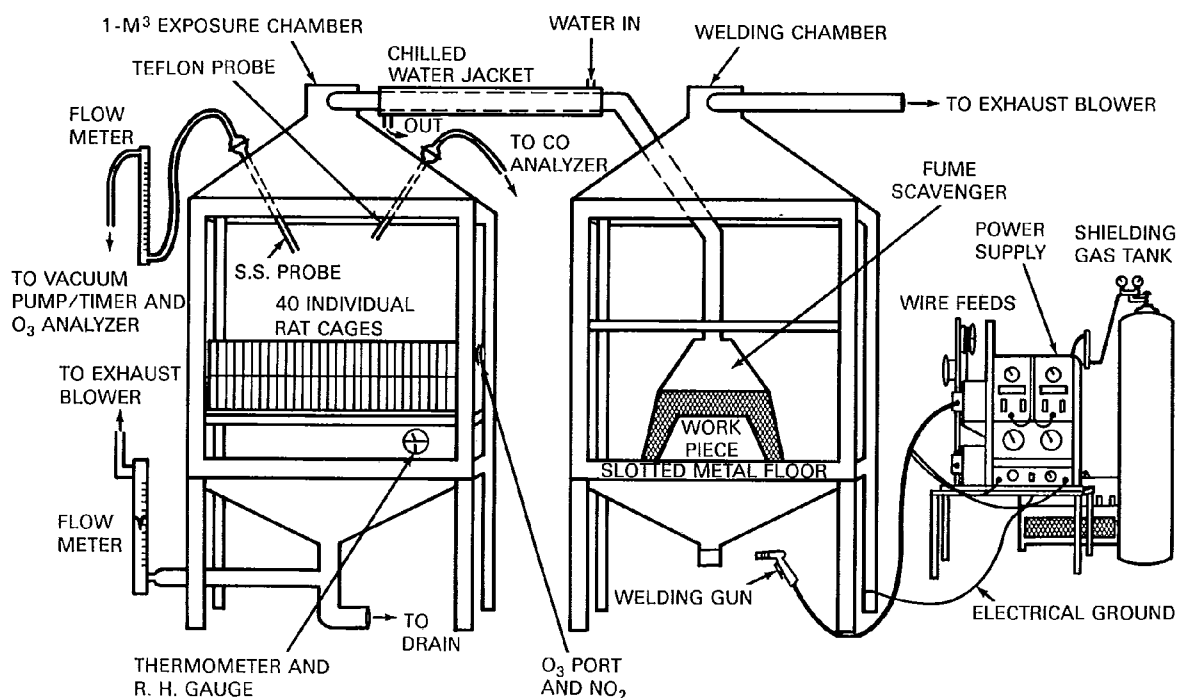


Figure 1 — Schematic View of the Arrangement for Exposing Rats to Welding Fumes

plastic bag filled with ice cubes on the chamber roof and a cold-water jacket on the copper pipe connecting the fume scavenger to the exposure chamber. A third 1-m³ glass and stainless steel chamber with a 200-liter per minute HEPA-filtered airflow from a clean air source was used to "expose" control animals concurrently.

Welding fume was generated for six hours using continuous 10-minute duty cycles⁴. Two skilled welders, spelling each other and assisting each other in the replacement of work pieces as needed, welded beads on the plates. The maximum welding period was nine minutes out of every 10 minutes. During each welding period, bead was laid continuously except for momentary breaks for workpiece exchange and restarting of the arc. A Hobart MEGA-FLEX 650 RVS power supply was used for all welding.

Preliminary runs were made with each electrode to determine the arc current and the on/off periods during each duty cycle needed to achieve mean six-hour fume (particulate) concentrations in the exposure chamber as near to 0.6 mg per liter as possible. This target concentration was selected based on a preliminary six-hour exposure with the stainless steel electrode (E308-16) fume which resulted in the deaths of 40/40 rats at a mean concentration of 1.78 mg per liter.

Ten closed-face filter (Gelman 47-mm GN-6) samples (gravimetric) of the fume in the exposure chamber were obtained at predetermined times during each six-hour run. Each sample was pulled via a stainless steel [0.5 in. (12.7 mm) I.D.] standard probe extended near the breathing zone of the animals. The sampling rate was 5.0 liters per minute for two minutes. Flow rate was measured with a Fischer-Porter 36-541-21 flowmeter calibrated with a wet test meter and remained constant throughout each sampling period. Samples were obtained during random portions of the duty cycles and each electrode fume was sampled similarly.

In addition, 47 mm open-face Nuclepore filter (0.2 μ pore size) samples of the fumes in the exposure chamber and at the welding site were obtained and shipped to Dr. Margaret Nasta, Mellon Institute, Carnegie Mellon University for particle sizing by automated electron beam analysis with SEM and chemical characterization by energy-dispersive X-ray analysis. A separate report on these analyses has been submitted by Dr. Nasta.

Table 1 lists the various parameters used with each electrode during the six-hour welding fume exposures. Arc current and voltage were recorded continuously on Moseley millivolt recorders. Arc length and drag angle

were maintained for optimal welds by the welder. Shielding gas flow rates were monitored with calibrated flow-raters appropriate to the gases. Wire-feed rates were controlled by Hobart 27 and Dualmatic CVS arc welding systems. Electrode materials were preweighed and postweighed at the end of each welding session to obtain M.O. rates.

Exposure Atmosphere Characterization

Homogeneity of Fume

Prior to the first test exposure, the homogeneity of particulate fume in the exposure chamber at the plane of the animal cages was determined using the E70S-3 electrode on steel plate. Four open-face filter samples were obtained simultaneously at four locations on top of the cages plus a closed-face sample via the standard probe. The gravimetric concentration was obtained from each sample. The results indicated a reasonably homogeneous (± 10 -18%) atmosphere in the breathing zone with a $\approx 25\%$ underestimation by the standard probe. Data are shown below.

E70S-3 Preliminary Gravimetric Concentrations (mg/L)					
Open-Faced Filter				Closed-Face Filter	
Sample:	1	2	3	4	1
	0.84	0.76	1.08	1.02	0.70

Total Particulates/Gravimetric Concentration

During each exposure, total particulate samples were obtained on 47 mm closed-face Gelman GN-6 membrane filters, via the standard probe, during 10 nearly evenly spaced periods within each six-hour fume generation period, starting 30 minutes after initiation of welding cycles. Each sample was collected at 5.0 liters per minute for 2.0 minutes. These samples were immediately weighed on an analytical balance (Mettler Model H 54AR) reading to 0.1 mg and then stored in glass vials within Teflon®-lined caps under nitrogen for possible future metal analysis. On the basis of sample weights obtained, the gravimetric concentration of particulate fume during each two-minute period was calculated. The mean and standard deviation of the 10 samples was taken to characterize the particulate concentration during the exposure period. (During the third hour,

4. Except for E5356, in which continuous two-minute duty cycles were employed.

Table 1
Fume Generation Parameters

Electrode	Diameter (inches)	Volts	Amps	Current	Shielding Gas	Gas Flow CFM	Workpiece	Continuous On/Off Periods	Melt Off Rate lb/hour
								Ten Minute Duty Cycles	
E70S-3	0.045	28	180	DC+	CO ²	40	1/2 in. steel	8 ft/2 ft	5.63
E308-16	1/4	24	210	DC+	—	—	1/2 in. steel	8 ft/2 ft	5.10
E7018	3/16	24	195	DC+	—	—	3/4 in. steel	8 ft/2 ft	4.66
E6010	3/16	29	125	DC+	—	—	1 in. steel	9 ft/1 ft	1.54
E70T-1	0.93	25	350	DC+	CO ²	45	1 in. steel	{ 8 ft/2 ft (3.5 hr) 6 ft/4 ft (2.5 hr)	9.20
E5356	3/64	26	135	DC+	Argon	45	1 in. aluminum	1 ft 54 in./6 in. ^a	0.14
E308-16	1/4	23	160	DC+	—	—	1 in. steel	5 ft/5 ft	2.84

a. E5356 electrode was melted during continuous two-minute duty cycles versus standard ten-minute duty cycle.

additional such filter samples were obtained to provide 100 mg of particulate to be used in *in vitro* macrophage studies.)

Particle Size Distribution and Characterization

Twice during each exposure, samples were obtained using Andersen 1-CFM eight-stage cascade impactors with backup filters. The stage plates and filters were pre and postweighed on the above analytical balance. The resulting distributions of total particulate mass collected were used to calculate the mass median aerodynamic diameter (MMAD) and σ_g for each sample of each fume.

Oxygen (O₂) Concentration

The O₂ percentage in the exposure chamber was monitored hourly with a Fyrite oxygen gauge (1 percent accuracy) with a protective particulate filter in the sampling line. Provision for supplementary O₂ was available in case the O₂ percentage fell below 19 percent, which it never did.

Ozone (O₃) Concentration

The O₃ concentration (in ppm) in the exposure chamber was monitored hourly using an AID Model 560 Ozone Analyzer (chemiluminescence principle) calibrated in 0.1 ppm increments up to 1.0 ppm with an AID Model 565 Ozone Generator (UV source) and with O₃-free room air. Samples were obtained via 1/4 inch Teflon® and stainless steel tubing with a Gelman GN-6 protective particulate filter in line.

Nitrogen Oxides (NO₂ and NO + NO₂) Concentrations

NO₂ (0.5 to 10 ppm) and NO + NO₂ (2 to 50 ppm) concentrations were separately monitored at hourly intervals with Draeger CH31001 and CH30001 tubes, sampling via a port in the chamber wall. In addition, an attempt was made to measure nitric oxide (NO) concentration directly, using a Miran 1A Infrared Vapor (IR) Analyzer calibrated with pure NO (99 percent) injected via a septum from a gas-tight syringe into a closed loop (5.61 liters) on the instrument cell. An analytical wavelength of 5.35 microns and a 20.25-meter pathlength was used. At this wavelength, NO₂ showed no absorbance. When compared to the results obtained by subtracting the Draeger NO₂ reading from the Draeger NO + NO₂ reading, no correlation between the obtained IR and the derived Draeger NO values could be established. It was subsequently found that the IR Analyzer was responding to some waste product diffusing from the feces of the exposed rats (but not of control rats), an emission which seemed to vary from electrode to electrode test. Thus, the NO readings obtained with the IR Analyzer were uninterpretable and could not be used to measure NO concentrations in the exposed chamber.

Carbon Monoxide (CO) Concentration

CO concentration was measured hourly in ppm using a second Miran 1A Infrared Vapor Analyzer sensitive to 0.2 ppm calibrated with pure CO injected via a septum from a gas-tight syringe into a closed loop (5.61 liters) on the instrument cell. An analytical wavelength of 4.61

microns and a 20.25-meter pathlength were used and the cell was maintained at a constant temperature in excess of 100° F. Samples were pulled at 5.0 liters per minute for five to six minutes (in excess of T_{99} for complete cell flushing) and the instrument response recorded on a stripchart. The peak response during each sampling period was logged as the CO concentration for that interval. Samples were pulled via a Teflon® line from the middle of the chamber through a protective in-line Gelman A/E glass fiber filter.

Temperature and Relative Humidity

Temperature and relative humidity were monitored in both exposure and control chambers with Abbeon Certified Temperature and Relative Humidity Gauges located at the level of the animals. The readings were logged from each exposure chamber every 15 minutes during chamber occupancy.

Experimental Design

The animals selected for each electrode test and concurrent common controls were subdivided randomly into Subgroups A, B, C, D, CCA, CCB, and CCD, with an additional 13 per sex to be used as donors of pulmonary macrophages for *in vitro* tests. The subgroup designations are defined in the following subsections, in terms of the use to which the animals were put:

(A) Subgroup A animals (five per sex per electrode) were used for two donations of urine (excreted 0–24 and 72–96 hours postexposure) to be pooled (by sex) and used in bacterial plate assays after concentration by lyophilization, and for gross and histopathology studies following a 14-day recovery period.

(B) Subgroup B animals (five per sex per electrode) were used to donate pulmonary macrophages by lung lavage for determination of macrophage count (recovery) and cell viability, as well as for ATP, lysozyme, and acid phosphatase concentrations, and phagocytosis activity as possible indicators of fibrogenicity potential.

(C) Subgroup C animals (five per sex per electrode) were used to donate bone (femur) marrow cells 24 hours postexposure for cytogenetic analysis.

(D) Subgroup D animals (five per sex per electrode) were similarly used to donate bone marrow cells 72 hours postexposure for cytogenetic analysis.

(CCA) Subgroup CCA animals (12 per sex) were used to donate urine and to be necropsied/histopathology as common controls for all A subgroups.

(CCB) Subgroup CCB animals (12 per sex) were used to donate pulmonary macrophages as common controls for all B subgroups.

(CCD) Subgroup CCD animals (12 per sex) were used to donate bone (femur) marrow as common controls for both Subgroup C and Subgroup D.

In Vitro Tests

The additional 13 unexposed animals per sex selected for each electrode fume test were used to donate untreated pulmonary macrophages for *in vitro* tests of the relative toxicity and fibrogenicity potential of the particulate phase of each fume collected from the exposure chamber.

Methodologies employed with each of these tests are described below under the respective subgroup designations and *in vitro* macrophage tests.

Supplemental Test

The initial test exposure to E308-16 fume at 0.601 mg/liter resulted in the deaths of 19 males and 20 females during or within 24 hours after the exposure; therefore, no further use was made of these animals (except to necropsy Subgroup A). A subsequent test exposure of 20 per sex was made at a particulate concentration expected to be the maximum acute nonlethal concentration of this fume, based on a series of "dose-ranging" exposures at different concentrations.⁵ This test exposure took place approximately six weeks after completion of the other electrode exposures, and was conducted as a separate experiment with its own control group (10 per sex).

Specimen, Raw Data, and Final Report Storage

All specimens, raw data, and the final report are stored in the archives of Hazleton Laboratories America, Incorporated.

Assay Methods

Subgroups A and CCA

Observations and Records

All of the Subgroup A rats were observed for toxic signs prior to exposure, at least every half hour during exposure, after removal from the exposure chamber, and

5. Exposure data, clinical signs, and mortality ratios for the "dose ranging" exposures are presented in Appendices 14A-14E (complete report).

twice daily thereafter for 14 consecutive days.⁶ Individual body weights were recorded initially at pre and post-exposure, on Days 7 and 14, and at termination.

Sacrifice and Gross Pathology

At termination, all surviving rats were sacrificed by exsanguination under sodium pentobarbital anesthesia. Terminal body weights were recorded prior to necropsy. Necropsies were also performed on animals that were found dead.

Organ Weights

Only the brains, lungs,⁷ livers, hearts, and kidneys of terminally sacrificed rats were weighed and organ/body weight ratios determined.

Tissue Preservation

The following tissues from all rats were preserved in 10 percent neutral buffered formalin:

Brain	Jejunum
Thyroid	Ileum
Trachea	Cecum
Heart	Colon
Liver	Rectum
Spleen	Urinary bladder
Kidneys	Testis with epididymis
Adrenals	Prostate
Stomach	Ovaries
Pancreas	Uterus
Duodenum	Nasal turbinates

The lungs with bronchi were preserved in a formalin-glutaraldehyde fixative.

Histopathology

The lungs of these animals were embedded in Paraplast®, sectioned, stained with hematoxylin and eosin, and examined microscopically.

Statistical Analyses

Absolute body weights and organ weight data of the common control group were compared statistically against the data of the fume-exposed groups of the same sex. Absolute body weights were evaluated at initiation, on Day 7, and at termination (Day 14).

6. The control animals were sacrificed after the morning observation on Day 13 because of scheduling necessity.

7. Lungs from the Subgroups C and D, as well as from CCD animals, were similarly weighed upon removal and trimmed for wet weight, and then were air-dried for 24 hours, further dried for 48 hours in a desiccator, and then reweighed for dry weight. The lung wet/dry weight ratio for each animal was calculated and presented by subgroup.

Analyses of the above data were performed in the following order. Levene's test for homogeneity of variances (Levene, 1960; Draper and Hunter, 1969) was performed, and if the variances proved to be homogeneous, the data were analyzed by one-way classification analysis of variance (ANOVA) (Winer, 1971). If the variances proved to be heterogeneous, a series of transformations was performed until variance homogeneity was achieved. These transformations were $\log_{10}$, square (X^2), square root ($X^{1/2}$), reciprocal ($1/X$), angular (arcsine $X^{1/2}$), and rank, respectively. If rank transformation was ineffective in removing variance heterogeneity, ANOVA of ranked data was completed. If ANOVA of untransformed or transformed data was significant, Dunnett's t-test (Dunnett, 1955 and 1964) was used for control versus compound-treated group mean comparisons. If ANOVA was not significant, the analysis was complete.

Data transformations are designated throughout this report as presented below:

A = Data analyzed following $\log_{10}$ transformation

B = Data analyzed following square (X^2) transformation

C = Data analyzed following square root ($X^{1/2}$) transformation

D = Data analyzed following reciprocal ($1/X$) transformation

E = Data analyzed following angular (arcsine $X^{1/2}$) transformation

F = Data analyzed following rank transformation

For mean tables, the above indications followed by the letters M, F, or B indicate the transformation occurred for either the Male, Female, or Both male and female groups.

Tests for homogeneity of variances and ANOVA were evaluated at the 5.0 percent one-tailed probability level. Control versus compound-treated group mean comparisons of the above data were evaluated at the 5.0 percent two-tailed probability level.

Statistical references are appended to this report, and statistically significant differences, as indicated by the aforementioned tests, are designated throughout this report by the term *significant* and/or as follows:

S+ = Significantly higher than the control value

S- = Significantly lower than the control value

Subgroup A — Body Fluid Mutagenicity Assay

Materials

Control Substances. The control substances listed on the following page were used in this study and were considered stable under the conditions of this assay.

Chemical	Manufacturer	Lot Number	Purity
Corn Oil (Mazola)	Best Foods	Not Applicable	100%
2-Aminoanthracene (2-AA)	Sigma	11 of 0600	Practical Grade
Deionized Glass Distilled Water (DGDH ₂ O)	Collected from AG-11 Automatic Collection System	Not Applicable	Assume 100%
Dimethylsulfoxide (DMSO)	Fisher	730913	Certified ACS
Methylnitronitroso-guanidine (MNNG) ^a	Aldrich	010247	97%
9-Aminoacridine (9-AA) ^a	Sigma	23F-0382	Grade II
2-Nitrofluorene (2-NF) ^a	Aldrich	261OPE	98%

a. Positive control agents used directly in the mutational assay.

Body Fluid Collection Procedure

Test Materials

1. Urine Collection. Urine from each animal was collected in individual Roth metabolism jars over a 24-hour period immediately following the conclusion of welding fume exposure (or air control exposure) and an additional 24-hour collection was performed starting 72 hours postexposure. The urine samples from test and control animals were collected into flasks held at 0–4°C, filter-sterilized and held frozen at approximately –20°C. The frozen samples were later lyophilized and used for analysis in the *Salmonella*/Mammalian Microsome Mutagenicity Assay.

2. Positive Control Group. Prior to initiation of the study, three male Sprague-Dawley descended rats were administered a single intraperitoneal injection of 2-Aminoanthracene (2-AA), 80 mg/kg dosing volume = 1 ml/100 gm. Pooled urine, collected from these animals for a 24-hour period following treatment, was held frozen and later concentrated as described below until performance of the mutational assay.

Urine was also collected and concentrated from five untreated male rats and served as the negative control for this group.

3. Concentration. Individual urine samples from each fume exposure and the accompanying control series, which were collected at the same time as the appropriate fume exposure urine, were pooled as follows:

Test Groups (Fume Exposure)	Negative Control Group
24 Hour Male Urine	24 Hour Male Urine
24 Hour Female Urine	24 Hour Female Urine
72 Hour Male Urine	72 Hour Male Urine
72 Hour Female Urine	72 Hour Female Urine

Pooled urine samples from each test fume and control exposure were concentrated by lyophilization. The residual dried material for each group was weighed and held frozen at approximately –20°C until performance of the mutational assay.

To expedite sample analysis in the mutational assay, the negative control urines collected from two animals per sex per fume for fume exposures E5356, E70S-3, E70T-1, E6010 and E7018 were separately pooled, concentrated, and used as the specific negative control for the appropriate test fume exposure. For fume exposure E308-16, the control urines collected from 10 animals per sex were treated in a similar manner and constituted the negative control for this test.

Mutagenicity Assay

1. Preparation of the Test Material. Sufficient weight of each residual material from each pooled urine sample was weighed and dissolved in deionized glass distilled water (DGDH₂O) to yield a 100 mg/ml solution. It should be noted that reconstitution of all residues resulted in cloudy, homogenous suspensions. The test suspensions for fume exposure groups, prepared as

described, were further diluted 1:10 in DGDH₂O; therefore, two concentrations of the residue collected from urine pooled by sex and postexposure time for each test fume exposure were evaluated in the *Salmonella*/Mammalian Microsome Mutational Assay. All control residues were prepared in DGDH₂O to contain 100 mg/ml, and were tested at a single concentration.

2. Mutational Assay. Exposure of the auxotrophic *S. typhimurium* strains to the concentrated urine samples was accomplished by the plate incorporation assay. For induction of reverse mutations, the reconstituted urine samples, prepared as described, were tested against five bacterial strains: TA1535, TA1537, TA1538, TA98 and TA100, with and without S-9 metabolic activation. Pooled urine samples from test animals and controls were plated in triplicate.

To each 2.5 ml of complete top agar the following were added: 0.1 ml of an overnight broth culture of each tester strain and 0.1 ml of the appropriate dilution of reconstituted test urine or control urine. For the activated phase of testing, 0.5 ml of the S-9 mix and 0.1 ml of a Beta-glucuronidase preparation were also added. The contents of the tube were mixed thoroughly and poured onto VBE minimal agar plates. Concentrated urine collected from animals administered the positive control were treated in a similar manner.

Plates were gently rotated and tilted to assure uniform distribution of the top agar, allowed to harden on an even surface for one hour, inverted and put into a dark 37°C ± 0.5°C incubator. After two days, the colonies in both test plates and controls were counted using an electronic colony counter.

3. Positive Control Compounds. In addition to the positive urine control, the following known mutagens were included in the experiment:

Strain	Minus S-9	Plus S-9
TA1535	MNNG (5 µg/plate)	2-AA (5 µg/plate)
TA1537	9-AA (75 µg/plate)	2-AA (5 µg/plate)
TA1538	2-NF (50 µg/plate)	2-AA (5 µg/plate)
TA98	2-NF (50 µg/plate)	2-AA (5 µg/plate)
TA100	MNNG (5 µg/plate)	2-AA (5 µg/plate)

4. Metabolic Activation. The mammalian microsome fraction used for metabolic activation was prepared from male Sprague-Dawley rats. The liver homogenate (S-9) was prepared in advance and stored frozen until used.

A. Preparation of Liver Homogenate (S-9). Enzymes were induced in male Sprague-Dawley rats by a single intraperitoneal injection of a polychlorinated biphenyl mixture (200 mg Monsanto Aroclor 1254 in

corn oil) at a dosage of 500 mg/kg five days before sacrifice. The animals were deprived of food and water prior to sacrifice.

The rats were sacrificed by decapitation, the livers removed, placed in sterile ice-cold beakers, and washed in an equal volume of 0.15 M KCl. All livers were minced with sterile scissors in three volumes of the sterile KCl rinsing solution and homogenized. The homogenates were centrifuged at 9000Xg in a refrigerated centrifuge and the supernate (S-9 fraction) was retained. The S-9 fraction was distributed in aliquots quickly frozen on dry ice, and stored in a freezer. As needed, sufficient aliquots of the S-9 fraction were thawed and kept on ice until incorporated into the S-9 mix. The unused portion was discarded at the end of the day.

B. Preparation of S-9 Mix. The S-9 mix contained per ml:

(1) S-9	0.05 ml ⁸
(2) MgCl ₂ - 0.4 M	0.02 ml
(3) KCl - 1.65 M	0.02 ml
(4) NADP - 0.05 M	0.08 ml
(5) glucose-6-phosphate - 0.1 M	0.05 ml
(6) sodium phosphate pH 7.4 - 0.2 M	0.50 ml
(7) H ₂ O	0.28 ml
	1.00 ml

The S-9 mix was freshly prepared on the day of the experiment. Ingredients (1), (2), (3), (6) and (7) were mixed and passed through a Millipore prefilter, a 0.8 µ membrane and a 0.45 µ sterile membrane. Ingredients (4) and (5) were aseptically added following filtration. The S-9 mix was kept on ice; the unused portion was discarded at the end of the day. Stock solutions of MgCl₂, KCl and NaH₂PO₄ were stored in the refrigerator; stocks of reagents G-6-PO₄ and NADP were held in a freezer.

C. Preparation of Beta-glucuronidase. Beta-glucuronidase was prepared at a concentration of 2.5 mg/ml in phosphate buffer, filter-sterilized, and kept on ice; the unused portion was discarded at the end of the day.

Subgroup B — *In Vivo* Rat Alveolar Macrophage Assay

Procedure

Media and Reagents. All media and reagents, including serum, required for this program were prepared in bulk

8. The appropriate amount of S-9 to be added was determined on the basis of standardization experiments using the promutagens: 2-acetylaminofluorene and 2-AA.

prior to the start of this program. Storage was appropriate, so that no degradation of media or reagents occurred.

Test System Information. The respiratory system has effective mucociliary transport and phagocytic cells that prevent the accumulation of inhaled particles in the lung and clear them away from the respiratory membrane.

Alveolar macrophages are phagocytes located on the surface of the small airways and in the alveoli of the lungs. These cells actively engulf bacteria and foreign particles that enter the lung and they detoxify these foreign substances. Since alveolar macrophages play a vital role in maintaining normal lung function, it is of considerable importance to determine the effects of potential environmental pollutants in these cells.

This work was designed to study the effects of six welding fumes on the alveolar macrophage cells lavaged from the lungs. Viability was assessed by trypan blue exclusions. Ability of macrophages to utilize oxidative phosphorylation was determined by measuring ATP levels. Phagocytic activity of the cells was assessed using an *in vitro* challenge to latex particles. In order to examine the impact of phagosomal welding fumes on lysosomal enzyme content, the cellular activities of lysozyme and acid phosphatase were determined.

A separate group of 10 clinically healthy Sprague-Dawley descended rats (five males and five females) aged eight to nine weeks were used for each fume tested. In addition, a common control group of 12 males and 12 females was evaluated. Only cell preparations free of mucous and blood were used for the assay.

Methodology. Alveolar macrophages from each exposed animal were cultured separately. Concurrent CCB control animals (two per sex) were included for each fume and the results pooled. A separate control group of five per sex was used for the E308-16 exposure test.

Lung Lavage. Approximately 20 hours following the six-hour exposure, the animals were euthanized by i.p. injection of sodium pentobarbital just before lung lavage via tracheostomy. The site for tracheal incision was washed thoroughly with alcohol, and the tracheostomy performed using aseptic techniques. Sterile saline (0.85 NaCl solution) containing penicillin (100 units/ml) (Gibco), streptomycin (100 µg/ml) (Gibco) and Kanamycin (100 µg/ml) (Gibco) was warmed to 37°C and used to lavage the lungs *in situ*. The first instillation was allowed to remain in the lungs for 15 minutes, and five subsequent instillations were removed immediately.

Cells from the lavage fluid were then pelleted by centrifugation at 1200 rpm for 10 minutes. The supernatant was removed and the cells resuspended in growth medium. An aliquot of this suspension was mixed with

0.4 percent trypan blue (Gibco) and counted in a hemocytometer. Total cells, percent live cells (unstained), and percent dead cells were recorded. The remaining cells were pelleted again and resuspended in prewarmed Medium 199 (Gibco) with Hank's balanced salt solution supplemented with 20 percent heat-inactivated, fetal bovine serum, 100 units/ml penicillin, 100 µg/ml streptomycin, and 100 µg/ml Kanamycin.

A cell count was performed and the suspension adjusted to approximately 1×10^6 cells/ml.

Design. Cells from each animal were established as individual cultures. Depending on the number of cells obtained from each animal, one to three cultures were established per animal. Initial viabilities were also measured. Only preparations having at least 95 percent viability were used in culture. The cell cultures were incubated at $37^\circ\text{C} \pm 0.5^\circ\text{C}$ in a humidified atmosphere with 5 percent CO_2 in air for 20 hours.

At the end of incubation, the medium containing unattached cells was decanted into a centrifuge tube. The attached cells were removed by trypsinization using trypsin—EDTA (0.25%) (Gibco). For each sample, the original medium and trypsinized cells were combined and separate aliquots of cells were removed for viability, ATP, lysozyme, acid phosphatase, and phagocytosis determinations.

Viability Determination. The cell viability was determined by counting the number of cells that excluded trypan blue dye (live), the number of cells that retained the dye (dead), and summing for total cells. Percentages of viable cells and a viability index were calculated for each culture.

Cellular ATP Determination. An aliquot of cells was removed from each starting cell suspension which contained viable and nonviable cells, and an equal volume of ATP-releasing reagent (Turner) and Hepes buffer (Turner) was added to the cells. The sample was placed into a photometer (Turner Instruments), and a luciferin-luciferase reaction mixture (Turner) was dispensed into the sample. The ATP in each sample of cells was calculated by comparison to an internal ATP standard (Turner).

Lysozyme Determination. For each culture, a sample of sonicated cell extract, prepared from each starting cell suspension, was added to an equal volume of *Micrococcus luteus* and incubated for 30 seconds at room temperature. Results were determined by reading the change in percent light transmission of the suspension at 645 nm. Enzyme determination was calculated by comparison to an internal crystalline lysozyme standard.

Acid Phosphatase Determination. For each culture, a sample of sonicated cell extract, prepared from each starting cell suspension, was placed on ice and 16 nM disodium p-nitrophenyl phosphate (Sigma) was added. The reaction tubes were incubated at 37°C. After 30 minutes, the incubation tubes were returned to the ice bath and 0.25N NaOH was added to stop the reaction. Each tube was vortexed and absorbance at 410 nm was read for each sample. Enzyme determination was calculated by comparison to an enzyme standard.

Phagocytosis Determination. Freshly isolated rat alveolar macrophage cells were placed in six-well dishes containing coverslips, and polystyrene latex particles (1.0 μ m diameter) were added to each culture at approximately 20 latex particles per macrophage. Cultures were placed at 37°C. After 30 minutes incubation, each culture was fixed, and stained with Giemsa, destained with 10 percent rosin, and rinsed in ethanol. The slides were processed in 100 percent xylene for three hours to remove extracellular particles.

The phagocytic index was determined for each culture by microscopically counting 200 macrophages per culture. Macrophages were classified according to numbers of latex spheres phagocytized: 0, 1-3, 4-6, 7-9, or >10. Results of cultures exposed to welding fumes were compared with control cultures and statistical differences noted, if present. Macrophages containing at least one particle were considered to be functionally active. Macrophages containing 10 particles or more were not considered to be functionally active due to the inability to distinguish particles from debris.

Statistical Analyses. Viability, cellular ATP, lysozyme, acid phosphatase, and phagocytosis determinations were analyzed by a Student's t-test (Snedecor and Cochran, 1980). All analyses were evaluated at the 5.0 percent one-tailed probability level.

Subgroups C, D, and CCD — *In Vivo* Bone Marrow Cytogenetic Analysis

Procedure

Administration of Colchicine. Twenty hours after removal from the exposure chamber, five animals per sex (Subgroup C) per fume, and 70 hours after removal from the chamber another five animals per sex (Subgroup D) per fume, and 10 common control animals per sex (Subgroup CCD, plus 10 additional control animals per sex for the E308-16 fume only), were administered colchicine by intraperitoneal injection at 2.0 mg/kg body weight (dosing factor = 5.0 ml/kg) to inhibit mitosis and arrest cells in metaphase. The colchicine was dissolved in Hank's Balanced Salt Solution (HBSS).

Sacrifice of Animals. Approximately two hours after injection of colchicine, the animals were sacrificed by injection of sodium pentobarbital.

Cytogenetic Techniques

1. Preparation of Slides. The bone marrow cells were processed according to the modified techniques described by Evans (1976) and Killian, et al. (1977). Immediately following sacrifice, bone marrow cells were collected from both femurs of each animal by aspiration into 5 ml of HBSS, prewarmed to 37°C. The aspirate was centrifuged for five minutes at approximately 1100 rpm. The supernate was decanted and 7.0 ml of prewarmed (37°C) 0.075M KCl were added to each tube. After 25 minutes, five drops of freshly prepared fixative (methanol:acetic acid, 3:1) were added to each tube. The tubes were immediately capped, gently inverted to mix the contents and centrifuged for five minutes at 1100 rpm. The supernate was decanted, and 5.0 ml of fixative was added slowly down the sides of each tube. The cells were resuspended and recentrifuged for five minutes. The supernate was discarded, and a new addition of 5.0 ml of fresh fixative was added to each tube. The cells were washed once more with fixative, then refrigerated. The chilled preparations were centrifuged at ~1100 rpm for five minutes, the supernate was decanted and the cells suspended in 0.5-2.0 ml fresh fixative. Several drops of the final cell suspension were dispersed onto precleaned glass microscope slides and air-dried. Cell density was checked using a phase-contrast microscope. Two slides were made for each animal and were marked with the animal's identification number.

2. Stain Preparation. Fresh stain was prepared by mixing 10 ml of Giemsa stain (Harleco) with 240 ml of glass distilled deionized water. The cells were stained in this solution for 10 minutes. Slides were rinsed twice in glass distilled water, air-dried, and subsequently mounted with glass cover slips in CoverBond® mounting media.

Cytogenetic Analysis

1. Chromosome Evaluation. After all slides were prepared, stained, and cover-slipped, a code number was temporarily assigned to each animal by a person not involved in the scoring of the slides. The slides were not decoded until all had been analyzed.

An attempt was made to examine at least 50 cells in metaphase from each group. In some instances, it was not possible to locate 50 spreads, so as many spreads as could be found were analyzed. The slides were scanned with a low power objective (10X or 25X) to find cells in the metaphase stage, and the chromosomes were analyzed with high power oil immersion lens (100X). Only those cells in the metaphase stage of mitosis were

analyzed for the presence of cytogenetic abnormalities. The following items were recorded for each animal: numbers and types of chromosomal aberrations, mitotic index, modal number for each metaphase, and the vernier location of each metaphase containing damage. The mitotic index was recorded as the number of cells undergoing mitosis per 500 cells counted and was represented as a percentage.

2. Classification of Cytogenetic Aberrations. Chromosomal aberrations were characterized as follows:

- (1) chromatid breaks—including fragments and deletions
- (2) chromosome breaks—including acentric fragments, deletions, and minutes
- (3) chromatid and chromosome gaps
- (4) exchanges—rings, dicentrics, translocations, quadriradials and triradials
- (5) cells with ≥ 10 aberrations
- (6) pulverized cells

Chromatid aberrations involve a break in only one arm of the chromosome; chromosomal aberrations involve both arms at identical sites. A break is defined as any separation that exceeds the width of a chromatid arm or a discontinuity accompanied by disturbance of the axial integrity. A break may or may not be associated with an identifiable piece of displaced chromatid material; i.e., fragment.

Chromatid and chromosome gaps are paucities in the stain involving one or both chromatid arms, and are less than the width of the arm(s). The origin of this type of damage is still in question and, although recorded, was not included in the statistical analysis.

Aberrant configurations which alter the structural appearance of an entire chromosome or involve the joining together of more than one chromosome were categorized as exchanges. Exchanges consist of dicentrics, rings, translocations, triradials, and quadriradials. Those cells with 10 or more scorable aberrations were classified separately. Thus, when determining the total number of aberrations in the cells analyzed for each individual animal, cells with ≥ 10 aberrations were counted as 10 aberrations, as suggested by Killian, et al. (1977).

3. Statistical Analyses. Upon completion of all scoring, the slides were decoded and the data was collated into the appropriate groups for statistical analyses.

The mean mitotic indices, mean modal numbers, percent aberrant cells, and the mean number of aberrations per cell for each group were statistically compared using the Kruskal-Wallis nonparametric analysis of variance and nonparametric pairwise group comparisons (Kruskal and Wallis, 1952; 1966). All tests were one-tailed at the 95 percent confidence interval ($p \leq 0.05$).

Subgroup B—*In Vitro* Rat Alveolar Macrophage Assay

Procedure

Test Materials

1. Collection of Fumes. For each of the six fumes generated, approximately a 100 mg gravimetric sample was taken on Gelman GN-6 membrane filters during the third hour of exposure. Immediately after removal from the chamber, each sample was weighed and stored in a glass vial under nitrogen for no more than 30 minutes before use in the *in vitro* assay.

2. Control Articles. Cell culture medium was used as the negative control. Cab-O-Sil at 50 $\mu\text{g}/\text{ml}$ in saline solution (see *Lung Lavage*) was used as the positive control.

3. Media and Reagents. All media and reagents, including serum, required for this program were prepared in bulk prior to the start of this program. Storage was appropriate, so that no degradation of media or reagents occurred.

Test System Information. A separate group of 26 clinically healthy animals (13 males and 13 females) aged eight to nine weeks, and breathing only ambient laboratory air, was used to obtain macrophages for each fume tested. Only individual lung lavage preparations free of mucous and blood were used. From each group of animals, a pooled sample of the lavage fluid was stained with Giemsa and checked for cell type. Preparations were pooled and all had at least 90 percent macrophages and initial macrophage viabilities of at least 95 percent.

Methodology. Each fume was tested at eight half-log concentrations of fume particulate in triplicate, beginning at 10,000 $\mu\text{g}/\text{ml}$. Appropriate negative and positive controls were included in each assay.

Lung Lavage. On the day of sacrifice, the animals were euthanized by i.p. injection of sodium pentobarbital just before lung lavage via tracheostomy. The site for tracheal incision was washed thoroughly with alcohol, and the tracheostomy performed using aseptic techniques. Sterile saline (0.85% NaCl solution) containing penicillin (100 units/ml), streptomycin (100 $\mu\text{g}/\text{ml}$) and Kanamycin (100 $\mu\text{g}/\text{ml}$) was warmed to 37°C and used to lavage the lungs *in situ*. The first instillation was allowed to remain in the lungs for 15 minutes, and five subsequent instillations were removed immediately.

Cells from the lavage fluid were then pelleted by centrifugation at 1200 rpm for 10 minutes. The supernatant was removed and the cells resuspended in growth medium. A portion of this suspension was mixed with

0.4 percent trypan blue and counted on a hemocytometer. Total cells, percent live cells (unstained), and percent viable cells and viability index were recorded. The remaining cells were pelleted again and resuspended in prewarmed Medium 199 with Hank's balanced salt solution supplemented with 20 percent heat-inactivated fetal bovine serum, 100 units/ml of penicillin, 100 $\mu\text{g}/\text{ml}$ streptomycin and 100 $\mu\text{g}/\text{ml}$ Kanamycin.

A cell count was performed and the suspension adjusted to approximately 1×10^6 cells/ml. The prepared cell suspension was added to each of three cell culture wells just prior to treatment with the fume sample dilutions.

Design and Treatments. For each of the six fumes generated, a special gravimetric sample was collected on three or more Gelman GN-6 membrane filters during the third hour of exposure. After removal from the chamber, this sample was weighed immediately and stored in a glass vial under nitrogen for not more than 30 minutes. Approximately 100 mg of each fume was collected in this manner.

Each filter was then extracted with an appropriate volume of medium and sonicated to remove any remaining particulates from the filter. Stock suspensions of particulate sample were prepared to contain the fume particulate at approximately 2000 $\mu\text{g}/\text{ml}$ on a weight per volume basis. This was $\approx 2X$ concentration of the highest test concentration.

The collected test fume suspension was then added to the media in eight half-log concentration levels, starting at 10,000 $\mu\text{g}/\text{ml}$. Each assay (for each concentration) was performed in triplicate. The suspensions were then incubated at $37^\circ \pm 0.5^\circ\text{C}$ in a humidified atmosphere of 5 percent CO_2 in air for a period of 20 hours.

Viability Determinations. At the end of the incubation, the medium containing unattached cells was decanted into a centrifuge tube. The attached cells were removed by trypsinization, using trypsin-EDTA (0.25%). For each sample, the original medium and the trypsinized cells were combined and an aliquot of cells removed for each of the following determinations: viability, ATP, lysozyme, acid phosphatase, and phagocytosis.

Cell Viability Determination. The cell viability was determined by recording total cells counted, percent cells excluding trypan blue (live), and percent cells retaining the dye (dead). In addition, the concentration of collected fume that reduced cell viability by 50 percent (the EC_{50}) was determined. All six fumes were evaluated in this manner and compared with both positive and negative control groups and with each other.

Cellular ATP Determination. An aliquot of cell suspension was removed from the culture, and an equal volume of ATP-releasing reagent and Hepes buffer was added to the cells. The sample was placed into a photometer (Turner Instruments) and a luciferin-luciferase reaction mixture was dispensed into the sample. The ATP in each sample of cells was calculated by comparison to a concurrent ATP standard.

Lysozyme Determination. For each culture, a sample of sonicated cell extract was added to an equal volume of *Micrococcus luteus* and incubated for 30 seconds at room temperature. Results were determined by reading the change in percent light transmission of the suspension at 645 nm. Enzyme determination was calculated by comparison to a crystalline lysozyme standard.

Acid Phosphatase Determination. For each culture, a sample of sonicated cell extract was placed on ice, and 16 nM disodium-p-nitrophenyl phosphate was added. The reaction tubes were incubated at 37°C . After 30 minutes, the incubation tubes were returned to the ice bath, and 0.25N NaOH was added to stop the reaction. Each tube was vortexed and absorbance at 410 nm was read for each sample. Enzyme determination was calculated by comparison to an enzyme standard.

Phagocytosis Determination. Freshly isolated rat alveolar macrophage cells were placed in six-well dishes containing coverslips, and polystyrene latex particles (1.0 μm diameter) were added to each culture at approximately 20 latex particles per macrophage. Cultures were placed at 37°C . After 30 minutes incubation, each culture was fixed, and stained with Giemsa, destained with 10 percent rosin, and rinsed in ethanol. The slides were processed in 100 percent xylene for three hours to remove extracellular particles.

The phagocytic index was determined for each culture by microscopically counting 200 macrophages per culture. Macrophages were classified according to numbers of latex spheres phagocytized: 0, 1-3, 4-6, 7-9, or 10. Results of cultures exposed to welding fumes were compared with control cultures and statistical differences noted, if present. Macrophages containing at least one particle were considered to be functionally active. Macrophages containing 10 particles or more were not considered to be functionally active due to the inability to distinguish particles from debris.

Statistical Analyses. Viability, cellular ATP, lysozyme, acid phosphatase, and phagocytosis determinations were analyzed by a Student's t-test (Snedecor and Cochran, 1980). All analyses were evaluated at the 5.0 percent one-tailed probability level.

Results

Gravimetric Concentrations

The mean ($\pm$ S.D.) particulate concentration for each exposure is presented in Table 2, along with the mean data for the other chamber parameters monitored during exposures.

Individual and mean gravimetric concentration values for each exposure are presented in Appendix 1.

Particle Size Analyses

Individual mass median aerodynamic diameters (MMAD's) and geometric standard deviations (σ_g 's) are presented in Appendix 2.

Test Atmospheric Gas Concentrations

Hourly test concentrations of oxygen, ozone, nitrogen oxides (NO_2 and $\text{NO} + \text{NO}_2$), and carbon monoxide are presented in Appendix 3.

Temperature and Relative Humidity

Hourly temperature and relative humidity readings in test and control chambers are presented in Appendix 4.

Subgroups A and CCA

Body Weights and Clinical Observations

Individual and mean body weights are presented in Appendices 5A and 5B. Group mean body weights are presented in Tables 1A and 1B (Complete Report). Clinical observations and mortality (by group) are summarized in Tables 2A and 2B (Complete Report).

No treatment-related trends were noted in the mean body weights although mean body weights of the E70S-3

males were significantly lower than CCA males at Day 7. This was not considered to be biologically significant because this group had a somewhat lower mean at Day 1 (pre-exposure) when compared to the CCA control group. All remaining postexposure body weight data were comparable to the CCA control group.

Clinical signs noted among the E308-16 Subgroup A (initial test) rats included rhinorrhea, salivation, and urine stains around the anus as well as dyspnea during the exposure. All these animals were found dead by Day 3. Signs noted among rats exposed to E7018, E6010, and E70T-1 fumes, as well as to fume on the second E308-16 exposure, included dyspnea, polypnea, wheezing, and bloody crust on the muzzle as well as brown dust or stain on the fur. One E308-16 second exposure female died during Day 1 postexposure. All E5356 and E70S-3 animals appeared normal except for brown dust on the fur in the latter group. All animals surviving for 14 days appeared normal by Day 2 postexposure.

Gross Pathology

Individual gross pathology findings are presented in Appendix 6 (Complete Report). Summarized findings are presented in Table 3 (Complete Report).

The majority of the gross pathology found was comparable to that in the CCA control group or incidental in nature. Gross pathology findings noted at a greater incidence in the fume-exposed groups were noted in the lung and kidneys. Findings in the lungs of exposed rats included failure to collapse, mottled, dark, firm, and pale focus(i)/area(s) in the E70S-3, E308-16, and E7018 animals, and findings in the kidneys included dark focus(i)/area(s), fluid under the capsule, or fluid-filled, dilated pelvis(es), and granular material in the E70T-1 animals. Dilated pelvis(es) were also noted in some control animals, rendering this finding ambiguous.

Table 2
Measured Mean Fume Characteristics

Electrode	Particulate Concentration mg/liter	Particle Size		O_2 %	O_3 ppm	NO_x ppm	NO_2 ppm	CO ppm	Temp. °F	R.H. %
		MMAD μ	$\pm \sigma_g$							
E70S-3	0.672 $\pm$ 0.138	0.765	2.24	19.7	0	2.5	<0.5	797	78	51
E308-16	0.601 $\pm$ 0.098	1.08	1.54	19.4	0	9.6	0	47.6	79	61
E7018	0.641 $\pm$ 0.132	0.890	1.78	19.3	0	16.8	<0.5	69.2	76	44
E6010	0.551 $\pm$ 0.084	0.860	2.06	19.7	0	11.3	0	41.2	78	45
E70T-1	0.890 $\pm$ 0.187	0.865	2.16	19.6	0	4.3	0	931	78	41
E5356	0.559 $\pm$ 0.066	0.845	2.11	19.6	0	20.0	0	2.5	77	51
E308-16	0.268 $\pm$ 0.117	1.02	2.13	19.5	0	9.5	0	37.0	77	33

Terminal Body Weights, Organ Weights, and Organ/Body Weight Ratios

Individual terminal body weights, organ weights, and organ/body weight ratios are presented in Appendix 7 (Complete Report). Mean values are presented in Table 4 (Complete Report).

Terminal body weights were comparable between the CCA control group and all fume-exposed groups.

Several occurrences of statistically significant organ weight differences were noted between the CCA control group and the fume-exposed groups as indicated in the chart below.

Lung Wet/Dry Weight Ratios

Lung wet/dry weights and wet/dry ratios are presented in Appendix 8 (Complete Report) and the means are presented in Table 5 (Complete Report).

Analysis of wet and dry lung weights revealed significant increases in the E7018 wet lung weights of males and females and the E70T-1 wet and dry lung weights of females. No significance in wet/dry lung ratios was observed.

Histopathology

Individual histopathology findings are presented in Appendix 9 (Complete Report). Findings are summarized in Table 6 (Complete Report).

E70S-3 — Pigmented macrophages were present in alveoli of all treated rats. One female had a minimal focal acute pneumonitis.

E7018 — Minimal to slight increases in pigmented macrophages were noted in alveoli in all but one treated rat. Occasional increases in normal alveolar macrophages were noted also.

E6010 — Minimal to moderate increases in pigmented macrophages were noted in all treated rats.

Minimal multifocal perivascular edema was noted in two males.

E70T-1 — Slight to moderate increases in pigmented macrophages were noted in all treated rats.

E5356 — Minimal increases in pigmented macrophages were noted in two male and one female treated rat. Minimal to slight increases in nonpigmented alveolar macrophages were noted in two animals of each sex. Five animals were completely unremarkable.

E308-16 (Initial Test) — All treated rats died prior to the scheduled sacrifice (see second test results below).

E308-16 (Second Test) — Lungs from treated animals of both sexes had variable numbers of pigmented macrophages, largely in the alveoli. In addition, two treated female rats had perivascular edema with one of those (died) having an acute pneumonitis (interstitial pneumonia). No other changes were noted. The presence of pigmented macrophages indicated that the test material was reaching the level of the alveoli and was being phagocytized and removed in a normal manner. The edema and pneumonia in two females indicated a moderate irritation with breakdown of vascular integrity. The change in the rat with pneumonitis was considered to be the cause of death (the animal died prior to 14 days postexposure). Welding fume generated from electrode E308-16 was noted to cause a persisting mild to moderate irritation and edema in the lungs of some female rats exposed to 0.27 mg per liter by inhalation for six hours. Male rats and three of five female rats showed only normal phagocytic response 14 days after the exposure.

Subgroup A — Body Fluid Mutagenicity Assay

The mean number of revertant colonies in the five *S. typhimurium* strains tested with pooled, concentrated, and reconstituted urine samples collected from male and

Males				
Parameter	E6010	E5356	E70S-3	E308-16 E7018 (second test)
Lung weight	S+	S+		
Lung/body weight ratio	S+			S+
Heart weight			S-	S-
Females				
Parameter	E70T-1	E5356	E7018	E308-16 (second test)
Lung weight	S+	S+	S+	S+
Lung/body weight ratio	S+	S+	S+	

female rats following exposure to the fumes of the six electrodes are shown in Tables 7-12 (Complete Report). The results indicated that none of the six fumes produced detectable levels of mutagenic urinary contents or metabolites, as evidenced by the lack of a two-fold or greater increase in revertant colonies at either of the test concentrations as compared to the appropriate control series. These findings were not altered by the inclusion of metabolic activation and Beta-glucuronidase into the test system.

Diagnostic positive controls with an agent (2-AA) that produces known urinary mutagenic metabolites along with standard controls for this assay are included with each table and confirm the sensitivity of the test system to detect mutagenic activity.

Subgroup B—*In Vivo* Rat Alveolar Macrophage Assay

Test System Information

Body weights of animals used in the study appear in Appendices 10A through 10F (Complete Report). No statistical differences were observed in mean body weights of animals exposed to the different fumes as compared to controls. The cell recovery and percentage of macrophage from each lavage fluid was determined. These data also appear in Appendices 10A through 10F (Complete Report).

As shown in Tables 13 and 14 (Complete Report), statistically significant decreases in cell recovery and in percentage macrophages were observed in all exposed male groups. Statistically significant decreases in cell recovery and in percentage macrophages were also observed in females exposed to Fumes E7018 and E70T-1. There were not enough cells to evaluate Fume E6010.

No cultures were set up for animals exposed to Fume E308-16 because all lavages yielded bloody preparations.

Viability Determinations

Initial viabilities were determined for each lavage fluid. Macrophage viability was again measured at 20 hours after culture initiation. No statistical differences in viabilities were observed for animals exposed to any fume. These results appear in Appendices 11A through 11F (Complete Report), and are summarized in Table 15A (Complete Report).

Phagocytosis

The effect of each fume on phagocytic ability of macrophages from exposed animals was determined. These results appear in Appendices 11A through 11F (Complete Report), and are summarized in Table 15B (Complete Report). Apparent decreases in phagocytic

ability were observed in males and females for all fumes studied except Fume E5356. Preparations from Fume E70S-3 male and Fumes E7018 and E6010 females, had too few samples to evaluate statistically. No cultures were set up for animals exposed to Fume E3018-16. This decrease may be due to the inability to distinguish between particle ingestion and debris when counting greater than 10 particles, and may not be physiological due to this limitation of the test system.

ATP Determinations

The effect of each fume on ATP levels in macrophages from exposed animals was determined. These results appear in Appendices 12A through 12F (Complete Report). Significant differences in ATP levels (Table 16) were observed for male rats exposed to Fumes E70S-3, E6010, E70T-1, and E5356, and for female rats exposed to Fumes E70S-3, E70T-1, and E5356. No results were obtained from males exposed to Fumes E308-16 and E7018, and females exposed to Fumes E308-16, E7018, and E6010 due to bloody preparations or too few cells recovered.

Acid Phosphatase Determination

The effect of each fume on acid phosphatase in macrophages from exposed animals was determined. These results appear in Appendices 12A through 12F (Complete Report). Statistically significant increases in acid phosphatase (Table 17) levels were observed for Fume E70S-3 male and females. This fume was the only fume of the six fumes evaluated statistically for this parameter. No data were available for evaluation of the other fumes due to bloody preparations or insufficient cells recovered as noted in Table 17 (Complete Report).

Lysozyme Determination

The effect of each fume on lysozyme in macrophages from exposed animals was determined. These results appear in Appendices 12A through 12F (Complete Report), and are summarized in Table 18 (Complete Report). As noted in Table 18, no statistical data is available comparing lysozyme levels of exposed animals with control levels.

Subgroups C, D, and CCD—*In Vivo* Bone Marrow Cytogenetic Analysis

Cytogenetic Analysis

A summary of the chromosomal aberration data is presented in Table 20 (Complete Report). Individual animal data are presented in Appendix 13 (Complete Report).

Results from the analysis of data showed no statistically significant increase in the frequency of chromosomal aberrations compared to the control value in any of the six groups exposed to welding fumes.

Modal Number

The mean modal number and standard deviation for each group are presented in Table 21 (Complete Report).

The average number of chromosomes in the examined metaphases was determined for each animal, and all test groups were statistically compared to the appropriate control group. Rats have a normal diploid chromosome number of 42. Statistical analysis revealed a small but significant increase in the E7018 test animals versus their control animals at 20 hours postexposure ($p = 0.0117$) but not at 70 hours.

Mitotic Index

The number of cells undergoing mitosis per 500 cells counted (mitotic index) was determined for each animal. The mean mitotic index and standard deviation for each group appear in Table 22 (Complete Report).

No statistically significant differences between the mean mitotic indices of the test groups and the controls were seen.

Subgroup B — *In Vitro* Rat Alveolar Macrophage Assay

Viability Determinations

Macrophage viabilities and viability indices were determined for each of the six fumes, and the results appear in Tables 23A through 23F (Complete Report). From these results, the concentration of fume particulates that reduced viability by 50 percent (EC_{50}) was calculated by graphing the percent viable for each fume. Relative toxicities of the six fumes were determined by comparing the EC_{50} values as shown in Table 24 (Complete Report).

Phagocytosis

The effect of each fume on the phagocytic ability of rat alveolar macrophages was determined. These results are presented in Tables 25A through 25F (Complete Report). Fume E6010 depressed phagocytic activity of rat alveolar macrophage cells at 1089 $\mu\text{g}/\text{ml}$; at higher concentrations, no intact cells were observed. Fume E308-16 depressed phagocytic activity at 13 and 39 $\mu\text{g}/\text{ml}$; at higher concentrations, no intact cells were observed. Fume E7018 depressed activity at 39 $\mu\text{g}/\text{ml}$ and Fume

E70T-1 at 118 $\mu\text{g}/\text{ml}$; at higher concentrations, no intact cells were observed. Fume E5356 was depressed at 359 $\mu\text{g}/\text{ml}$, but cells remained up to 72 percent viable at 3300 $\mu\text{g}/\text{ml}$. Fume E70S-3 showed close to normal phagocytic activity and viability at all concentrations tested.

ATP Determinations

The effect of each fume on cellular ATP levels was determined. These results appear in Tables 26A through 26F (Complete Report). ATP values were significantly different than controls for Fume E70S-3 at 359, 1089, 3300, and 10,000 $\mu\text{g}/\text{ml}$; for Fume E308-16 at all concentrations; for E7018 at all concentrations; for E6010 beginning at 359 $\mu\text{g}/\text{ml}$; for E70T-1 at 359, 1089, and 10,000 $\mu\text{g}/\text{ml}$; and for Fume E5356 at 1089 $\mu\text{g}/\text{ml}$ through 10,000 $\mu\text{g}/\text{ml}$. ATP values were significantly lower than controls for Fume E5356 at 1089, 3300, and 10,000 $\mu\text{g}/\text{ml}$; for Fume E70S-3 at 359, 1089, 3300, and 10,000 $\mu\text{g}/\text{ml}$; for Fume E70T-1 at 359, 1089, 3300, and 10,000 $\mu\text{g}/\text{ml}$; for Fume E6010 at 359, 1089, 3300, and 10,000 $\mu\text{g}/\text{ml}$; and for Fumes E7018 and E308-16 at all concentrations.

Acid Phosphatase Determinations

The effect of each fume on cellular acid phosphatase levels was determined. These results appear in Tables 27A through 27F (Complete Report). Acid phosphatase values were significantly lower than controls for Fume E70S-3 beginning at 4 $\mu\text{g}/\text{ml}$, but higher at 39 and 110 $\mu\text{g}/\text{ml}$. At 359 $\mu\text{g}/\text{ml}$, the samples were too turbid to read. There was no effect on acid phosphatase levels following exposure to up to 1089 $\mu\text{g}/\text{ml}$ of Fume E308-16; concentrations greater than 1089 $\mu\text{g}/\text{ml}$ were too turbid to read. Values were also significantly lower for Fume E7018 at 13, 39, and 359 $\mu\text{g}/\text{ml}$, and at 4, 13, 39, and 359 $\mu\text{g}/\text{ml}$ for Fume E6010. At the higher concentrations, the samples were too turbid to read. Acid phosphatase levels were significantly higher at 4, 39, and 118 $\mu\text{g}/\text{ml}$ of Fume E70T-1, and too turbid to read at the higher concentrations. Fume E5356 was significantly lower only at 13 $\mu\text{g}/\text{ml}$ and too turbid to read beginning at concentrations of 359 $\mu\text{g}/\text{ml}$.

Lysozyme Determinations

The effect of each fume on cellular lysozyme was determined. These results are presented in Tables 28A through 28F (Complete Report). No significant differences were observed between control values and any of the six fumes. It is important to note here the wide range in values among triplicate samples.

Table 1A
Mean Body Weights and Standard Deviations (grams)
Toxicity Study of Welding Fumes in Rats

2235-100/101

Group		Pre-Exposure	Day Postexposure				Found Dead
		Day 1	Day 1	Day 7	Day 14	Day 15	
MALES							
Control Group CCA	Mean	287.3	273.7	309.2	328.8	298.3	
	S.D.	18.68	18.42	17.49	30.95	23.36	
E5356—Group A	Mean	286.4	276.0	319.0	353.4	320.6	
	S.D.	31.55	28.59	20.54	15.14	16.01	
E70S-3—Group A	Mean	263.4	249.8	279.4 ^{S-}	303.8	281.8	
	S.D.	9.61	8.14	11.17	11.48	8.76	
E70T-1—Group A	Mean	284.8	270.8	303.2	346.2	310.8	
	S.D.	23.58	18.61	28.67	34.56	32.44	
E308-16—Group A ^a	Mean	287.8	263.6				239.0 14.16
	S.D.	5.54	4.28				
E6010—Group A	Mean	279.2	263.6	302.0	341.6	308.0	
	S.D.	10.35	9.37	5.79	4.51	5.74	
E7018—Group A	Mean	289.2	273.8	309.8	338.0	305.8	
	S.D.	30.71	27.62	23.64	26.28	23.03	
E308-16—Group A (Repeat)	Mean	261.4	249.2	277.0	326.8	289.6	
	S.D.	9.21	8.87	18.87	19.28	20.23	
Control Group CCA (Repeat)	Mean	255.8	245.0	288.8	317.6	286.8	
	S.D.	17.34	14.20	11.82	16.01	15.66	
FEMALES							
Control Group CCA	Mean	196.8	188.3	205.5	221.7	199.0	
	S.D.	6.55	6.54	11.04	13.15	11.95	
E5356—Group A	Mean	205.4	194.6	211.0	227.0	203.0	
	S.D.	9.63	10.45	10.49	13.10	11.79	
E70S-3—Group A	Mean	190.8	181.4	204.2	213.0	194.8	
	S.D.	5.54	5.55	8.23	8.19	6.76	
E70T-1—Group A	Mean	209.6 ^{S+}	198.8	215.8	227.5	205.0	
	S.D.	3.36	2.28	3.19	3.49	3.08	
E308-16—Group A ^a	Mean	189.2	179.4				156.6 22.51
	S.D.	10.99	11.13				
E6010—Group A	Mean	194.4	182.6	205.6	219.2	196.2	
	S.D.	5.27	6.43	9.29	8.04	7.60	
E7018—Group A	Mean	197.2	185.4	202.2	216.8	195.6	
	S.D.	9.20	7.06	8.23	12.13	9.56	
E308-16—Group A (Repeat)	Mean	193.2	180.8	200.0	222.5	195.0	
	S.D.	4.15	6.02	1.83	5.07	5.89	
Control Group CCA (Repeat)	Mean	184.6	178.0	203.8	216.2	192.0	
	S.D.	14.22	11.34	4.44	3.03	3.54	

a. All animals were found dead prior to the Day 7 observation.

2236-100/101

Table 1B
Mean Initial Body Weights and Standard Deviations (grams)
Toxicity Study of Welding Fumes in Rats

Group		Day 1	
		Pre-Exposure	Postexposure
MALES			
Control Group CCB	Mean	282.0	266.2
	S.D.	17.75	16.36
Control Group CCD	Mean	286.5	270.8
	S.D.	21.67	22.29
E5356—Group B	Mean	301.2	287.6
	S.D.	11.17	9.81
—Group C	Mean	304.2	289.6
	S.D.	11.08	10.85
—Group D	Mean	305.6	290.2
	S.D.	12.26	10.73
E70S-3—Group B	Mean	270.4	254.2
	S.D.	14.29	11.43
—Group C	Mean	266.0	253.0
	S.D.	8.83	8.31
—Group D	Mean	266.4	253.0
	S.D.	17.18	15.57
E70T-1—Group B	Mean	286.8	270.6
	S.D.	6.69	6.07
—Group C	Mean	276.4	261.4
	S.D.	9.63	8.71
—Group D	Mean	281.8	265.6
	S.D.	17.54	15.29
E308-16—Group B	Mean	282.0	259.2
	S.D.	8.86	7.53
—Group C	Mean	278.0	253.2
	S.D.	4.80	7.46
—Group D	Mean	284.0	261.4
	S.D.	6.28	10.67
E6010—Group B	Mean	285.8	268.6
	S.D.	12.11	9.89
—Group C	Mean	273.4	259.6
	S.D.	14.48	13.74
—Group D	Mean	275.2	259.8
	S.D.	15.21	13.97
E7018—Group B	Mean	296.8	273.2
	S.D.	8.81	9.58
—Group C	Mean	289.6	272.0
	S.D.	10.90	12.71
—Group D	Mean	306.4	277.0
	S.D.	4.04	18.79

Table 1B (Continued)

2236-100/101

Group		Day 1	
		Pre-Exposure	Postexposure
MALES			
E308-16—Group B	Mean	264.6	245.6
(Repeat)	S.D.	8.96	6.19
—Group C	Mean	254.8	246.0
	S.D.	14.17	5.15
—Group D	Mean	268.8	255.2
	S.D.	7.09	7.46
E308-16—Group CCB	Mean	262.8	248.8
(Repeat)	S.D.	6.50	5.81
—Group CCD	Mean	263.8	249.0
	S.D.	8.20	7.35
FEMALES			
Control Group CCB	Mean	196.3	184.3
	S.D.	11.71	10.60
Control Group CCD	Mean	195.8	184.7
	S.D.	9.33	9.87
E5356—Group B	Mean	200.0	190.6
	S.D.	8.69	7.64
—Group C	Mean	196.0	184.2
	S.D.	7.78	5.40
—Group D	Mean	190.4	179.6
	S.D.	12.46	12.93
E70S-3—Group B	Mean	193.4	184.6
	S.D.	3.05	2.97
—Group C	Mean	189.6	181.6
	S.D.	8.50	6.88
—Group D	Mean	193.4	182.6
	S.D.	15.27	14.48
E70T-1—Group B	Mean	205.8	193.6
	S.D.	8.17	9.21
—Group C	Mean	203.6	194.2
	S.D.	10.55	9.68
—Group D	Mean	203.8	194.0
	S.D.	4.15	6.08
E308-16—Group B	Mean	193.8	177.4
	S.D.	10.96	10.67
—Group C	Mean	189.2	171.2
	S.D.	9.34	11.23
—Group D	Mean	190.4	177.6
	S.D.	12.20	12.22

(Continued)

Table 1B (Continued)

2236-100/101

Group		Day 1	
		Pre-Exposure	Postexposure
FEMALES			
E6010—Group B	Mean	192.0	177.6
	S.D.	7.52	6.58
—Group C	Mean	193.2	181.6
	S.D.	5.63	4.98
—Group D	Mean	196.0	186.2
	S.D.	10.56	9.20
E7018—Group B	Mean	202.2	187.8
	S.D.	9.26	9.88
—Group C	Mean	193.2	180.4
	S.D.	2.68	3.51
—Group D	Mean	199.8	187.2
	S.D.	6.76	6.30
E308-16—Group B (Repeat)	Mean	193.0	181.0
	S.D.	5.29	5.96
—Group C	Mean	195.4	182.8
	S.D.	9.13	8.04
—Group D	Mean	194.2	183.0
	S.D.	5.93	4.42
E308-16—Group CCB (Repeat)	Mean	189.4	180.0
	S.D.	8.88	6.08
—Group CCD	Mean	190.2	179.0
	S.D.	4.82	5.92

Key to Table 2A

NOTE: Due to the poor visibility in the chamber during exposure, the exact number of animals exhibiting clinical signs could not be determined at certain intervals. The following approximations were made at these intervals and are indicated in the Table as follows:

Table 2A
Summary of Clinical Observations
Toxicity Study of Welding Fumes in Rats
Exposure Period—Subgroup A Males and Females

2236-100/101

Observations	Time During Exposure (Hour)											
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
<u>E5356</u>												
Number of animals observed	10	10	10	10	10	10	10	10	10	10	10	10
Appeared normal	10	10	10	10	10	10	10	10	10	10	10	10
<u>E70S-3</u>												
Number of animals observed	10	10	10	10	10	10	10	10	10	10	10	10
Appeared normal	10	10	10	10	10	10	10	10	0	0	0	0
Brown dust on fur	0	0	0	0	0	0	0	0	10	10	10	10
<u>E308-16</u>												
Number of animals observed	10	10	10	10	10	10						
Appeared normal	10	10	10	10	10	10						
Dyspnea (gasping, labored respiration)	0	0	0	0	0	0	c	a	a	a	a	a
Rhinorrhea (slight dark fluid, dark or red bloody discharge)	0	0	0	0	0	0	c	c	c	c	c	c
<u>E7018</u>												
Number of animals observed	10										10	10
Appeared normal	10	b	b	b	b	b	b	b	b	b	10	10
Dyspnea	0				c	c	c				0	0
Polypnea	0	c	c	c	c	c	c	c	c	c	0	0
<u>E6010</u>												
Number of animals observed	10	10	10					10	10	10	10	10
Appeared normal	10	10	10	a				10	10	10	10	10
Polypnea				b	b	b	b	0	0	0	0	0
<u>E70T-1</u>												
Number of animals observed												
Appeared normal	a	a	a									
Brown stain on nose	b	b	b	b	b	b	b	b	b	b	b	b
Polypnea			b									
Dyspnea				c	b	b	b	c	c	c	c	c
Brown dust on fur							a		c	c	c	c
<u>Control Group CCA</u>												
Number of animals observed	12	12	12	12	12	12	12	12	12	12	12	12
Appeared normal	12	12	12	12	12	12	12	12	12	12	12	12
<u>E308-16—Group A (Repeat)</u>												
Number of animals observed	10	10	10	10	10	10	10	10	10	10	10	10
Appeared normal	10	10	10	10	10	10	10	10	10	10	10	10

- a. Indicates several of the animals that were visible showed the designated clinical sign.
 b. Indicates most of the animals that were visible showed the designated clinical sign.
 c. Indicates that remaining animals that were visible appeared normal.

Table 2B
Summary of Clinical Observations
Toxicity Study of Welding Fumes in Rats
Postexposure Period—Subgroup A Males and Females

2236-100/101

Observations	Exposure Off/ Removal from Chamber	Day Postexposure														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MALES																
E5356																
Number of animals observed	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Appeared normal	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
E70S-3																
Number of animals observed	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Appeared normal	2	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Brown stain on body, nose and/or mouth	3	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E308-16																
Number of animals observed	5	5	2													
Appeared normal	0	0	0													
Found dead	0	3	2													
Dyspnea (gasping)	5	2	1													
Wheezing	5	0	1													
Bloody crust on nose, mouth and/or eyes	5	2	1													
Salivation	0	0	1													
Urine stains on anus	0	0	1													
E7018																
Number of animals observed	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Appeared normal	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Brown stain on fur	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chromadacryorrhea	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bloody crust on eye	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E6010																
Number of animals observed	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Appeared normal	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Brown stain on fur	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bloody crust on nose	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E70T-1																
Number of animals observed	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Appeared normal	0	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Brown stain on fur/body	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown stain on nose	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bloody crust on face	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Control Group CCA																
Number of animals observed	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Appeared normal	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
E308-16—Group A (Second Exposure)																
Number of animals observed	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Appeared normal	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Brown stain on fur	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(Continued)

Table 2B (Continued)

2236-100/101

Observations	Exposure Off/ Removal from Chamber	Day Postexposure														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FEMALES																
E5356																
Number of animals observed	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Appeared normal	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
E70S-3																
Number of animals observed	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Appeared normal	0	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Brown stain on body and/or nose	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E308-16																
Number of animals observed	5	5	2	1												
Appeared normal	0	0	0	0												
Found dead	0	3	1	1												
Dyspnea (gasping)	5	2	0	0												
Wheezing	5	0	0	0												
Bloody crust on nose	5	0	1	1												
Salivation	1	0	0	0												
Languid	0	0	1	1												
E7018																
Number of animals observed	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Appeared normal	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Brown stain on fur	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E6010																
Number of animals observed	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Appeared normal	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Brown stain on fur	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bloody crust on nose	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E70T-1																
Number of animals observed	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Appeared normal	0	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Brown stain on fur/body	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown stain on nose	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Control Group CCA																
Number of animals observed	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Appeared normal	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
E308-16—Group A (Second Exposure)																
Number of animals observed	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4
Appeared normal	0	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Found dead	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown stain on fur	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wheezing	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Key to Tables 3-6

223610A—Subgroup A

Group 1 = Common Control
Group 2 = E5356 Repeat
Group 3 = E70S-3
Group 4 = E308-16
Group 5 = E7018
Group 6 = E6010
Group 7 = E70T-1

223610C—Subgroups C and D

Group 1 = Common Control
Group 2 = E5356 Repeat
Group 3 = E70S-3
Group 4 = E308-16
Group 5 = E7018
Group 6 = E6010
Group 7 = E70T-1

223610G—Subgroup A

Group 1 = Common Control
Group 2 = E308-16 Repeat

Standard Key to Gross Pathology Incidence Summary

Locations of Tissue Masses Observed Grossly

DFL = Dorsal-Front-Left
DFR = Dorsal-Front-Right
DHL = Dorsal-Hind-Left
DHR = Dorsal-Hind-Right
DFM = Dorsal-Front-Mid
DHM = Dorsal-Hind-Mid
VFL = Ventral-Front-Left
VFR = Ventral-Front-Right
VHL = Ventral-Hind-Left
VHR = Ventral-Hind-Right
VFM = Ventral-Front-Mid
VHM = Ventral-Hind-Mid

The above locations are used in conjunction with the keywords MASS and SMALL MASS.

Other Symbols and Notations

H- = Finding noted during processing
of tissues in histology
(precedes keyword)

Table 3
Summary of Gross Pathology Findings
Toxicity Study of Welding Fumes in Rats

2236-100/101

Hazleton Laboratories America, Inc.
 Department of Pathology
 Vienna, Virginia

Path/Tox System Output
 Toxicity Study of Welding Fumes
 GROSS PATHOLOGY INCIDENCE SUMMARY

Printed: 21-May-84
 Study Number: 223610A

Table Includes:		Number of Animals Affected						
		MALE						
Sex = All; Group = All; Weeks = All Death = All; Subset = All								
Sex:								
Group:		1	2	3	4	5	6	7
Organ and Keyword(s) or Phrase		12	5	5	5	5	5	5
Top of List								
Brain (BR)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Adrenals (AD)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Thyroid (TY)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Trachea (TR)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Lung w/Bronchi (LU)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	1	0	5	3	4
Failure to Collapse		0	0	0	5	0	0	0
Dark		0	0	2	2	0	2	0
Pale Focus (I)/Area (S)		0	0	0	1	0	0	0
Mottled		0	0	2	3	0	0	0
Dark Focus (I)/Area (S)		0	0	0	0	0	0	1
Heart (HT)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	4	5	5	5	5
Pale Focus (I)/Area (S)		0	0	1	0	0	0	0
Spleen (SP)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	11	5	5	5	5	5	5
Pale		0	0	0	0	0	0	0
Pale Film on Capsule		1	0	0	0	0	0	0
Liver (LI)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Dark Focus (I)/Area (S)		0	0	0	0	0	0	0
Pale Focus (I)/Area (S)		0	0	0	2	0	0	0
Kidneys (KD)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	11	5	4	5	4	5	5
Fluid Filled		0	0	0	0	0	0	0
Dilated Pelvis(es)		1	0	0	0	1	0	0
Granular Material		0	0	0	0	0	0	0
Granular/Pitted/Rough		0	0	0	0	0	0	0
Stomach (ST)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	4	5	5	5
Pale Focus (I)/Area (S)		0	0	0	1	0	0	0
Dark Focus (I)/Area (S)		0	0	0	0	0	0	0

Table 3 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
GROSS PATHOLOGY INCIDENCE SUMMARY

Printed: 21-May-84

Study Number: 223610A

Table Includes: Sex = All; Group = All; Weeks = All Death = All; Subset = All		Number of Animals Affected						
		MALE						
		1	2	3	4	5	6	7
Organ and Keyword(s) or Phrase	Number:	12	5	5	5	5	5	5
Duodenum (DU)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Jejunum (JE)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Ileum (IL)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Pancreas (PA)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Cecum (CE)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Dark Focus (I)/Area (S)		0	0	0	0	0	0	0
Colon (CO)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Rectum (RE)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Testes w/Epidid (TP)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Prostate (PR)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Urinary Bladder (UB)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Ovaries (OV)	Number Examined:	0	0	0	0	0	0	0
	Not Remarkable:	0	0	0	0	0	0	0
Uterus (UT)	Number Examined:	0	0	0	0	0	0	0
	Not Remarkable:	0	0	0	0	0	0	0
Intraluminal Fluid		0	0	0	0	0	0	0
Nasal Turbinates (NT)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Mesenteric L.N. (MS)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Peritoneal Cavit (PC)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Lymph Node, Other (LN)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	4	5	5
Dark		0	0	0	0	1	0	0
Thymus (TH)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	4

(Continued)

Table 3 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
GROSS PATHOLOGY INCIDENCE SUMMARY

Printed: 21-May-84
Study Number: 223610A

Table Includes: Sex = All; Group = All; Weeks = All Death = All; Subset = All	Sex:	Number of Animals Affected						
		MALE						
		1	2	3	4	5	6	7
Organ and Keyword(s) or Phrase	Group:	12	5	5	5	5	5	5
Dark Focus (I)/Area (S)	Number:	0	0	0	0	0	0	1
End of List								

	Sex:	Number of Animals Affected						
		FEMALE						
		1	2	3	4	5	6	7
Organ and Keyword(s) or Phrase	Group:	12	5	5	5	5	5	5
Top of List								
Brain (BR)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Adrenals (AD)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Thyroid (TY)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Trachea (TR)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Lung w/Bronchi (LU)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	0	5	4	4
Failure to Collapse		0	0	0	4	0	0	0
Dark		0	0	0	0	0	0	1
Pale Focus (I)/Area (S)		0	0	0	0	0	0	0
Mottled		0	0	0	5	0	0	0
Dark Focus (I)/Area (S)		0	0	0	0	0	1	0
Heart (HT)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Pale Focus (I)/Area (S)		0	0	0	0	0	0	0
Spleen (SP)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	4	5	5	5
Pale		0	0	0	1	0	0	0
Pale Film on Capsule		0	0	0	0	0	0	0
Liver (LI)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	11	5	5	4	5	3	3
Dark Focus (I)/Area (S)		0	0	0	0	0	1	0
Pale Focus (I)/Area (S)		1	0	0	1	0	1	2
Kidneys (KD)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	9	5	4	3	5	5	3

Table 3 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
GROSS PATHOLOGY INCIDENCE SUMMARY

Printed: 21-May-84

Study Number: 223610A

Table Includes:

Sex = All; Group = All; Weeks = All
Death = All; Subset = All

Organ and Keyword(s) or Phrase	Number:	Number of Animals Affected						
		FEMALE						
		1	2	3	4	5	6	7
	Sex:							
	Group:							
		12	5	5	5	5	5	5
Fluid Filled		0	0	0	1	0	0	0
Dilated Pelvis(es)		2	0	1	2	0	0	2
Granular Material		0	0	1	0	0	0	1
Granular/Pitted/Rough		1	0	0	0	0	0	0
Stomach (ST)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	11	5	5	4	5	5	4
Pale Focus (I)/Area (S)		0	0	0	1	0	0	0
Dark Focus (I)/Area (S)		1	0	0	0	0	0	1
Duodenum (DU)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Jejunum (JE)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Ileum (IL)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Pancreas (PA)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Cecum (CE)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	4	5	5	5	5	5
Dark Focus (I)/Area (S)		0	1	0	0	0	0	0
Colon (CO)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Rectum (RE)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Testes w/Epidid (TP)	Number Examined:	0	0	0	0	0	0	0
	Not Remarkable:	0	0	0	0	0	0	0
Prostate (PR)	Number Examined:	0	0	0	0	0	0	0
	Not Remarkable:	0	0	0	0	0	0	0
Urinary Bladder (UB)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Ovaries (OV)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Uterus (UT)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	10	3	5	5	4	3	4
Intraluminal Fluid		2	2	0	0	1	2	1
Nasal Turbinates (NT)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Mesenteric L.N. (MS)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5

(Continued)

Table 3 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
GROSS PATHOLOGY INCIDENCE SUMMARY

Printed: 21-May-84

Study Number: 223610A

Table Includes: Sex = All; Group = All; Weeks = All Death = All; Subset = All		Number of Animals Affected						
		FEMALE						
		1	2	3	4	5	6	7
Organ and Keyword(s) or Phrase	Number:	12	5	5	5	5	5	5
Peritoneal Cavit (PC)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Lymph Node, Other (LN)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	5
Dark		0	0	0	0	0	0	0
Thymus (TH)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	12	5	5	5	5	5	4
Dark Focus (I)/Area (S)		0	0	0	0	0	0	1
Dark		0	1	0	0	0	0	0

****End of List****

Hazleton Laboratories America, Inc. Path/Tox System Output Acute Inhalation Toxicity of Welding Fumes Printed: 06-Apr-84
Department of Pathology Project 2236-101
Vienna, Virginia OBSERVATIONS INCIDENCE SUMMARY Study Number: 223610G

Table Includes: Sex = All; Group = All; Weeks = All Death = T; Subset = All		Number of Animals Affected			
		MALE		FEMALE	
		1	2	1	2
Organ and Keyword(s) or Phrase	Number:	5	5	5	4
Top of List					
Brain (BR)	Number Examined:	5	5	5	4
	Not Remarkable:	5	5	4	4
Indentation (Dorsal Surface)		0	0	1	0
Adrenals (AD)	Number Examined:	5	5	5	4
	Not Remarkable:	5	5	5	4
Thyroid (TY)	Number Examined:	5	5	5	4
	Not Remarkable:	5	5	5	4
Trachea (TR)	Number Examined:	5	5	5	4
	Not Remarkable:	5	5	5	4
Lung (LU)	Number Examined:	5	5	5	4
	Not Remarkable:	5	1	3	2
Mottled		0	1	0	1
Dark Focus (I)/Area (S)		0	1	1	0
Dark		0	2	0	1
H-Collapsed		0	0	1	0
Heart (HT)	Number Examined:	5	5	5	4
	Not Remarkable:	5	5	5	4
Spleen (SP)	Number Examined:	5	5	5	4
	Not Remarkable:	5	5	5	4

Table 3 (Continued)

2236-100/101

Hazleton Laboratories America, Inc. Path/Tox System Output
 Department of Pathology Acute Inhalation Toxicity of Welding Fumes Printed: 06-Apr-84
 Vienna, Virginia Project 2236-101
 OBSERVATIONS INCIDENCE SUMMARY Study Number: 223610G

Table Includes: Sex = All; Group = All; Weeks = All Death = T; Subset = All		Number of Animals Affected			
		MALE		FEMALE	
Sex:	Group:	1	2	1	2
Organ and Keyword(s) or Phrase	Number:	5	5	5	4
Liver (LI)	Number Examined:	5	5	5	4
	Not Remarkable:	5	4	5	4
Pale Focus (I)/ Area (S)		0	1	0	0
Kidneys (KD)	Number Examined:	5	5	5	4
	Not Remarkable:	2	4	5	4
Dilated Pelvis(es)		3	1	0	0
Stomach (ST)	Number Examined:	5	5	5	4
	Not Remarkable:	5	5	5	4
Duodenum (DU)	Number Examined:	5	5	5	4
	Not Remarkable:	5	5	5	4
Jejunum (JE)	Number Examined:	5	5	5	4
	Not Remarkable:	5	5	5	4
Ileum (IL)	Number Examined:	5	5	5	4
	Not Remarkable:	5	5	5	4
Pancreas (PA)	Number Examined:	5	5	5	4
	Not Remarkable:	5	5	5	4
Cecum (CE)	Number Examined:	5	5	5	4
	Not Remarkable:	5	5	5	4
Colon (CO)	Number Examined:	5	5	5	4
	Not Remarkable:	5	5	5	4
Rectum (RE)	Number Examined:	5	5	5	4
	Not Remarkable:	5	5	5	4
Testes w/Epidid (TP)	Number Examined:	5	5	0	0
	Not Remarkable:	5	5	0	0
Prostate (PR)	Number Examined:	5	5	0	0
	Not Remarkable:	5	5	0	0
Urinary Bladder (UB)	Number Examined:	5	5	5	4
	Not Remarkable:	5	5	5	4
Ovaries (OV)	Number Examined:	0	0	5	4
	Not Remarkable:	0	0	5	4
Uterus (UT)	Number Examined:	0	0	5	4
	Not Remarkable:	0	0	5	4
Nasal Turbinates (NT)	Number Examined:	5	5	5	4
	Not Remarkable:	5	5	5	4
Bone(s), Other (OB)	Number Examined:	5	5	5	4
	Not Remarkable:	5	5	4	4
Perforation(s)		0	0	1	0

** End of List **

Table 4
Mean Organ Weights and Organ/Body Weight Ratios with Standard Deviations
Toxicity Study of Welding Fumes in Rats

2236-100/101

Hazleton Laboratories America, Inc. Path/Tox System Output Printed: 27-Mar-84
 Department of Pathology Toxicity Study of Welding Fumes
 Vienna, Virginia MEAN ABSOLUTE ORGAN WEIGHTS (g) Study Number: 223610A

		Sex:	MALE						
Table Includes:		Group:	1	2	3	4	5	6	7
Sex = All; Group = All; Weeks = All		Number:	12	5	5	5	5	5	5
Death = All; Subset = All									
Brain (BR)	Number in Group:	12	5	5	0	5	5	5	
	Mean:	2.02	2.04	1.89		2.00	2.06	1.96	
	Standard Deviation:	0.14	0.07	0.08		0.12	0.09	0.07	
Lung (LU)	Number in Group:	12	5	5	0	5	4	5	
	Mean:	1.37	1.56 ^{S+}	1.25		1.39	1.62 ^{S+}	1.47	
	Standard Deviation:	0.11	0.14	0.10		0.15	0.08	0.18	
Kidneys (KD)	Number in Group:	12	5	5	0	5	5	5	
	Mean:	2.56	2.50	2.30		2.41	2.63	2.51	
	Standard Deviation:	0.24	0.18	0.08		0.24	0.23	0.37	
Heart (HT)	Number in Group:	12	5	5	0	5	5	5	
	Mean:	0.98	0.95	0.87 ^{S+}		0.87 ^{S+}	0.96	0.94	
	Standard Deviation:	0.09	0.10	0.06		0.07	0.03	0.09	
Liver (LI)	Number in Group:	12	5	5	0	5	5	5	
	Mean:	8.82	9.28	7.90		8.71	9.25	8.75	
	Standard Deviation:	1.04	0.55	0.66		0.88	0.43	0.80	
		Sex:	FEMALE						
		Group:	1	2	3	4	5	6	7
		Number:	12	5	5	5	5	5	5
Brain (BR)	Number in Group:	12	5	5	0	5	5	5	
	Mean:	1.87	1.84	1.88		1.80	1.85	1.83	
	Standard Deviation:	0.09	0.03	0.06		0.09	0.07	0.05	
Lung (LU)	Number in Group:	12	5	5	0	5	5	5	
	Mean:	1.09	1.31 ^{S+}	1.07		1.20 ^{S+}	1.16	1.23 ^{S+}	
	Standard Deviation:	0.08	0.04	0.03		0.10	0.07	0.02	
Kidneys (KD)	Number in Group:	12	5	5	0	5	5	5	
	Mean:	1.71	1.68	1.68		1.70	1.57	1.65	
	Standard Deviation:	0.12	0.09	0.14		0.14	0.12	0.19	
Heart (HT)	Number in Group:	12	5	5	0	5	5	5	
	Mean:	0.71	0.71	0.64		0.72	0.67	0.69	
	Standard Deviation:	0.06	0.07	0.03		0.06	0.05	0.02	
Liver (LI)	Number in Group:	12	5	5	0	5	5	5	
	Mean:	6.40	6.21	6.02		6.15	5.96	6.05	
	Standard Deviation:	0.58	0.62	0.71		0.47	0.24	0.28	

Table 4 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.		Path/Tox System Output				Printed: 06-Apr-84	
Department of Pathology		Acute Inhalation Toxicity of Welding Fumes					
Vienna, Virginia		Project 2236-101					
		ABSOLUTE ORGAN WEIGHT MEANS (g)				Study Number: 223610G	
Table Includes:		Sex:		MALE		FEMALE	
Sex = All; Group = All; Weeks = All		Group:		1	2	1	2
Death = T; Subset = All		Number:		5	5	5	4
Terminal Body Weight (g)	Number in Group:	5	5	5	4		
	Mean:	286.8	289.6	192.0	195.0		
	Standard Deviation:	15.7	20.2	3.5	5.9		
Lung ^{BF} (LU)	Number in Group:	5	5	5	4		
	Mean:	1.37	1.59	1.19	1.30 st		
	Standard Deviation:	0.07	0.23	0.07	0.04		
Heart (HT)	Number in Group:	5	5	5	4		
	Mean:	0.91	0.97	0.71	0.71		
	Standard Deviation:	0.03	0.08	0.07	0.02		
Liver (LI)	Number in Group:	5	5	5	4		
	Mean:	8.51	9.04	6.12	6.35		
	Standard Deviation:	1.23	0.50	0.34	0.14		
Kidneys (KD)	Number in Group:	5	5	5	4		
	Mean:	2.45	2.61	1.57	1.58		
	Standard Deviation:	0.21	0.33	0.10	0.06		
Brain (BR)	Number in Group:	5	5	5	4		
	Mean:	1.85	1.91	1.75	1.77		
	Standard Deviation:	0.11	0.06	0.15	0.07		

Hazleton Laboratories America, Inc.		Path/Tox System Output				Printed: 27-Mar-84			
Department of Pathology		Toxicity Study of Welding Fumes							
Vienna, Virginia		MEAN ORGAN/TERMINAL BODY WEIGHT RATIOS (%)				Study Number: 223610A			
Table Includes:		Sex:	MALE						
Sex = All; Group = All; Weeks = All	Group:	1	2	3	4	5	6	7	
Death = All; Subset = All	Number:	12	5	5	5	5	5	5	
Brain (BR)	Number in Group:	12	5	5	0	5	5	5	
	Mean:	0.683	0.637	0.670		0.658	0.668	0.634	
	Standard Deviation:	0.080	0.042	0.030		0.056	0.023	0.047	
Lung (LU)	Number in Group:	12	5	5	0	5	4	5	
	Mean:	0.459	0.485	0.445		0.456	0.524 ^{S+}	0.473	
	Standard Deviation:	0.022	0.028	0.031		0.025	0.029	0.029	
Kidneys (KD)	Number in Group:	12	5	5	0	5	5	5	
	Mean:	0.861	0.780	0.816		0.789	0.854	0.805	
	Standard Deviation:	0.074	0.028	0.048		0.046	0.077	0.058	
Heart (HT)	Number in Group:	12	5	5	0	5	5	5	
	Mean:	0.331	0.297	0.308		0.284	0.312	0.302	
	Standard Deviation:	0.042	0.021	0.021		0.021	0.014	0.005	
Liver (LI)	Number in Group:	12	5	5	0	5	5	5	
	Mean:	2.950	2.897	2.803		2.844	3.003	2.820	
	Standard Deviation:	0.190	0.134	0.175		0.122	0.083	0.098	

(Continued)

Table 4 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
MEAN ORGAN/TERMINAL BODY WEIGHT RATIOS (%)

Printed: 27-Mar-84

Study Number: 223610A

Table Includes: Sex = All; Group = All; Weeks = All Death = All; Subset = All		Sex:		FEMALE						
		Group:	Number:	1	2	3	4	5	6	7
Brain (BR)	Number in Group:		12	5	5	0	5	5	5	5
	Mean:		0.942	0.907	0.968		0.921	0.943	0.892	
	Standard Deviation:		0.063	0.057	0.029		0.041	0.053	0.024	
Lung (LU)	Number in Group:		12	5	5	0	5	5	5	5
	Mean:		0.550	0.647 ^{S+}	0.548		0.614 ^{S+}	0.592	0.602 ^{S+}	
	Standard Deviation:		0.036	0.023	0.021		0.051	0.036	0.015	
Kidneys (KD)	Number in Group:		12	5	5	0	5	5	5	5
	Mean:		0.862	0.829	0.863		0.868	0.801	0.803	
	Standard Deviation:		0.064	0.020	0.062		0.058	0.032	0.084	
Heart (HT)	Number in Group:		12	5	5	0	5	5	5	5
	Mean:		0.357	0.349	0.331		0.367	0.340	0.334	
	Standard Deviation:		0.022	0.016	0.010		0.020	0.021	0.015	
Liver (LI)	Number in Group:		12	5	5	0	5	5	5	5
	Mean:		3.214	3.054	3.084		3.141	3.039	2.952	
	Standard Deviation:		0.147	0.202	0.286		0.101	0.091	0.127	

Hazleton Laboratories America, Inc. Path/Tox System Output Acute Inhalation Toxicity of Welding Fumes Printed: 06-Apr-84
Department of Pathology Project 2236-101
Vienna, Virginia ORGAN TO TERMINAL BODY WEIGHT RATIO MEANS (%) Study Number: 223610G

Table Includes: Sex = All; Group = All; Weeks = All Death = T; Subset = All		Sex:		MALE		FEMALE	
		Group:	Number:	1	2	1	2
Lung ^{BF} (LU)	Number in Group:		5	5	5	4	4
	Mean:		0.480	0.547 ^{S+}	0.620	0.669 ^{S+}	
	Standard Deviation:		0.027	0.043	0.042	0.027	
Heart (HT)	Number in Group:		5	5	5	4	4
	Mean:		0.316	0.334	0.369	0.363	
	Standard Deviation:		0.015	0.032	0.038	0.021	
Liver (LI)	Number in Group:		5	5	5	4	4
	Mean:		2.960	3.131	3.188	3.256	
	Standard Deviation:		0.337	0.211	0.186	0.065	
Kidneys (KD)	Number in Group:		5	5	5	4	4
	Mean:		0.853	0.901	0.817	0.809	
	Standard Deviation:		0.032	0.094	0.049	0.043	
Brain (BR)	Number in Group:		5	5	5	4	4
	Mean:		0.646	0.662	0.912	0.908	
	Standard Deviation:		0.049	0.032	0.070	0.055	

Table 5
Mean Lung Wet/Dry Weights and Lung Wet/Dry Weight Ratios with Standard Deviations
Toxicity Study of Welding Fumes in Rats

2236-100/101

Hazleton Laboratories America, Inc.
 Department of Pathology
 Vienna, Virginia

Path/Tox System Output
 Toxicity Study of Welding Fumes
 MEAN ABSOLUTE ORGAN WEIGHTS (g)

Printed: 20-Feb-84

Study Number: 223610C

Table Includes:		Sex:	MALE						
Sex = All; Group = All; Weeks = All		Group:	1	2	3	4	5	6	7
Death = Sched; Subset = All		Number:	12	10	10	3	10	10	10
Lung - Wet (LU0)	Number in Group:		12	10	10	3	10	10	10
	Mean:		1.49	1.48	1.38	1.49	1.64 ^{S+}	1.50	1.48
	Standard Deviation:		0.15	0.15	0.08	0.06	0.14	0.09	0.13
Lung - Dry (LU1)	Number in Group:		12	10	10	3	10	10	10
	Mean:		0.31	0.31	0.30	0.33	0.34	0.33	0.30
	Standard Deviation:		0.02	0.03	0.02	0.01	0.03	0.03	0.02
		Sex:	FEMALE						
		Group:	1	2	3	4	5	6	7
		Number:	12	10	10	1	10	10	10
Lung - Wet (LU0)	Number in Group:		12	10	10	1	10	10	10
	Mean:		1.20	1.18	1.16	0.97	1.31 ^{S+}	1.22	1.31 ^{S+}
	Standard Deviation:		0.09	0.10	0.10		0.11	0.10	0.08
Lung - Dry (LU1)	Number in Group:		12	10	10	1	10	10	10
	Mean:		0.25	0.25	0.25	0.23	0.28	0.26	1.29 ^{S+}
	Standard Deviation:		0.02	0.02	0.03		0.02	0.02	0.03

Hazleton Laboratories America, Inc.
 Department of Pathology
 Vienna, Virginia

Path/Tox System Output
 Toxicity Study of Welding Fumes
 MEAN LUNG WET/DRY RATIOS (g)

Printed: 20-Feb-84

Study Number: 223610C

Table Includes:		Sex:	MALE						
Sex = All; Group = All; Weeks = All		Group:	1	2	3	4	5	6	7
Death = Sched; Subset = All		Number:	12	10	10	10	10	10	10
	Number in Group:		12	10	10	3	10	10	10
	Mean:		4.80	4.72	4.63	4.62	4.82	4.57	4.89
	Standard Deviation:		0.35	0.09	0.19	0.03	0.16	0.33	0.46
		Sex:	FEMALE						
		Group:	1	2	3	4	5	6	7
		Number:	12	10	10	1	10	10	10
	Number in Group:		12	10	10	1	10	10	10
	Mean:		4.73	4.70	4.61	4.22	4.78	4.65	4.60
	Standard Deviation:		0.18	0.11	0.16	—	0.08	0.22	0.36

Table 6
Summary of Histopathology Findings
Toxicity Study of Welding Fumes in Rats

2236-100/101

Hazleton Laboratories America, Inc. Path/Tox System Output Printed: 23-May-84
 Department of Pathology Toxicity Study of Welding Fumes
 Vienna, Virginia HISTOPATHOLOGY INCIDENCE SUMMARY Study Number: 223610A

Table Includes: Sex = All; Group = All; Screen = All; Weeks = All Death = All; Find = All; Subset = All		Number of Animals Affected						
		MALE						
Organ and Finding Description	Number:	1	2	3	4	5	6	7
		12	5	5	5	5	5	5
Top of List								
Lung (LU)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	10	2	0	0	0	0	0
— Alveolar Macrophages		1	2	0	0	2	0	1
— Pigmented Macrophages		0	2	5	2	5	5	5
— Perivascular/Peribronchial Lymphoid Hyperplasia		0	0	0	0	0	0	0
— Pneumonitis		0	0	0	2	0	0	0
— Congestion		0	0	0	4	0	0	0
— Perivascular Edema		1	0	0	5	0	2	0
— Alveolar Edema		0	0	0	4	0	0	0
— Fibrinous Pneumonia		0	0	0	0	0	0	0
— Hemorrhage		0	0	0	1	0	0	0
— Seropurulent Pneumonia		0	0	0	2	0	0	0
End of List								

Table Includes: Sex = All; Group = All; Screen = All; Weeks = All Death = All; Find = All; Subset = All		Number of Animals Affected						
		FEMALE						
Organ and Finding Description	Number:	1	2	3	4	5	6	7
		12	5	5	5	5	5	5
Top of List								
Lung (LU)	Number Examined:	12	5	5	5	5	5	5
	Not Remarkable:	9	3	0	0	1	0	0
— Alveolar Macrophages		2	2	1	0	0	0	0
— Pigmented Macrophages		0	1	5	2	4	5	5
— Perivascular/Peribronchial Lymphoid Hyperplasia		1	0	0	0	0	0	0
— Pneumonitis		0	0	1	4	0	0	0
— Congestion		0	0	0	5	0	0	0
— Perivascular Edema		0	0	0	5	0	0	0
— Alveolar Edema		0	0	0	5	0	0	0
— Fibrinous Pneumonia		0	0	0	1	0	0	0
— Hemorrhage		0	0	0	0	0	0	0
— Seropurulent Pneumonia		0	0	0	0	0	0	0
End of List								

Hazleton Laboratories America, Inc. Path/Tox System Output Printed: 09-Feb-84
 Department of Pathology Acute Inhalation Toxicity of Welding Fumes
 Vienna, Virginia Project 2236-101
 HISTOPATHOLOGY INCIDENCE SUMMARY Study Number: 223610G

Table Includes: Sex = All; Group = All; Screen = All; Weeks = All Death = All; Find = All; Subset = All		Number of Animals Affected			
		MALE		FEMALE	
Organ and Finding Description	Number:	1	2	1	2
		5	5	5	5
Top of List					
Lung (LU)	Number Examined:	5	5	5	5
— Perivascular/Peribronchial Lymphoid Hyperplasia		4	3	2	3
— Pigmented Macrophages		0	4	0	5
— Perivascular Edema		0	0	0	2
— Congestion		0	0	0	1
— Pneumonitis		0	0	0	1
End of List					

Key to Tables 7-12

Abbreviations

2-AA	2-Aminoanthracene
9-AA	9-Aminoacridine
DMSO	Dimethylsulfoxide
DGDH ₂ O	Deionized Glass Distilled Water
g	Gram
HIS ⁺	Histidine Positive
hr	Hour
M	Molar
mg	Milligram
min	Minute
ml	Milliliter
mm	Millimeter
mM	Millimolar
MNNG	Methylnitronitrosoguanidine
NaCL	Sodium Chloride
2-NF	2-Nitrofluorene
OD	Optical Density
pH	Acid-base Scale: log of reciprocal of hydrogen ion concentration
S-9	Supernatant from 9000Xg centrifugation of a liver homogenate
SD	Standard Deviation
μ	Micron
μg	Microgram
ul	Microliter
4-NPA	4-Nitro-O-Phenylenediamine
A	Heavy Precipitation
B	Moderate Precipitation
C	Slight Precipitation
D	Repeat Test
NA	Not Applicable

NOTE: It should be noted that all listed references may not appear in text or tables.

NOTE: Values Represent Mean of Triplicate Plates.

2236-100/101

Table 7
Mean Number ($\pm$ S.D.) of Revertant Colonies Following Treatment of Five *S. Typhimurium* Strains with Pooled and Concentrated Urine Collected from Rats Exposed to Fumes of E5356/Lab #379 in the Absence and Presence of Metabolic Activation
Toxicity Study of Welding Fumes in Rats

Pooled Urine Concentrates ^a			Strains											
Test Fume	Time (Hrs.)	Sex	Concentration (μg/plate)	1535		1537		1538		TA98		TA100		
				-	+	-	+	-	+	-	+	-	+	
Negative Control	24	M	10,000	32.3 ± 5.1	18.0 ± 4.6	10.3 ± 3.2	11.0 ± 4.4	20.3 ± 2.5	39.3 ± 9.1	40.0 ± 4.4	52.7 ± 9.0	127.0 ^b ± 1.4	137.3 ± 11.0	
				1,000	25.0 ± 6.0	15.3 ± 6.7	10.0 ± 2.7	8.7 ± 2.1	20.0 ± 4.4	46.0 ± 17.6	40.0 ± 10.4	56.0 ± 12.5	117.7 ± 11.9	123.3 ± 7.0
					10,000	32.3 ± 10.7	17.0 ± 4.4	9.0 ± 4.4	10.7 ± 3.5	23.0 ± 5.6	37.7 ± 2.1	44.0 ± 7.0	52.0 ± 7.8	127.3 ± 3.5
	72	M	1,000	26.3 ± 3.5		18.3 ± 4.0	11.7 ± 3.2	8.7 ± 2.1	21.3 ± 2.9	38.7 ± 3.5	49.3 ± 0.6	43.0 ± 14.7	119.3 ± 16.7	106.0 ± 5.3
				10,000	25.0 ± 5.0	15.7 ± 6.4	6.0 ± 2.0	10.0 ± 3.5	20.7 ± 5.1	29.7 ± 1.2	27.7 ± 5.5	63.0 ± 10.6	112.3 ± 8.3	130.7 ± 8.4
					1,000	22.3 ± 3.8	18.0 ± 5.7	6.7 ± 2.3	9.0 ± 1.7	17.0 ± 5.2	33.7 ± 10.1	28.7 ± 6.0	50.7 ± 1.5	101.0 ± 11.4
	72	F	10,000	25.0 ± 2.7		11.3 ± 2.5	9.7 ± 4.0	11.3 ± 2.5	20.3 ± 5.1	42.3 ± 8.1	44.0 ± 11.5	54.3 ± 0.6	114.3 ± 6.7	114.0 ± 7.0
				1,000	21.0 ± 3.5	13.7 ± 2.1	7.3 ± 3.5	15.3 ± 3.5	15.3 ± 2.1	39.3 ± 6.5	29.7 ± 4.7	56.3 ± 14.4	106.3 ± 7.1	124.0 ± 7.9
					10,000	28.7 ± 3.2	20.3 ± 2.5	11.3 ± 3.8	15.0 ± 3.0	20.3 ± 3.5	33.0 ± 3.5	43.3 ± 7.1	55.3 ± 9.1	130.0 ± 9.5
	24	F	10,000	27.3 ± 9.0		16.3 ± 5.5	9.3 ± 2.5	11.3 ± 3.1	23.3 ± 3.1	35.7 ± 1.5	43.0 ± 12.5	57.0 ± 5.3	115.0 ± 7.9	155.0 ± 18.5
				10,000	25.7 ± 3.8	17.7 ± 3.0	9.3 ± 3.2	12.7 ± 0.6	19.7 ± 6.0	35.7 ± 4.5	39.0 ± 7.9	53.3 ± 9.1	116.0 ± 16.6	145.7 ± 5.1
					10,000	20.3 ± 7.8	18.0 ± 1.0	9.7 ± 2.1	13.0 ± 1.0	15.7 ± 0.6	43.0 ± 6.6	30.7 ± 6.0	65.3 ± 7.4	96.7 ± 13.1
24	M	10,000	NA ± NA	12.0 ± 4.6		NA ± NA	10.0 ± 3.5	NA ± NA	30.7 ± 5.5	NA ± NA	50.0 ± 7.9	NA ± NA	121.3 ± 5.5	

a. Activated test contains 0.25 mg/ml B-glucuronidase.

b. Based on two plate counts; one plate contaminated.

Table 7 (Continued)

Pooled Urine Concentrates ^a		Strains												2236-100/101	
		1535				1537				1538				TA98	
		-	+	-	+	-	+	-	+	-	+	-	+	-	+
Test Fume	Time (Hrs.)	Sex	Concentration ($\mu\text{g}/\text{plate}$)												TA100
2AA ^b Control	24	M	10,000	NA	268.3 $\pm$ 43.7	NA	93.3 $\pm$ 16.6	NA	1301.3 $\pm$ 85.7	NA	1672.0 $\pm$ 91.5	NA	1467.7 $\pm$ 207.8	NA	
Plate Assay Controls (Concentration/Plate)															
ORG ^a	100 μl			14.3 $\pm$ 5.5	11.6 $\pm$ 4.0	5.7 $\pm$ 0.6	7.7 $\pm$ 1.5	21.0 $\pm$ 6.9	20.3 $\pm$ 2.3	28.7 $\pm$ 6.0	39.3 $\pm$ 2.1	111.0 $\pm$ 13.8	113.7 $\pm$ 8.3		
				19.7 $\pm$ 2.5	12.3 $\pm$ 1.5	8.0 $\pm$ 3.0	10.7 $\pm$ 4.2	11.0 $\pm$ 2.6	20.3 $\pm$ 3.1	47.0 $\pm$ 4.6	38.6 $\pm$ 5.9	114.7 $\pm$ 8.5	112.7 $\pm$ 7.6		
DGDH ₂ O ^a	100 μl			15.0 $\pm$ 3.6	9.7 $\pm$ 1.2	6.7 $\pm$ 1.5	8.7 $\pm$ 3.8	12.3 $\pm$ 5.0	19.7 $\pm$ 6.0	44.3 $\pm$ 7.0	30.7 $\pm$ 1.5	98.7 $\pm$ 6.7	92.7 $\pm$ 2.9		
ORG ^a	100 μl			2024.3 $\pm$ 143.3	NA	NA	NA	NA	NA	NA	NA	2179.7 $\pm$ 37.8	NA		
DMSO	5 μg														
MNNG	75 μg														
9AA	50 μg														
2NF	5 μg														
2AA															

a. Activated test contains 0.25 mg/ml B-glucuronidase.

b. 80 mg/ml administered as a single intraperitoneal injection.

2236-100/101

Table 8
Mean Number ($\pm$ S.D.) of Revertant Colonies Following Treatment of Five *S. Typhimurium* Strains with Pooled and Concentrated Urine Collected from Rats Exposed to Fumes of E70S-3/Lab #380 in the Absence and Presence of Metabolic Activation
Toxicity Study of Welding Fumes in Rats

Pooled Urine Concentrates ^a			Strains										
Test Fume	Time (Hrs.)	Sex	Concentration (μg/plate)	1535		1537		1538		TA98		TA100	
				-	+	-	+	-	+	-	+	-	+
Negative Control	24	M	10,000	33.7 ± 7.0	29.3 ± 3.5	6.3 ± 3.1	18.3 ± 5.7	11.3 ± 3.1	34.3 ± 6.1	38.0 ± 3.5	39.0 ± 9.2	116.3 ± 4.0	125.7 ± 6.5
			1,000	24.0 ± 10.4	28.0 ± 9.5	9.0 ± 1.7	18.3 ± 1.2	16.7 ± 3.1	36.0 ± 6.2	41.0 ± 7.0	42.7 ± 9.1	112.0 ± 4.6	133.0 ± 10.6
	24	F	10,000	28.0 ± 6.9	23.7 ± 9.0	7.3 ± 0.6	15.3 ± 7.1	20.7 ± 8.3	35.7 ± 8.5	49.0 ± 3.5	50.0 ± 3.6	109.3 ± 13.9	149.0 ± 13.9
			1,000	28.0 ± 2.6	33.0 ± 4.6	7.3 ± 2.1	16.7 ± 4.7	13.0 ± 1.0	31.3 ± 7.8	37.3 ± 6.5	43.7 ± 12.4	98.3 ± 17.2	130.0 ± 14.0
	72	M	10,000	32.7 ± 4.6	37.3 ± 7.6	8.0 ± 5.0	31.3 ± 9.9	15.7 ± 6.7	31.0 ± 6.2	27.0 ± 6.1	32.7 ± 4.2	112.0 ± 8.5	136.7 ± 27.9
			1,000	25.3 ± 2.1	30.3 ± 2.5	8.0 ± 2.6	34.7 ± 6.0	20.0 ± 4.6	32.3 ± 6.4	36.0 ± 5.0	43.0 ± 5.6	101.7 ± 10.8	123.7 ± 8.5
	72	F	10,000	26.0 ± 6.6	38.0 ± 6.2	6.0 ± 0.0	25.3 ± 4.9	18.3 ± 1.5	39.3 ± 11.9	38.3 ± 8.0	50.3 ± 10.7	124.7 ± 9.8	121.0 ± 32.8
			1,000	24.3 ± 10.0	25.7 ± 9.1	6.3 ± 0.6	16.3 ± 1.2	12.7 ± 1.2	32.7 ± 6.5	36.7 ± 10.1	43.3 ± 16.2	110.7 ± 17.6	131.0 ± 24.8
2AA Negative Control	24	M	10,000	28.0 ± 1.0	30.3 ± 9.3	5.3 ± 2.1	19.0 ± 5.2	14.0 ± 3.6	26.7 ± 4.0	28.0 ± 3.6	35.0 ± 6.2	111.0 ± 8.2	114.7 ± 17.9
	24	F	10,000	29.3 ± 4.5	41.0 ± 1.0	6.7 ± 2.5	23.3 ± 3.8	21.3 ± 7.6	39.7 ± 6.4	44.0 ± 5.2	42.3 ± 6.8	111.7 ± 7.5	134.3 ± 7.6
	72	M	10,000	34.7 ± 8.5	30.0 ± 7.8	11.7 ± 5.1	26.7 ± 8.1	14.7 ± 2.1	29.3 ± 3.2	31.7 ± 7.6	40.0 ^b ± 7.1	99.7 ± 16.0	125.0 ± 21.6
	72	F	10,000	29.0 ± 3.5	44.7 ± 5.5	7.7 ± 1.5	33.7 ± 7.5	17.3 ± 3.8	33.0 ± 6.1	32.0 ± 2.6	40.7 ± 3.1	98.3 ± 6.0	133.0 ± 10.6

a. Activated test contains 0.25 mg/ml B-glucuronidase.

b. Based on two plate counts; one plate contaminated.

Table 8 (Continued)

Pooled Urine Concentrates ^a				Strains									
Test Fume	Time (Hrs.)	Sex	Concentration (μg/plate)	1535		1537		1538		TA98		TA100	
				-	+	-	+	-	+	-	+	-	+
2AA ^b Control	24	M	10,000	NA	484.0 ± 3.0	NA	90.0 ± 23.5	NA	1298.0 ± 57.2	NA	1395.0 ± 219.8	NA	1564.3 ± 55.0
Plate Assay Controls (Concentration/Plate)													
ORG + DGDH ₂ O ^a	100 μl	ORG ^a	100 μl	18.7 ± 3.8	24.0 ± 4.0	7.3 ± 3.2	15.7 ± 2.1	14.3 ± 0.6	35.0 ± 6.0	28.7 ± 5.1	47.0 ± 3.5	105.0 ± 2.6	170.3 ± 17.2
				11.3 ± 2.5	26.3 ± 4.5	6.7 ± 2.1	18.3 ± 2.5	9.0 ± 4.4	29.0 ± 2.0	33.7 ± 11.0	46.7 ± 13.1	104.0 ± 8.5	156.0 ± 34.8
				20.0 ± 3.6	14.3 ± 3.1	4.0 ± 2.6	6.3 ± 0.6	14.7 ± 2.1	17.0 ± 1.0	29.0 ± 10.5	38.0 ± 9.0	92.0 ± 5.3	103.0 ± 5.6
DMSO				1868.7 ± 141.4	NA	NA	NA	NA	NA	NA	NA	2186.0 ± 71.5	NA
MNNG			5 μg										
9AA			75 μg	NA	NA	820.0 ± 84.5	NA	NA	NA	NA	NA	NA	NA
2NF			50 μg	NA	NA	NA	NA	1590.0 ± 54.6	NA	2185.3 ± 178.8	NA	NA	NA
2AA			5 μg	NA	248.7 ± 6.5	NA	295.7 ± 31.1	NA	1840.0 ± 34.2	NA	2047.3 ± 80.5	NA	2183.0 ± 47.3

a. Activated test contains 0.25 mg/ml B-glucuronidase.

b. 80 mg/ml administered as a single intraperitoneal injection.

2236-100/101

Table 9
Mean Number ($\pm$ S.D.) of Revertant Colonies Following Treatment of Five *S. Typhimurium* Strains with Pooled and Concentrated Urine Collected from Rats Exposed to Fumes of E701-1/Lab #381 in the Absence and Presence of Metabolic Activation
Toxicity Study of Welding Fumes in Rats

Pooled Urine Concentrates ^a		Strains											
		1535			1537			1538			TA98		
Test Fume	Time (Hrs.)	Sex	Concentration (μ g/plate)	-	+	-	+	-	+	-	+	-	+
	24	M	10,000	32.3 $\pm$ 4.7	19.7 $\pm$ 5.9	11.7 $\pm$ 3.5	10.0 $\pm$ 3.6	18.7 $\pm$ 8.1	23.7 $\pm$ 5.9	25.7 $\pm$ 8.1	30.7 $\pm$ 4.0	110.3 $\pm$ 18.6	119.0 $\pm$ 15.1
			1,000	35.3 $\pm$ 10.5	17.7 $\pm$ 0.6	11.3 $\pm$ 3.8	6.3 $\pm$ 2.3	17.7 $\pm$ 5.9	21.0 $\pm$ 5.6	20.0 $\pm$ 3.0	27.3 $\pm$ 0.6	113.3 $\pm$ 22.2	105.0 $\pm$ 11.8
	24	F	10,000	39.3 $\pm$ 9.1	21.7 $\pm$ 3.2	8.7 $\pm$ 3.5	8.3 $\pm$ 3.5	20.0 $\pm$ 4.6	22.3 $\pm$ 3.8	21.3 $\pm$ 4.9	31.3 $\pm$ 11.6	110.3 $\pm$ 3.8	129.3 $\pm$ 17.9
			1,000	34.0 $\pm$ 7.2	20.0 $\pm$ 2.0	7.7 $\pm$ 1.2	8.0 $\pm$ 2.6	17.7 $\pm$ 3.2	25.3 $\pm$ 3.5	16.7 $\pm$ 4.7	23.3 $\pm$ 5.0	103.0 $\pm$ 19.1	113.3 $\pm$ 11.5
	72	M	10,000	40.3 $\pm$ 3.5	25.0 $\pm$ 1.7	7.0 $\pm$ 3.5	9.7 $\pm$ 3.8	11.0 $\pm$ 2.0	23.3 $\pm$ 5.5	18.0 $\pm$ 2.0	26.3 $\pm$ 4.0	105.7 $\pm$ 25.4	106.7 $\pm$ 14.4
			1,000	22.0 $\pm$ 2.6	17.7 $\pm$ 6.0	5.3 $\pm$ 1.5	10.3 $\pm$ 4.7	15.3 $\pm$ 5.9	21.0 $\pm$ 7.9	18.7 $\pm$ 0.6	26.0 $\pm$ 1.7	103.0 $\pm$ 1.7	115.0 $\pm$ 15.9
	72	F	10,000	35.7 $\pm$ 5.0	26.3 $\pm$ 2.3	9.0 $\pm$ 2.6	5.3 $\pm$ 2.5	13.0 $\pm$ 3.6	18.0 $\pm$ 5.2	36.7 $\pm$ 20.8	25.0 $\pm$ 3.5	112.0 $\pm$ 19.5	112.7 $\pm$ 17.2
			1,000	30.7 $\pm$ 7.0	19.0 $\pm$ 6.0	11.3 $\pm$ 2.5	7.7 $\pm$ 1.2	15.3 $\pm$ 6.4	23.0 $\pm$ 3.6	24.3 $\pm$ 5.5	22.3 $\pm$ 2.9	108.3 $\pm$ 3.5	107.7 $\pm$ 11.9
Negative Control	24	M	10,000	27.3 $\pm$ 1.5	30.7 $\pm$ 5.7	5.0 $\pm$ 1.7	8.7 $\pm$ 4.7	19.0 $\pm$ 2.6	23.3 $\pm$ 9.3	27.7 $\pm$ 6.0	24.3 $\pm$ 2.5	105.7 $\pm$ 17.2	119.3 $\pm$ 23.7
	24	F	10,000	27.7 $\pm$ 1.5	31.7 $\pm$ 12.3	5.3 $\pm$ 0.6	9.0 $\pm$ 3.6	17.0 $\pm$ 2.6	24.0 $\pm$ 2.6	21.7 $\pm$ 1.5	29.0 $\pm$ 6.1	105.0 $\pm$ 12.8	121.7 $\pm$ 30.5
	72	M	10,000	28.0 $\pm$ 7.2	25.7 $\pm$ 4.7	8.3 $\pm$ 3.2	7.0 $\pm$ 1.0	19.7 $\pm$ 4.7	21.3 $\pm$ 9.6	26.7 $\pm$ 7.8	31.3 $\pm$ 6.8	101.3 $\pm$ 4.7	117.3 $\pm$ 12.0
	72	F	10,000	28.7 $\pm$ 2.5	22.0 $\pm$ 5.0	7.3 $\pm$ 3.5	11.0 $\pm$ 3.6	19.3 $\pm$ 5.5	19.3 $\pm$ 5.5	25.7 $\pm$ 7.5	30.0 $\pm$ 16.5	116.0 $\pm$ 2.6	118.7 $\pm$ 8.3
2AA Negative Control	24	M	10,000	NA $\pm$ 1.2	17.7 $\pm$ 1.2	NA	11.0 $\pm$ 2.6	NA	28.7 $\pm$ 6.4	NA	54.7 $\pm$ 4.9	NA	129.0 $\pm$ 9.0

a. Activated test contains 0.25 mg/ml B-glucuronidase.

Table 9 (Continued)

Pooled Urine Concentrates ^a		Strains										2236-100/101
Test Fume	Time (Hrs.)	Sex	Concentration ($\mu\text{g}/\text{plate}$)	1535		1537		1538		TA98		TA100
				-	+	-	+	-	+	-	+	
2AA ^b Control	24	M	10,000	NA	608.3 $\pm$ 22.5	NA	90.0 $\pm$ 18.2	NA	1471.3 $\pm$ 173.8	NA	1565.3 $\pm$ 89.1	NA 1464.7 $\pm$ 61.0
Plate Assay Controls (Concentration/Plate)												
ORG ^a	100 μl			17.3 $\pm$ 6.7	13.7 $\pm$ 6.5	5.3 $\pm$ 1.5	7.7 $\pm$ 1.5	10.7 $\pm$ 1.5	17.7 $\pm$ 2.3	58.3 $\pm$ 18.8	39.3 $\pm$ 11.1	114.7 $\pm$ 6.1
												116.3 $\pm$ 11.5
ORG + DGDH ₂ O ^a	100 μl			16.3 $\pm$ 3.1	12.3 $\pm$ 1.5	5.7 $\pm$ 0.6	10.7 $\pm$ 4.0	13.0 $\pm$ 1.7	24.3 $\pm$ 2.5	55.3 $\pm$ 4.7	48.3 $\pm$ 1.2	116.3 $\pm$ 16.9
												130.7 $\pm$ 12.0
ORG + DMSO	100 μl			15.7 $\pm$ 7.6	17.0 $\pm$ 0.0	5.7 $\pm$ 2.1	7.7 $\pm$ 1.2	11.3 $\pm$ 4.9	20.0 $\pm$ 1.7	51.3 $\pm$ 6.1	47.7 $\pm$ 4.0	96.7 $\pm$ 15.1
												103.7 $\pm$ 3.5
MNNG	5 μg			2060.3 $\pm$ 141.9	NA	NA	NA	NA	NA	NA	NA	2575.3 $\pm$ 106.9
												NA
9AA	75 μg			NA	NA	947.3 $\pm$ 243.2	NA	NA	NA	NA	NA	NA
												NA
2NF	50 μg			NA	NA	NA	NA	1750.0 $\pm$ 58.2	NA	2186.0 $\pm$ 123.0	NA	NA
												NA
2AA	5 μg			NA	242.0 $\pm$ 26.1	NA	328.7 $\pm$ 48.0	NA	1571.7 $\pm$ 110.6	NA	1891.3 $\pm$ 63.4	NA 2113.3 $\pm$ 223.1

a. Activated test contains 0.25 mg/ml B-glucuronidase.

b. 80 mg/ml administered as a single intraperitoneal injection.

2236-100/101

Table 10

Mean Number ($\pm$ S.D.) of Revertant Colonies Following Treatment of Five *S. Typhimurium* Strains with Pooled and Concentrated Urine Collected from Rats Exposed to Fumes of E6010/Lab #383 in the Absence and Presence of Metabolic Activation

Toxicity Study of Welding Fumes in Rats

Pooled Urine Concentrates ^a			Strains											
Test Fume	Time (Hrs.)	Sex	Concentration (μg/plate)	1535		1537		1538		TA98		TA100		
				-	+	-	+	-	+	-	+	-	+	
Negative Control	24	M	10,000	19.3 ± 2.5	21.7 ± 4.5	5.0 ± 1.0	10.7 ± 3.5	17.0 ± 7.2	16.7 ± 2.3	17.3 ± 6.5	25.3 ± 4.6	128.0 ± 6.1	107.7 ± 15.8	
				F	1,000	21.0 ± 9.5	23.7 ± 9.1	8.0 ± 2.6	8.0 ± 2.6	18.3 ± 4.5	25.3 ± 2.3	22.3 ± 3.8	22.7 ± 2.5	122.3 ± 16.2
		F	10,000			26.7 ± 10.0	24.0 ± 7.2	8.0 ± 2.6	11.3 ± 6.5	12.3 ± 3.5	20.3 ± 3.5	21.0 ± 4.6	30.0 ± 8.9	107.3 ± 17.0
				1,000	19.0 ± 1.0	18.3 ± 3.5	9.0 ± 3.6	8.3 ± 4.2	12.0 ± 2.6	25.0 ± 8.0	16.0 ± 2.0	30.7 ± 4.5	103.0 ± 9.5	97.3 ± 6.8
	72	M	10,000		22.3 ± 6.4	18.7 ± 4.0	9.3 ± 2.5	8.3 ± 4.2	15.3 ± 3.8	21.0 ± 2.6	40.7 ± 8.3	36.7 ± 4.7	104.3 ± 4.0	107.3 ± 11.9
				1,000	19.3 ± 2.5	19.7 ± 6.0	7.0 ± 1.0	7.7 ± 0.6	16.0 ± 7.0	25.0 ± 7.2	42.0 ± 3.6	48.0 ± 4.4	101.0 ± 7.5	101.0 ± 4.6
		F	10,000		28.3 ± 6.1	22.0 ± 7.8	7.0 ± 1.0	8.0 ± 3.6	19.3 ± 4.2	21.7 ± 6.5	19.0 ± 7.8	26.0 ± 7.2	126.3 ± 11.6	116.7 ± 12.2
				1,000	21.7 ± 4.6	16.7 ± 4.0	6.0 ± 1.0	9.0 ± 2.6	14.3 ± 3.1	25.7 ± 2.1	16.0 ± 4.6	30.0 ± 8.2	108.0 ± 3.6	100.0 ± 10.4
	24	M	10,000		18.0 ± 1.0	17.7 ± 4.0	6.0 ± 1.0	8.3 ± 4.0	18.0 ± 5.0	17.7 ± 4.6	47.3 ± 5.5	45.0 ± 3.6	122.7 ± 22.5	113.7 ± 28.2
				F	10,000	27.0 ± 8.0	21.7 ± 8.1	7.3 ± 1.5	10.0 ± 3.6	12.7 ± 1.5	25.0 ± 2.6	39.7 ± 11.5	48.7 ± 6.7	129.0 ± 9.8
		M	10,000			21.0 ± 5.3	23.0 ± 3.0	8.0 ± 3.0	9.0 ± 3.5	14.7 ± 1.2	27.7 ± 4.9	36.3 ± 3.1	45.0 ± 11.3	121.0 ± 15.1
				F	10,000	23.0 ± 1.0	18.0 ± 3.5	8.3 ± 3.1	10.0 ± 1.7	16.0 ± 4.0	23.7 ± 0.6	42.0 ± 2.0	49.3 ± 4.6	133.3 ± 19.9
24	M	10,000	NA ± 1.2			17.7 ± 1.2	NA	11.0 ± 2.6	NA	28.7 ± 6.4	NA	54.7 ± 4.9	NA	129.0 ± 9.0
2AA Negative Control														

a. Activated test contains 0.25 mg/ml B-glucuronidase.

Table 10 (Continued)

Pooled Urine Concentrates ^a		Strains										2236-100/101
Test Fume	Time (Hrs.)	Sex	Concentration (μ g/plate)	1535	1537	1538	TA98	TA100				
2AA ^b Control	24	M		NA	608.3 $\pm$ 22.5	NA	90.0 $\pm$ 18.2	NA	1471.3 $\pm$ 173.8	NA	1565.3 $\pm$ 89.1	NA 1464.7 $\pm$ 61.0
Plate Assay Controls (Concentration/Plate)												
ORG ^a	100 μ l			17.3 $\pm$ 6.7	13.7 $\pm$ 6.5	5.3 $\pm$ 1.5	7.7 $\pm$ 1.5	10.7 $\pm$ 1.5	17.7 $\pm$ 2.3	58.3 $\pm$ 18.8	39.3 $\pm$ 11.1	114.7 $\pm$ 11.5
				16.3 $\pm$ 3.1	12.3 $\pm$ 1.5	5.7 $\pm$ 0.6	10.7 $\pm$ 4.0	13.0 $\pm$ 1.7	24.3 $\pm$ 2.5	55.3 $\pm$ 4.7	48.3 $\pm$ 1.2	116.3 $\pm$ 12.0
ORG + DGDH ₂ O ^a	100 μ l			15.7 $\pm$ 7.6	17.0 $\pm$ 0.0	5.7 $\pm$ 2.1	7.7 $\pm$ 1.2	11.3 $\pm$ 4.9	20.0 $\pm$ 1.7	51.3 $\pm$ 6.1	47.7 $\pm$ 4.0	96.7 $\pm$ 15.1
				2060.3 $\pm$ 141.9	NA	NA	NA	NA	NA	NA	NA	2575.3 $\pm$ 106.9
DMSO	5 μ g			NA	NA	947.3 $\pm$ 243.2	NA	NA	NA	NA	NA	NA
MNNG	75 μ g			NA	NA	NA	NA	NA	NA	NA	NA	NA
9AA	50 μ g			NA	NA	NA	NA	NA	NA	NA	NA	NA
2NF	5 μ g			NA	NA	NA	NA	NA	NA	NA	NA	NA
2AA	5 μ g			NA	NA	NA	NA	NA	NA	NA	NA	NA

a. Activated test contains 0.25 mg/ml B-glucuronidase.
b. 80 mg/ml administered as a single intraperitoneal injection.

2236-100/101

Table 11
Mean Number ($\pm$ S.D.) of Revertant Colonies Following Treatment of Five *S. Typhimurium* Strains with Pooled and Concentrated Urine Collected from Rats Exposed to Fumes of E7018/Lab #384 in the Absence and Presence of Metabolic Activation
Toxicity Study of Welding Fumes in Rats

Pooled Urine Concentrates ^a		Strains													
Test Fume	Time (Hrs.)	Sex	Concentration (μg/plate)	1535		1537		1538		TA98		TA100			
				-	+	-	+	-	+	-	+	-	+		
Negative Control	24	M	10,000	18.7 ± 1.2	36.3 ± 11.0	6.7 ± 4.0	25.7 ± 5.5	18.7 ± 9.6	34.0 ± 8.0	37.0 ± 6.1	39.3 ± 8.3	114.7 ± 10.0	126.7 ± 21.0		
				1,000	18.3 ± 7.6	26.7 ± 6.7	8.3 ± 0.6	21.7 ± 5.9	19.3 ± 9.1	35.0 ± 6.2	35.7 ± 1.2	39.0 ± 7.2	110.0 ± 7.2	121.3 ± 11.9	
		F	10,000		17.0 ± 1.0	38.3 ± 10.6	8.0 ± 3.0	22.3 ± 3.5	21.3 ± 3.1	35.0 ± 4.6	46.0 ± 11.5	33.0 ± 5.3	129.0 ± 6.6	148.3 ± 6.4	
				1,000	22.0 ± 3.5	45.7 ± 4.9	4.7 ± 2.9	23.3 ± 2.9	14.7 ± 4.0	38.3 ± 2.1	35.0 ± 6.6	39.3 ± 11.2	110.7 ± 4.9	118.7 ± 15.3	
	72	M	10,000		12.3 ± 5.0	36.0 ± 8.7	5.7 ± 1.5	29.0 ± 4.4	18.3 ± 3.2	36.3 ± 5.5	36.3 ± 4.9	35.3 ± 4.7	87.7 ± 5.5	113.3 ± 13.7	
				1,000	19.0 ± 1.0	30.3 ± 4.5	7.0 ± 1.0	20.3 ± 4.2	12.3 ± 4.5	30.0 ± 6.0	27.7 ± 3.2	47.0 ± 2.6	71.3 ± 4.0	93.0 ± 11.1	
		F	10,000		24.7 ± 11.6	50.0 ± 7.9	7.3 ± 1.2	32.0 ± 4.6	19.3 ± 5.1	43.7 ± 2.3	40.0 ± 11.5	58.0 ± 6.6	129.3 ± 6.0	157.7 ± 3.2	
				1,000	21.3 ± 3.2	43.7 ± 10.8	6.3 ± 1.5	29.7 ± 2.9	21.3 ± 4.6	39.0 ± 5.3	35.0 ± 2.0	45.3 ± 11.0	96.3 ± 6.4	127.3 ± 7.8	
	24	M	10,000		21.3 ± 2.1	30.3 ± 7.6	7.3 ± 3.5	26.7 ± 2.5	15.3 ± 4.5	35.7 ± 10.4	34.7 ± 4.7	40.7 ± 8.3	76.7 ± 6.5	128.7 ± 8.6	
				10,000	19.0 ± 1.0	35.7 ± 2.5	4.0 ± 1.0	27.0 ± 3.6	10.0 ± 3.6	37.3 ± 0.6	36.3 ± 7.5	44.3 ± 7.5	75.7 ± 5.5	123.0 ± 8.2	
		F	10,000		32.0 ± 8.7	35.7 ± 12.7	9.7 ± 2.9	29.3 ± 6.1	16.0 ± 2.0	39.3 ± 6.1	36.7 ± 6.1	32.0 ± 5.6	85.5 ± 12.0	104.3 ± 17.8	
				10,000	20.7 ± 8.0	35.3 ± 6.1	6.3 ± 1.5	32.7 ± 2.5	13.3 ± 1.5	35.3 ± 5.7	40.3 ± 2.9	42.7 ± 2.9	90.7 ± 5.9	104.0 ± 11.5	
24	M	10,000	NA ± 1.2		22.7 ± 4.0	NA ± 4.0	19.0 ± 4.0	NA ± 6.1	NA ± 9.8	45.7 ± 9.8	NA ± 8.5	137.0 ± 8.5			

a. Activated test contains 0.25 mg/ml β -glucuronidase.

Table 11 (Continued)

Pooled Urine Concentrates ^a		Strains										2236-100/101
Test Furnc	Time (Hrs.)	Sex	Concentration (μ g/plate)	1535		1537		1538		TA98		TA100
				-	+	-	+	-	+	-	+	
2AA ^b Control	24	M	10,000	NA	484.0 $\pm$ 3.0	NA	90.0 $\pm$ 23.5	NA	1298.0 $\pm$ 57.2	NA	1395.0 $\pm$ 219.8	NA 1564.3 $\pm$ 55.0
Plate Assay Controls (Concentration/Plate)												
ORG ^b	100 μ l			18.7 $\pm$ 3.8	24.0 $\pm$ 4.0	7.3 $\pm$ 3.2	15.7 $\pm$ 2.1	14.3 $\pm$ 0.6	35.0 $\pm$ 6.0	28.7 $\pm$ 5.1	47.0 $\pm$ 3.5	105.0 $\pm$ 2.6
												170.3 $\pm$ 17.2
ORG + DGDH ₂ O ^b	100 μ l			11.3 $\pm$ 2.5	26.3 $\pm$ 4.5	6.7 $\pm$ 2.1	18.3 $\pm$ 2.5	9.0 $\pm$ 4.4	29.0 $\pm$ 2.0	33.7 $\pm$ 11.0	46.7 $\pm$ 13.1	104.0 $\pm$ 8.5
												156.0 $\pm$ 34.8
ORG + DMSO	100 μ l			20.0 $\pm$ 3.6	14.3 $\pm$ 3.1	4.0 $\pm$ 2.6	6.3 $\pm$ 0.6	14.7 $\pm$ 2.1	17.0 $\pm$ 1.0	29.0 $\pm$ 10.5	38.0 $\pm$ 9.0	92.0 $\pm$ 5.3
												103.0 $\pm$ 5.6
MNNG	5 μ g			1868.7 $\pm$ 141.4	NA	NA	NA	NA	NA	NA	NA	2186.0 $\pm$ 71.5
												NA
9AA	75 μ g			NA	NA	820.0 $\pm$ 84.5	NA	NA	NA	NA	NA	NA
												NA
2NF	50 μ g			NA	NA	NA	NA	1590.0 $\pm$ 54.6	NA	2183.3 $\pm$ 178.8	NA	NA
												NA
2AA	5 μ g			NA	248.7 $\pm$ 6.5	NA	295.7 $\pm$ 31.1	NA	1840.0 $\pm$ 34.2	NA	2047.3 $\pm$ 80.5	2183.0 $\pm$ 47.3
												NA

a. Activated test contains 0.25 mg/ml B-glucuronidase.

b. 80 mg/ml administered as a single intraperitoneal injection.

2236-100/101

Table 12
Mean Number ($\pm$ S.D.) of Revertant Colonies Following Treatment of Five *S. Typhimurium* Strains with Pooled and Concentrated Urine Collected from Rats Exposed to Fumes of E308-16/Lab #382 in the Absence and Presence of Metabolic Activation
Toxicity Study of Welding Fumes in Rats

Pooled Urine Concentrates ^a				Strains									
Test Fume	Time (Hrs.)	Sex	Concentration (μg/plate)	1535		1537		1538		TA98		TA100	
				-	+	-	+	-	+	-	+	-	+
Negative Control	24	M	10,000	22.7 ± 3.1	14.3 ± 2.1	7.0 ± 2.0	13.3 ± 6.7	19.7 ± 0.6	39.0 ± 1.7	39.3 ± 7.0	44.7 ± 20.6	118.0 ± 25.5	118.3 ± 16.0
			1,000	20.7 ± 3.8	11.7 ± 5.5	8.0 ± 4.0	9.7 ± 2.1	11.0 ± 3.5	42.3 ± 12.9	47.0 ± 7.5	48.0 ± 7.0	103.0 ± 12.8	128.7 ± 15.9
	24	F	10,000	26.7 ± 8.0	11.0 ± 3.5	8.0 ± 3.5	9.3 ± 3.8	20.7 ± 3.2	36.0 ± 5.6	51.0 ^b ± 8.5	34.7 ± 7.1	117.3 ± 11.6	124.3 ± 6.4
			1,000	17.7 ± 1.5	12.3 ± 0.6	8.7 ± 3.8	14.3 ± 5.7	16.7 ± 1.5	33.0 ± 2.6	43.3 ± 13.7	50.0 ± 18.5	101.7 ± 14.2	132.3 ± 17.4
	72	M	10,000	13.3 ± 5.7	16.0 ± 6.1	7.0 ± 6.1	7.3 ± 1.2	15.0 ± 7.5	33.0 ± 11.8	40.3 ± 13.0	34.3 ± 9.1	117.3 ± 19.7	109.0 ± 13.7
			1,000	16.0 ± 4.4	11.0 ± 4.4	7.3 ± 1.5	8.0 ± 3.6	11.7 ± 4.0	39.3 ± 4.2	41.3 ± 8.7	41.0 ± 2.0	108.7 ± 14.0	97.3 ± 6.7
	72	F	10,000	18.7 ± 2.3	14.7 ± 1.2	7.3 ± 1.5	10.7 ± 4.2	14.7 ± 3.2	25.7 ± 5.5	40.3 ± 2.5	54.7 ± 7.1	134.3 ± 13.6	124.7 ± 12.1
			1,000	15.7 ± 2.9	12.0 ± 6.6	8.3 ± 2.5	7.3 ± 3.2	18.7 ± 5.7	30.7 ± 4.9	36.0 ± 11.4	34.0 ± 8.9	115.3 ± 9.0	98.7 ± 5.5
2AA Negative Control	24	M	10,000	24.0 ± 6.6	17.0 ± 5.6	9.3 ± 1.5	12.0 ± 1.7	16.3 ± 3.8	33.3 ± 4.0	40.7 ± 8.5	38.3 ± 7.1	123.0 ± 7.2	118.0 ± 14.9
	24	F	10,000	22.3 ± 3.5	12.3 ± 3.5	10.0 ± 2.0	11.3 ± 5.9	15.3 ± 3.8	29.0 ± 4.4	40.5 ^b ± 12.0	40.3 ± 2.1	124.7 ± 16.6	144.0 ± 13.5
	72	M	10,000	17.3 ± 1.5	11.7 ± 4.6	10.3 ± 5.1	9.7 ± 3.2	15.7 ± 5.7	44.3 ± 10.4	37.3 ± 7.8	54.5 ^b ± 12.0	116.0 ± 16.4	84.0 ± 28.0
	72	F	10,000	20.3 ± 3.2	14.0 ± 6.1	10.7 ± 4.6	8.7 ± 2.1	14.3 ± 4.2	38.7 ± 7.1	36.3 ± 9.1	59.7 ± 4.5	157.0 ± 18.5	127.7 ± 14.6
2AA Negative Control	24	M	10,000	NA	12.0 ± 4.6	NA	10.0 ± 3.5	NA	30.7 ± 5.5	NA	50.0 ± 7.9	NA	121.3 ± 5.5

a. Activated test contains 0.25 mg/ml B-glucuronidase.

b. Based on two plate counts; one plate contaminated.

Table 12 (Continued) 2236-100/101

Pooled Urine Concentrates ^a		Strains									
		Time (Hrs.)	Sex	Concentration ($\mu\text{g}/\text{plate}$)	1535	1537	1538	TA98	TA100		
Test Fume					-	+	-	+	-	+	-
2AA ^b Control		24	M	10,000	NA	268.3 $\pm$ 43.7	NA	93.3 $\pm$ 16.6	NA	1301.3 $\pm$ 91.5	NA
Plate Assay Controls (Concentration/Plate)											
ORG ^a				100 μl	14.3 $\pm$ 5.5	11.6 $\pm$ 4.0	5.7 $\pm$ 0.6	7.7 $\pm$ 1.5	21.0 $\pm$ 6.9	20.3 $\pm$ 2.3	28.7 $\pm$ 6.0
ORG + DGDH ₂ O ^a				100 μl	19.7 $\pm$ 2.5	12.3 $\pm$ 1.5	8.0 $\pm$ 3.0	10.7 $\pm$ 4.2	11.0 $\pm$ 2.6	20.3 $\pm$ 3.1	39.3 $\pm$ 2.1
ORG + DMSO				100 μl	15.0 $\pm$ 3.6	9.7 $\pm$ 1.2	6.7 $\pm$ 1.5	8.7 $\pm$ 3.8	12.3 $\pm$ 5.0	19.7 $\pm$ 6.0	28.7 $\pm$ 6.0
MNNG				5 μg	2024.3 $\pm$ 143.3	NA	NA	NA	NA	NA	NA
9AA				75 μg	NA	NA	778.0 $\pm$ 73.6	NA	NA	NA	NA
2NF				50 μg	NA	NA	NA	NA	1603.7 $\pm$ 79.6	NA	2331.7 $\pm$ 228.5
2AA				5 μg	NA	386.7 $\pm$ 8.6	NA	117.0 $\pm$ 17.6	NA	1913.3 $\pm$ 85.6	NA
										2091.0 $\pm$ 225.5	2180.3 $\pm$ 146.9

a. Activated test contains 0.25 mg/ml B-glucuronidase.

b. 80 mg/ml administered as a single intraperitoneal injection.

Key to Tables 13-29

ND = No Data
 NA = Not Applicable
 NS = Not Significant
 NR = No Result
 T = Toxic, >10 particles injected—debris and particles indistinguishable
 TT = Too turbid to read
 A = Bloody preparation; not evaluated
 b = Too few cells to evaluate
 c = Sample discarded due to poor viability

Table 13			
Effect of Welding Fumes on Cell Recovery from Lung Lavage Fluid of Exposed Animals Toxicity Study of Welding Fumes in Rats			
Fume	Mean Cell Recovery ($\times 10^6$)	Standard Deviation	P-Value
<u>Males</u>			
Control	3.36	1.531	—
E70S-3	1.09	0.384	(0.002)
E308-16	A	A	A
E7018	0.32 ^b	0.106	(0.0004)
E6010	0.85	0.205	(0.0014)
E70T-1	1.24	0.517	(0.0029)
E5356	1.29	0.281	(0.0032)
<u>Females</u>			
Control	2.79	1.426	—
E70S-3	0.99	0.222	(0.005)
E308-16	A	A	A
E7018	0.19 ^b	0.106	(0.0007)
E6010	0.32	0.219	(0.001)
E70T-1	1.49	0.663	(0.0299)
E5356	1.56	0.763	(0.0204)

Table 14 2236-100/101
**Effects of Welding Fumes on Percentage Macrophage
 from Lung Lavage Fluid of Exposed Animals
 Toxicity Study of Welding Fumes in Rats**

Fume	Mean % Macrophages	Standard Deviation	P-Value
<u>Males</u>			
Control	94.6	2.70	—
E70S-3	98.2	3.16	(0.037)
E308-16	A	A	A
E7018	78.2	40.0	NS
E6010	16.3	15.2	(0.0062)
E70T-1	85.1	6.73	(0.0199)
E5356	97.1	0.95	(0.0252)
<u>Females</u>			
Control	95.5	4.48	—
E70S-3	88.6	9.57	NS
E308-16	A	A	A
E7018	33.4	35.9	(0.0091)
E6010	32.1	b	b
E70T-1	87.2	4.00	(0.0088)
E5356	95.3	7.64	NS

Table 15A 2236-100/101
**Effects of Welding Fumes on Viability of
 Alveolar Macrophages from Rats
 Toxicity Study of Welding Fumes in Rats**

Fume	Mean % Viable	Standard Deviation	P-Value
<u>Males</u>			
Control	94.3	1.96	—
E70S-3	93.6	4.85	NS
E308-16	A	A	A
E7018	b	b	b
E6010	96.2	2.73	NS
E70T-1	92.1	2.74	NS
E5356	97.8	2.25	NS
<u>Females</u>			
Control	82.9	28.2	—
E70S-3	86.5	5.37	NS
E308-16	A	A	A
E7018	b	b	b
E6010	93	c	c
E70T-1	92.0	4.89	NS
E5356	94.4	3.34	NS

Table 15B
Effects of Welding Fumes on Phagocytosis in
Alveolar Macrophages from Rats
Toxicity Study of Welding Fumes in Rats

2236-100/101

Fume	Mean % Phagocytosis	Standard Deviation	P-Value
Males			
Control	56.8	11.6	—
E70S-3	8.3	5.24	(<0.00001)
E308-16	A	A	A
E7018	b	b	b
E6010	11.6 ^b	18.7	(0.0298)
E70T-1	0.53 ^b	0.71	(<0.00001)
E5356	66.0	2.06	(0.0321)
Females			
Control	61.0	15.4	—
E70S-3	8.7	6.54	(<0.00001)
E308-16	A	A	A
E7018	b	b	b
E6010	10.9 ^b	b	b
E70T-1	1.6 ^b	1.91	(<0.00001)
E5356	64.9	28.1	NS

Table 16
Effects of Welding Fumes on ATP Values in
Alveolar Macrophages from Rats
Toxicity Study of Welding Fumes in Rats

2236-100/101

Fume	Mean ATP (g/ml × 10 ⁻⁸)	Standard Deviation	P-Value
Males			
Control	22.2	14.0	—
E70S-3	13.5	4.51	(0.0049)
E308-16	A	A	A
E7018	b	b	b
E6010	13.3 ^b	4.51	(0.0258)
E70T-1	6.3	2.06	(<0.00001)
E5356	14.3 ^b	1.23	(0.0068)
Females			
Control	20.0	7.25	—
E70S-3	11.7	3.68	(0.0008)
E308-16	A	A	A
E7018	A, b, c	A, b, c	A, b, c
E6010	11 ^b	b	b
E70T-1	9.2	1.13	(0.0008)
E5356	11.83	1.77	(0.0021)

Table 17
Effects of Welding Fumes on Acid Phosphatase
Values in Alveolar Macrophages from Rats
Toxicity Study of Welding Fumes in Rats

2236-100/101

Fume	Mean Acid Phosphatase ($\mu\text{g/ml}$)	Standard Deviation	P-Value
<u>Males</u>			
Control	3.05	1.35	—
E70S-3	9.34	5.72	(0.0016)
E308-16	A	A	A
E7018	b	b	b
E6010	b	b	b
E70T-1	TT	TT	TT
E5356	b	b	b
<u>Females</u>			
Control	4.7	3.80	—
E70S-3	9.1	3.27	(0.0036)
E308-16	A	A	A
E7018	b	b	b
E6010	b	b	b
E70T-1	TT	TT	TT
E5356	5.2 ^b	0.14	NS

Table 18
Effects of Welding Fumes on Lysozyme Values in
Alveolar Macrophages from Rats
Toxicity Study of Welding Fumes in Rats

2236-100/101

Fume	Mean Lysozyme ($\mu\text{g/ml}$)	Standard Deviation	P-Value
<u>Males</u>			
Control	34.7	37.4	—
E70S-3	60.8	71.7	NS
E308-16	A	A	A
E7018	b	b	b
E6010	b	b	b
E70T-1	TT	TT	TT
E5356	b	b	b
<u>Females</u>			
Control	24.1	22.3	—
E70S-3	32.5	26.5	NS
E308-16	A	A	A
E7018	b	b	b
E6010	b	b	b
E70T-1	TT	TT	TT
E5356	6.3 ^b	1.77	NS

Table 19
Summary of the Effects of Six Welding Fumes on
Rat Alveolar Macrophages from Exposed Animals
Toxicity Study of Welding Fumes in Rats

Fume	Sex	Mean Cell Recovery	Mean % Macrophages	Viability %	Phag %	ATP g/ml×10 ⁻⁸	AP µg/ml	Lys µg/ml
E70S-3	Male	1.09	98.2	93.6	8.3	13.5	9.3	60.8
	Female	0.99	88.6	86.5	8.7	11.7	9.1	32.5
E308-16	Male	A	A	A	A	A	A	A
	Female	A	A	A	A	A	A	A
E7018	Male	0.32 ^A	78.2	b	b	b	b	b
	Female	0.19 ^A	33.4	b	b	b	b	b
E6010	Male	0.85	16.3	96.2	11.6 ^A	13.3 ^A	b	b
	Female	0.43	32.1	93 ^b	10.9 ^A	11 ^b	b	b
E70T-1	Male	1.24	85.1	92.1	0.5 ^b	6.3	TT	TT
	Female	1.49	87.2	92.1	1.6 ^A	9.2 ^A	TT	TT
E5356	Male	1.29	97.1	97.8	66	14.3 ^b	b	A
	Female	1.56	95.3	94.4	64.9	11.8	5.2	6.2 ^A

Table 20
Summary of Aberration Data
***In Vivo* Bone Marrow Chromosome Study with Welding Fumes**
Toxicity Study of Welding Fumes in Rats

Treatment	Number of Animals with Analyzable Cells Per Group	Number of Metaphases Analyzed Per Group	Number of Aberrant Cells Per Group	Percent Aberrant Cells Per Group	P ^a Value	Total Number of Aberrations Per Group	Average Number of Aberrations Per Cell	P ^a Value
Group C—20 Hours Postexposure								
E5356	10	500	2	0.4	NS	2	0.004	NS
E70S-3	9	450	0	0	NS	0	0	NS
E70T-1	10	500	1	0.2	NS	1	0.002	NS
E6010	10	484	4	0.8	NS	4	0.008	NS
E7018	10	500	8	1.6	NS	8	0.016	NS
E308-16	9	450	5	1.1	NS	5	0.011	NS
Group D—70 Hours Postexposure								
E5356	10	500	0	0	NS	0	0	NS
E70S-3	9	450	1	0.2	NS	1	0.002	NS
E70T-1	10	500	1	0.2	NS	1	0.002	NS
E6010	9	425	3	0.7	NS	3	0.007	NS
E7018	6	300	0	0	NS	0	0	NS
E308-16	10	500	4	0.8	NS	4	0.008	NS
Air Control	18	888	4	0.5	—	6	0.007	—
Air Control (Fume E308-16 only)	9	450	1	0.2	—	1	0.002	—

^a Significant increase, not biologically significant.

Table 21
Modal Numbers
***In Vivo* Bone Marrow Chromosome Study with Welding Fumes**
Toxicity Study of Welding Fumes in Rats

2236-100/101

Treatment	Mean Modal Number	± S.D.	P-Value
<u>Group C—20 Hours Postexposure</u>			
E5356	41.50	0.34	NS
E70S-3	41.72	0.09	NS
E70T-1	41.38	0.08	NS
E6010	41.63	0.10	NS
E7018	41.81	0.03	0.0117(S)
E308-16	41.62	0.06	NS
<u>Group D—70 Hours Postexposure</u>			
E5356	41.50	0.25	NS
E70S-3	41.73	0.15	NS
E70T-1	41.44	0.07	NS
E6010	41.63	0.13	NS
E7018	41.49	0.15	NS
E308-16	41.61	0.04	NS
Air Control	41.53	0.19	—
Air Control (Fume E308-16 only)	41.61	0.05	—

Table 22
Mitotic Index
***In Vivo* Bone Marrow Chromosome Study with Welding Fumes**
Toxicity Study of Welding Fumes in Rats

2236-100/101

Treatment	Mean Mitotic Index	± S.D.	P-Value
<u>Group C—20 Hours Postexposure</u>			
E5356	2.9	1.4	NS
E70S-3	1.0	0.5	NS
E70T-1	3.3	1.2	NS
E6010	2.3	2.1	NS
E7018	2.1	1.1	NS
E308-16	4.3	0.9	NS
<u>Group D—70 Hours Postexposure</u>			
E5356	3.6	1.6	NS
E70S-3	1.3	0.8	NS
E70T-1	3.7	1.2	NS
E6010	1.1	1.3	NS
E7018	0.4	0.4	NS
E308-16	3.2	1.7	NS
Air Control	2.5	2.2	—
Air Control (Fume E308-16 only)	3.0	1.3	—

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Table 23A
Viability Determinations in Rat Alveolar Macrophages
Exposed to Fume E70S-3 Particulates
Toxicity Study of Welding Fumes in Rats

Concentration ($\mu\text{g/ml}$)	Relative Number of Viable Cells	% Viable	Viability Index
0	98	96.4	1.0
4	89	94.2	0.91
13	84	95.1	0.86
39	91.3	95.1	0.93
118	77	99.2	0.79
359	87	96.6	0.89
1089	97	99.4	0.99
3300	90	100	0.92
10,000	69.3	96.9	0.71
Cab-O-Sil	9.7	13.8	0.10

$$\text{Viability Index} = \frac{\text{Relative Number of Viable Cells Treated}}{\text{Relative Number of Viable Cells Control}}$$

2236-100/101

Table 23B
Viability Determinations in Rat Alveolar Macrophages
Exposed to Fume E308-16 Particulates
Toxicity Study of Welding Fumes in Rats

Concentration ($\mu\text{g/ml}$)	Relative Number of Viable Cells	% Viable	Viability Index
0	103	98.6	1.0
4	113	95.8	0.97
13	137.3	74.6	0.76
39	25.5	14.0	0.14
118	25.0	14.1	0.14
359	16	11.2	0.11
1089	12.7	8.8	0.09
3300	3	1.8	0.02
10,000	0	0	0
Cab-O-Sil	2.5	2.1	0.02

Table 23C 2236-100/101
Viability Determinations in Rat Alveolar Macrophages
Exposed to Fume E7018 Particulates
Toxicity Study of Welding Fumes in Rats

Concentration ($\mu\text{g/ml}$)	Relative Number of Viable Cells	% Viable	Viability Index
0	121.7	97.7	1.0
4	77.7	65.5	0.67
13	45	37.9	0.39
39	28.3	16.1	0.16
118	10.3	7.73	0.08
359	7.7	5.8	0.06
1089	0	0	0
3300	0	0	0
10,000	0	0	0
Cab-O-Sil	3	3.3	0.03

Table 23D 2236-100/101
Viability Determinations in Rat Alveolar Macrophages
Exposed to Fume E6010 Particulates
Toxicity Study of Welding Fumes in Rats

Concentration ($\mu\text{g/ml}$)	Relative Number of Viable Cells	% Viable	Viability Index
0	130.3	96.6	1.0
4	124	96.2	1.0
13	126	84.3	0.87
39	116.7	83.4	0.86
118	86	67.5	0.70
359	19.3	11.5	0.12
1089	2.3	2.7	0.03
3300	0	0	0
10,000	0	0	0
Cab-O-Sil	2	1	0.01

2236-100/101

Table 23E
Viability Determinations in Rat Alveolar Macrophages
Exposed to Fume E70T-1 Particulates
Toxicity Study of Welding Fumes in Rats

Concentration ($\mu\text{g}/\text{ml}$)	Relative Number of Viable Cells	% Viable	Viability Index
0	118.3	96.1	1.0
4	97.0	87.2	0.91
13	97.3	84.4	0.88
39	75.7	72.4	0.75
118	36.7	36.9	0.38
359	32.8	22.2	0.23
1089	0.33	0.3	0.003
3300	4	6.7	0.04
10,000	2.7	5.4	0.06
Cab-O-Sil	2.0	0	0

2236-100/101

Table 23F
Viability Determinations in Rat Alveolar Macrophages
Exposed to Fume E5356 Particulates
Toxicity Study of Welding Fumes in Rats

Concentration ($\mu\text{g}/\text{ml}$)	Relative Number of Viable Cells	% Viable	Viability Index
0	125.3	95.4	1.0
4	120.7	96.5	1.01
13	101	95.1	1.0
39	103	94.9	0.99
118	92.7	93.6	0.98
359	81.7	92.2	0.97
1089	76.7	85.8	0.90
3300	40.3	72.2	0.76
10,000	21.0	48.3	0.51
Cab-O-Sil	0	0	0

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Table 24
Effect of Five Welding Fumes on the Viability of
Rat Alveolar Macrophages
Toxicity Study of Welding Fumes in Rats

Fume	EC ₅₀ µg/ml
E7018	7
E308-16	22
E70T-1	78
E6010	170
E5356	10,000
E70S-3	> 10,000

2236-100/101

Table 25A
Phagocytosis in Rat Alveolar Macrophage Cells
Exposed to Fume E70S-3 Particulates
Toxicity Study of Welding Fumes in Rats

Concentration	% Phagocytic Cells	Phagocytic Index
0	74.2	1.00
4	76.7	1.03
13	82.6	1.11
39	76.9	1.04
118	90.0	1.21
359	89.0	1.20
1089	59.0	0.80
3300	71.6	0.96
10,000	53.5	0.72
Cab-O-Sil	T	T

$$\text{Phagocytic Index} = \frac{\% \text{ Phagocytic Cells Treated}}{\% \text{ Phagocytic Cells Control}}$$

Table 25B
Phagocytosis in Rat Alveolar Macrophage Cells
Exposed to Fume E308-16 Particulates
Toxicity Study of Welding Fumes in Rats

2236-100/101

Concentration	% Phagocytic Cells	Phagocytic Index
0	95.9	1.00
4	90.5	0.94
13	63.1	0.66
39	30.3	0.31
118	T	T
359	T	T
1089	T	T
3300	T	T
10,000	T	T
Cab-O-Sil	21.5	0.22

Table 25C
Phagocytosis in Rat Alveolar Macrophage Cells
Exposed to Fume E7018 Particulates
Toxicity Study of Welding Fumes in Rats

2236-100/101

Concentration	% Phagocytic Cells	Phagocytic Index
0	86.5	1.00
4	92.3	1.07
13	85.9	0.99
39	>10.4	>0.12
118	6	0.07
359	7.4	0.08
1089	T	T
3300	T	T
10,000	T	T
Cab-O-Sil	T	T

Table 25D
Phagocytosis in Rat Alveolar Macrophage Cells
Exposed to Fume E6010 Particulates
Toxicity Study of Welding Fumes in Rats

2236-100/101

Concentration	% Phagocytic Cells	Phagocytic Index
0	100.0	1.00
4	82.9	0.83
13	100.0	1.00
39	<98.4	0.98
118	<98.2	0.98
359	<95.3	0.95
1089	55.2	0.55
3300	T	T
10,000	T	T
Cab-O-Sil	6.4	0.06

Table 25E
Phagocytosis in Rat Alveolar Macrophage Cells
Exposed to Fume E70T-1 Particulates
Toxicity Study of Welding Fumes in Rats

2236-100/101

Concentration	% Phagocytic Cells	Phagocytic Index
0	74.2	1.00
4	80.7	1.09
13	<96	1.29
39	<95	1.28
118	1	0.01
359	0	0.00
1089	0	0.00
3300	0	0.00
10,000	13.3	0.18
Cab-O-Sil	T	T

Table 25F
Phagocytosis in Rat Alveolar Macrophage Cells
Exposed to Fume E5356 Particulates
Toxicity Study of Welding Fumes in Rats

2236-100/101

Concentration	% Phagocytic Cells	Phagocytic Index
0	68.4	1.00
4	49.3	0.72
13	80.0	1.17
39	78.9	1.15
118	12	0.17
359	1	0.01
1089	0	0.00
3300	T	T
10,000	T	T
Cab-O-Sil	T	T

Table 26A
ATP Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E70S-3 Particulates
Toxicity Study of Welding Fumes in Rats

2236-100/101

Concentrations ($\mu\text{g/ml}$)	ATP ($\text{g/ml} \times 10^{-8}$)	Mean	Standard Deviation	P-Value
0	7.9, 6.3, 5.6	6.6	1.2	—
4	10.7, 7.6, 9.7	9.3	1.6	0.048
13	9.2, 7.4, 7.6	8.1	1.0	NS
39	8.1, 14.3, 12.6	11.7	3.2	NS
118	7.4, 8.3, 8.6	8.1	0.6	NS
359	2.9, 4.1, 4.1	3.7	0.7	0.0175
1089	1.9, 0.9, 1.8	1.5	0.6	0.0106
3300	0, 1.4, 1.0	0.8	0.7	0.0027
10,000	1.7, 0, 0	0.6	1.0	0.0032
Cab-O-Sil	0.2, 0.06, 0	0.09	0.1	0.0054

Table 26B 2236-100/101
ATP Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E308-16 Particulates
Toxicity Study of Welding Fumes in Rats

Concentrations ($\mu\text{g/ml}$)	ATP ($\text{g/ml} \times 10^{-8}$)	Mean	Standard Deviation	P-Value
0	5.8, 5.2, 6.3	5.8	0.6	—
4	3.1, 2.2, 1.8	2.4	0.7	0.0032
13	1.5, 1.6, 1.2	1.4	0.2	0.0030
39	0.5, 1.2	0.9	0.5	0.0046
118	1.1, 0.7	0.9	0.3	0.0030
359	1.1, 1.0, 1.0	1.0	0.06	0.0023
1089	0.2, 0.4, 0.4	0.3	0.1	0.0018
3300	0.4, 1.2	0.8	0.6	0.0052
10,000	1.0, 0, 0.06	0.4	0.6	0.0006
Cab-O-Sil	5.1, 7.2, 4.6	5.6	1.4	NS

Table 26C 2236-100/101
ATP Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E7018 Particulates
Toxicity Study of Welding Fumes in Rats

Concentrations ($\mu\text{g/ml}$)	ATP ($\text{g/ml} \times 10^{-8}$)	Mean	Standard Deviation	P-Value
0	23.4, 32.3, 31.4	29.0	5.0	—
4	12.4, 13.6, 11.1	12.4	1.3	0.0147
13	7.2, 7.5	7.4	0.2	0.0083
39	2.0, 1.7, 1.7	1.8	0.2	0.0053
118	2.5, 2.6, 2.6	2.6	0.1	0.0056
359	2.7, 3.0, 1.6	2.4	0.7	0.0057
1089	2.1, 2.0, 1.1	1.7	0.6	0.0053
3300	0.9, 1.4, 2.6	1.6	0.0	0.0054
10,000	1.7, 2.5, 2.3	2.2	0.4	0.0055
Cab-O-Sil	2.7, 2.4	2.6	0.2	0.0056

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Table 26D
ATP Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E6010 Particulates
Toxicity Study of Welding Fumes in Rats

Concentrations ($\mu\text{g/ml}$)	ATP ($\text{g/ml} \times 10^{-8}$)	Mean	Standard Deviation	P-Value
0	8.3, 9.2, 8.0	8.3	0.6	—
4	7.8, 8.3, 5.6	7.1	1.4	NS
13	11.1, 17.6, 11.7	13.2	3.5	NS
39	10.0, 10.5, 8.5	9.5	1.0	NS
118	10.0, 7.8, 10.0	9.0	1.2	NS
359	1.3, 2.3, 1.2	1.6	0.6	0.001
1089	1.0, 0.3, 0.8	0.7	0.4	<0.0001
3300	0.01, 0.1, 0.7	0.3	0.4	<0.0001
10,000	0.7, 0, 0.6	0.4	0.4	<0.0001
Cab-O-Sil	0.9, 0.6, 0.3	0.6	0.3	0.003

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Table 26E
ATP Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E70T-1 Particulates
Toxicity Study of Welding Fumes in Rats

Concentrations ($\mu\text{g/ml}$)	ATP ($\text{g/ml} \times 10^{-8}$)	Mean	Standard Deviation	P-Value
0	6.6, 8.0, 7.6	7.4	0.7	—
4	11.8, 11.9, 7.6	10.4	2.5	NS
13	8.1, 8.4, TE	8.3	0.2	NS
39	10.1, 9.2, 8.5	9.3	0.8	0.0289
118	8.6, 8.1, 10.4	9.0	1.2	NS
3259	3.2, 3.4, 2.7	3.1	0.4	0.0058
1089	0.4, 0, 0.05	0.2	0.2	0.0018
3300	0, 0, 0.3	0.1	0.2	0.0017
10,000	0, 0.06, 0.1	0.1	0.1	0.0016
Cab-O-Sil	0, 0, 0	0.0	0.0	<0.0001

Table 26F
ATP Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E5356 Particulates
Toxicity Study of Welding Fumes in Rats

2236-100/101

Concentrations ($\mu\text{g/ml}$)	ATP ($\text{g/ml} \times 10^{-8}$)	Mean	Standard Deviation	P-Value
0	19.3, 12.2, 11.8	14.4	4.2	—
4	10.2, 16.6, 17.2	14.7	3.9	NS
13	16.6, 19.7, 16.1	17.5	2.0	NS
39	14.5, 18.6, 26.4	19.8	6.0	NS
118	18.2, 17.0, 9.1	14.8	4.9	NS
359	6.8, 11.2, 8.9	9.0	2.2	NS
1089	0.7, 2.1, 1.6	1.5	0.8	0.0174
3300	0.5, 0.0, 0.0	0.2	0.3	0.0140
10,000	0.0, 0.0, 0.0	0.0	0.0	0.0000
Cab-O-Sil	0.0, 0.5, 0.1	0.2	0.3	0.0141

Table 27A
Acid Phosphatase Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E70S-3 Particulates
Toxicity Study of Welding Fumes in Rats

2236-100/101

Concentrations ($\mu\text{g/ml}$)	Acid Phosphatase ($\mu\text{g/ml}$)	Mean	Standard Deviation	P-Value
0	1.9, 2.2, 2.1	2.1	0.15	—
4	1.4, 1.1, 1.5	1.3	0.21	0.008
13	1.1, 1.2, 1.2	1.2	0.06	0.0054
39	3.0, 2.9, 2.5	2.8	0.26	0.0127
118	3.7, 2.2, 4.5	3.5	1.17	0.0878
359	TT	—	—	—
1089	TT	—	—	—
3300	TT	—	—	—
10,000	TT	—	—	—
Cab-O-Sil	TT	—	—	—

2236-100/101

Table 27B
Acid Phosphatase Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E308-16 Particulates
Toxicity Study of Welding Fumes in Rats

Concentrations ($\mu\text{g}/\text{ml}$)	Acid Phosphatase ($\mu\text{g}/\text{ml}$)	Mean	Standard Deviation	P-Value
0	2.9, 4.0, 4.9	3.9	1.0	—
4	2.6, 3.2, TE	2.9	0.4	NS
13	3.7, 5.0, 4.7	4.5	0.7	NS
39	6.0, 5.5	5.8	0.4	NS
118	3.6, 3.6	3.6	0.0	NS
359	1.6, 4.2, 3.7	3.2	1.4	NS
1089	2.2, 4.8, 1.8	2.9	1.6	NS
3300	TT	—	—	—
10,000	TT	—	—	—
Cab-O-Sil	Not Determined	—	—	—

2236-100/101

Table 27C
Acid Phosphatase Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E7018 Particulates
Toxicity Study of Welding Fumes in Rats

Concentrations ($\mu\text{g}/\text{ml}$)	Acid Phosphatase ($\mu\text{g}/\text{ml}$)	Mean	Standard Deviation	P-Value
0	4.2, 4.8, 5.3	4.8	0.6	—
4	5.3, 5.2, 4.2	4.9	0.6	NS
13	2.4, 2.1	2.3	0.2	0.000
39	1.8, 1.3, 2.0	1.7	0.4	0.000
118	0, 0, 0	0.0	0.0	—
359	2.5, 2.4, 2.6	2.5	0.1	0.000
1089	TT	—	—	—
3300	TT	—	—	—
10,000	TT	—	—	—
Cab-O-Sil	5.8, 6.3, 6.6	6.2	0.4	0.003

2236-100/101

Table 27D
Acid Phosphatase Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E6010 Particulates
Toxicity Study of Welding Fumes in Rats

Concentrations ($\mu\text{g/ml}$)	Acid Phosphatase ($\mu\text{g/ml}$)	Mean	Standard Deviation	P-Value
0	7.3, 7.8, 7.6	7.6	0.25	—
4	4.1, 4.5, 4.5	4.4	0.23	0.0000
13	5.7, 5.5, 5.1	5.4	0.31	0.0001
39	7.0, 6.1, 5.8	6.3	0.62	0.0065
118	7.3, 8.8, 7.3	7.8	0.87	NS
359	6.1, 6.7, 7.2	6.7	0.55	0.0314
1089	TT	—	—	—
3300	TT	—	—	—
10,000	TT	—	—	—
Cab-O-Sil	8.6, 9.4, 9.9	9.3	0.66	0.0008

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Table 27E
Acid Phosphatase Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E70T-1 Particulates
Toxicity Study of Welding Fumes in Rats

Concentrations ($\mu\text{g/ml}$)	Acid Phosphatase ($\mu\text{g/ml}$)	Mean	Standard Deviation	P-Value
0	6.1, 6.1, 5.4	5.9	0.40	—
4	6.2, 7.5, 6.7	6.8	0.66	0.0200
13	5.4, 4.8, 4.6	4.9	0.42	0.0200
39	7.0, 7.1, 7.2	7.1	0.10	0.0049
118	6.7, 6.7, 6.0	6.5	0.40	NS
359	9.0, 9.5, 7.8	8.8	0.87	<0.00001
1089	TT	TT	TT	TT
3300	TT	TT	TT	TT
10,000	TT	TT	TT	TT
Cab-O-Sil	12.0, 11.5, 11.5	11.7	0.29	<0.00001

2236-100/101

Table 27F
Acid Phosphatase Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E5356 Particulates
Toxicity Study of Welding Fumes in Rats

Concentrations ($\mu\text{g}/\text{ml}$)	Acid Phosphatase ($\mu\text{g}/\text{ml}$)	Mean	Standard Deviation	P-Value
0	5.2, 5.5, 5.3	5.3	0.15	—
4	4.8, 6.1, 5.2	5.4	0.67	NS
13	3.6, 3.8, 3.9	3.8	0.15	0.0005
39	9.2, 4.5, 5.2	6.3	2.54	NS
118	5.1, 4.2, 4.8	4.7	0.46	NS
359	TT	—	—	—
1089	TT	—	—	—
3300	TT	—	—	—
10,000	TT	—	—	—
Cab-O-Sil	10.3, 9.0, 9.5	9.6	0.66	0.0041

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Table 28A
Lysozyme Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E70S-3 Particulates
Toxicity Study of Welding Fumes in Rats

Concentrations ($\mu\text{g}/\text{ml}$)	Lysozyme ($\mu\text{g}/\text{ml}$)	Mean	Standard Deviation	P-Value
0	60, 0, a	30.0	42.4	NS
4	a, 30, 87.5	30.8	1.1	NS
13	30, 60, 60	50.0	17.3	NS
39	a, 117.5, 30	73.8	61.9	NS
118	a, 30, 87.5	58.8	40.7	NS
359	a, 60, 0	30.0	42.4	NS
1089	30, 30, 60	40.0	17.3	NS
3300	TT	—	—	—
10,000	TT	—	—	—
Cab-O-Sil	60, 0, a	30.0	42.4	NS

^aNot on standard curve.

2236-100/101

Table 28B
Lysozyme Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E308-16 Particulates
Toxicity Study of Welding Fumes in Rats

Concentrations ($\mu\text{g/ml}$)	Lysozyme ($\mu\text{g/ml}$)	Mean	Standard Deviation	P-Value
0	0, 13, 37	16.7	18.8	NS
4	53, 0	26.5	37.5	NS
13	13, TE, 0	6.5	9.2	NS
39	53, 0	26.5	37.5	NS
118	0, 0	0.0	0.0	NS
359	0, 0, 0	0.0	0.0	NS
1089	0, 37, 0	12.3	21.4	NS
3300	TT	—	—	—
10,000	TT	—	—	—
Cab-O-Sil	13, 0, TE	6.5	9.2	NS

2236-100/101

Table 28C
Lysozyme Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E7018 Particulates
Toxicity Study of Welding Fumes in Rats

Concentrations ($\mu\text{g/ml}$)	Lysozyme ($\mu\text{g/ml}$)	Mean	Standard Deviation	P-Value
0	0, A, 65	32.5	46.0	NS
4	65, A, 22.5	43.8	30.1	NS
13	22.5, 45	33.8	15.9	NS
39	A, A, 45	b	b	b
118	265.2, 0, 65	110.1	138.2	NS
359	TT	—	—	—
1089	TT	—	—	—
3300	TT	—	—	—
10,000	TT	—	—	—
Cab-O-Sil	155, 132.5	143.8	15.9	NS

2236-100/101

Table 28D
Lysozyme Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E6010 Particulates
Toxicity Study of Welding Fumes in Rats

Concentrations ($\mu\text{g/ml}$)	Lysozyme ($\mu\text{g/ml}$)	Mean	Standard Deviation	P-Value
0	A, 130, A	b	b	b
4	130, 175, 45	116.7	66.0	NA
13	45, 45, 152.5	80.8	62.1	NA
39	A, 87.5, 217.5	152.5	91.9	NA
118	110, A, A	b	b	b
359	A, 0, 130	65.0	91.9	NA
1089	T	—	—	—
3300	T	—	—	—
10,000	T	—	—	—
Cab-O-Sil	22.5, 0, 65	29.2	33.0	NA

2236-100/101

Table 28E
Lysozyme Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E70T-1 Particulates
Toxicity Study of Welding Fumes in Rats

Concentrations ($\mu\text{g/ml}$)	Lysozyme ($\mu\text{g/ml}$)	Mean	Standard Deviation	P-Value
0	A, A, 30	b	b	b
4	135, 135, 70	113.3	37.5	NA
13	0, 0, 70	23.3	40.4	NA
39	A, A, 117.5	b	b	b
118	A, A, 87.5	b	b	b
359	A, A, 87.5	b	b	b
1089	TT	—	—	—
3300	TT	—	—	—
10,000	TT	—	—	—
Cab-O-Sil	30, 30, 30	30.0	0.0	NA

Table 28F 2236-100/101
Lysozyme Determinations in Rat Alveolar Macrophage Cells
Exposed to Fume E5356 Particulates
Toxicity Study of Welding Fumes in Rats

Concentrations ($\mu\text{g/ml}$)	Lysozyme ($\mu\text{g/ml}$)	Mean	Standard Deviation	P-Value
0	20, 20, 62	34.0	24.2	—
4	82, 40, 120	80.7	40.0	NS
13	0, 100, 0	66.7	57.7	NS
39	82, 40, 20	47.3	31.6	NS
118	0, 62, 0	20.7	35.8	NS
359	TT	—	—	—
1089	TT	—	—	—
3300	TT	—	—	—
10,000	TT	—	—	—
Cab-O-Sil	0, 0, 0	—	—	—

Table 29A 2236-100/101
Effect of Fume E70S-3 Particulates
on Rat Alveolar Macrophages
Toxicity Study of Welding Fumes in Rats

Concentration ($\mu\text{g/ml}$)	Viability Index	Phagocytic Index	ATP	% Control AP	Lysozyme
0	1.00	1.00	100.0	100.0	100.0
4	0.91	1.03	140.9	61.9	102.7
13	0.86	1.11	122.7	57.1	166.7
39	0.93	1.04	177.3	133.3	246.0
118	0.79	1.21	122.7	166.7	196.0
359	0.89	1.20	56.1	TT	100.0
1089	0.99	0.80	22.7	TT	133.3
3300	0.92	0.96	12.1	TT	TT
10,000	0.71	0.72	9.1	TT	TT
Cab-O-Sil	0.10	T	1	TT	100.0

Table 29B
Effect of Fume E308-16 Particulates
on Rat Alveolar Macrophages
Toxicity Study of Welding Fumes in Rats

2236-100/101

Concentration ($\mu\text{g/ml}$)	Viability Index	Phagocytic Index	ATP	% Control AP	Lysozyme
0	1.00	1.00	100.0	100.0	100.0
4	0.97	0.94	41.4	74.4	158.7
13	0.76	0.66	24.1	115.4	38.9
39	0.14	0.31	15.5	148.7	158.7
118	0.14	T	15.5	92.3	0.0
359	0.11	T	17.2	82.1	0.0
1089	0.09	T	5.2	74.4	73.7
3300	0.02	T	13.8	TT	TT
10,000	0.00	T	6.9	TT	TT
Cab-O-Sil	0.02	0.22	96.6	TT	38.9

Table 29C
Effect of Fume E7018 Particulates
on Rat Alveolar Macrophages
Toxicity Study of Welding Fumes in Rats

2236-100/101

Concentration ($\mu\text{g/ml}$)	Viability Index	Phagocytic Index	ATP	% Control AP	Lysozyme
0	1.00	1.00	100.00	100.00	100.0
4	0.67	1.07	92.7	102.1	134.8
13	0.37	0.99	25.5	47.9	104.0
39	0.16	>0.12	6.2	35.4	138.5 ^a
118	0.08	0.07	9.8	0.0	338.8
359	0.06	0.08	8.3	52.1	TT
1089	0.00	T	5.9	TT	TT
3300	0.00	T	5.5	TT	TT
10,000	0.00	T	7.6	TT	TT
Cab-O-Sil	0.03	T	9.0	129	442.5

^aBased on a single value, not a mean.

Table 29D
Effect of Fume E6010 Particulates
on Rat Alveolar Macrophages
Toxicity Study of Welding Fumes in Rats

2236-100/101

Concentration ($\mu\text{g/ml}$)	Viability Index	Phagocytic Index	ATP	% Control AP	Lysozyme
0	1.00	1.00	100.0	100.0	100.0 ^a
4	1.00	0.83	85.5	57.9	89.8
13	0.87	1.00	159.0	71.8	62.2
39	0.86	0.98	114.5	82.9	117.3
118	0.77	0.98	108.4	102.6	84.6 ^a
359	0.12	0.95	19.3	88.1	50.0
1089	0.03	0.55	8.4	TT	TT
3300	0.00	T	3.6	TT	TT
10,000	0.00	T	4.8	TT	TT
Cab-O-Sil	0.01	0.06	7.2	122.4	22.5

Table 29E
Effect of Fume E70T-1 Particulates
on Rat Alveolar Macrophages
Toxicity Study of Welding Fumes in Rats

2236-100/101

Concentration ($\mu\text{g/ml}$)	Viability Index	Phagocytic Index	ATP	% Control AP	Lysozyme
0	1.00	1.00	100.0	100.0	100.0 ^a
4	0.91	1.09	140.5	115.3	377.7
13	0.88	1.29	112.2	83.1	77.7
39	0.75	1.28	125.7	120.3	391.7 ^a
118	0.38	0.01	121.6	110.2	291.7 ^a
359	0.23	0.00	41.9	149.2	291.7 ^a
1089	0.003	0.00	2.70	TT	TT
3300	0.04	0.00	1.35	TT	TT
10,000	0.06	0.18	1.35	TT	TT
Cab-O-Sil	0.00	T	0.0	198.3	100.0

^aBased on a single value, not a mean.

Table 29F
Effect of Fume E5356 Particulates
on Rat Alveolar Macrophages
Toxicity Study of Welding Fumes in Rats

2236-100/101

Concentration ($\mu\text{g/ml}$)	Viability Index	Phagocytic Index	ATP	% Control AP	Lysozyme
0	1.00	1.00	100.0	100.0	100.0
4	1.01	0.72	102.1	101.9	237.3
13	1.00	1.17	121.5	71.7	196.2
39	0.99	1.15	137.5	118.9	139.1
118	0.98	0.17	102.7	88.7	60.9
359	0.97	0.01	62.5	TT	TT
1089	0.90	0.00	10.4	TT	TT
3300	0.76	0.00	1.39	TT	TT
10,000	0.51	0.00	0.0	TT	TT
Cab-O-Sil	0.00	0.00	1.39	181.1	TT

Appendices

These Appendices are not part of the *Toxicity of Welding Fume in Rats* but are included for information purposes only.

Appendix 1 Gravimetric Concentrations (mg/L) Toxicity Study of Welding Fumes in Rats

Sample											Mean	S.D.
1	2	3	4	5	6	7	8	9	10	11		
0.562	0.703	0.607	0.533	0.502	0.540	E5356	0.611	0.480	0.515		0.559	0.0655
						0.539						
0.962	0.667	0.706	0.813	0.665	0.597	E70S-3	0.564	0.702	0.495		0.672	0.1378
						0.545						
0.775	0.786	0.573	0.521	0.547	0.525	E308-16	0.581	0.488	0.575	0.632	0.601	0.0976
						0.607						
0.974	0.539	0.528	0.559	0.693	0.702	E7018	0.662	0.572	0.584		0.641	0.1323
						0.598						
0.566	0.661	0.521	0.553	0.675	0.419	E6010	0.544	0.472	0.623		0.551	0.0837
						0.477						
0.896	1.031	1.141	0.996	1.043	0.906	E70T-1	0.782	0.765	0.478		0.890	0.1872
						0.864						
0.135	0.450	0.140	0.284	0.413	0.185	E308-16 (Second Exposure)	0.130	0.322	0.277		0.268	0.1171
						0.345						

Appendix 2
Mass Median Aerodynamic Diameter (MMAD) (μ)
with Geometric Standard Deviations (σ)
Toxicity Study of Welding Fumes in Rats

	Sample		Mean
	1	2	
<u>E5356</u>			
MMAD (μ):	0.81	0.88	0.845
σ g:	2.19	2.02	2.105
<u>E70S-3</u>			
MMAD (μ):	0.74	0.79	0.765
σ g:	1.49	2.99	2.240
<u>E308-16</u>			
MMAD (μ):	0.97	1.18	1.075
σ g:	1.52	1.55	1.535
<u>E7018</u>			
MMAD (μ):	0.83	0.95	0.890
σ g:	1.76	1.79	1.775
<u>E6010</u>			
MMAD (μ):	0.77	0.95	0.860
σ g:	2.05	2.07	2.060
<u>E70T-1</u>			
MMAD (μ):	0.64	1.09	0.865
σ g:	2.11	2.21	2.160
<u>E308-16 (Second Exposure)</u>			
MMAD (μ):	0.86	1.18	1.020
σ g:	2.27	1.98	2.125

Appendix 3

Hourly Test Atmospheric Concentrations

Toxicity Study of Welding Fumes in Rats

Group A	Exposure Hour						Mean	S.D.
	1	2	3	4	5	6		
<u>% Oxygen</u>								
E5356	19.5	19.6	19.6	19.6	19.5	19.6	19.57	0.052
E70S-3	20.0	19.8	19.7	19.7	19.5	19.4	19.68	0.214
E308-16	19.6	19.4	19.4	19.4	19.4	19.3	19.42	0.098
E7018	19.5	19.3	19.3	19.3	19.2	19.3	19.32	0.098
E6010	19.8	19.8	19.8	19.8	19.8	19.3	19.72	0.204
E70T-1	19.5	19.8	19.5	19.6	19.7	19.6	19.62	0.117
E308-16 ^a	19.5	19.5	19.5	19.5	19.3	19.5	19.47	0.082
<u>ppm Ozone</u>								
E5356	<0.001 ^b	0	0	0	0	0	0	0.0
E70S-3	0	0	0	0	0	0	0	0.0
E308-16	<0.01 ^b	0	<0.01 ^b	<0.01 ^b	0	0	0	0.0
E7018	0	0	0	0	0	0	0	0.0
E6010	0	0	0	0	0	0	0	0.0
E70T-1	0	0	0	0	0	0	0	0.0
E308-16 ^a	0	0	0	0	0	0	0	0.0
<u>ppm Nitrogen Oxide (NO + NO₂)</u>								
E5356	20.0	20.0	20.0	20.0	20.0	20.0	20.0	0.00
E70S-3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.00
E308-16	15.0	10.0	7.5	10.0	7.5	7.5	9.6	2.92
E7018	20.0	20.0	12.0	17.0	15.0	17.0	16.8	3.06
E6010	15.0	12.5	10.0	10.0	10.0	10.0	11.3	2.09
E70T-1	3.0	5.0	5.0	5.0	4.5	3.0	4.3	0.99
E308-16 ^a	6.0	10.0	11.0	10.0	10.0	10.0	9.5	1.76
<u>Nitrogen Oxide (NO₂)</u>								
E5356	<0.5	0.5	<0.5	<0.5	0.5	<0.5	—	—
E70S-3	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	—	—
E308-16	0	0	0	0	0	0	0	0.00
E7018	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	—	—
E6010	0	0	0	0	0	0	0	0.00
E70T-1	0	0	0	0	0	0	0	0.00
E308-16 ^a	0	0	0	0	0	0	0	0.00
<u>ppm Carbon Monoxide</u>								
E5356	2.25	3.25	2.25	2.25	2.25	<2.25 ^b	2.450	0.4472
E70S-3	1330	810	710	780	750	400	796.7	300.64
E308-16	57.5	51.0	39.8	42.0	38.5	57.0	47.63	8.636
E7018	75	65	73	59	65	78	69.2	7.28
E6010	48	46	37	38	37	41	41.2	4.79
E70T-1	1690	1040	875	887	560	532	930.7	421.87
E308-16 ^a	44	44	24	39	39	32	37.0	7.75

^a Second Exposure.^b Value excluded from mean calculations.

Appendix 4
Temperature and Humidity Data
Toxicity Study of Welding Fumes in Rats

		Temperature (° F)							Humidity (%)						
		Hours							Hours						
Electrode	Reading	1	2	3	4	5	6	7	1	2	3	4	5	6	7
E5356															
Group A (Repeat)	1	72	77	77	78	77	76	78	52	50	50	50	50	50	51
	2	74	77	78	77	77	76	77	53	50	50	50	50	51	51
	3	74	77	78	77	77	77		53	50	50	50	50	51	
	4	76	77	78	77	76	77		50	50	50	50	51	51	
Control Groups CCB & CCD	1	68	70	71	71	72	72	72	51	50	50	51	51	50	51
	2	69	70	71	72	72	72	72	51	50	50	51	51	51	51
	3	70	70	71	72	72	72		51	50	51	51	51	51	
	4	70	71	71	72	72	72		50	50	51	51	50	51	
Control Group CCA	1	70	71	71	71	72	72	72	43	42	41	40	40	39	38
	2	71	71	71	71	72	72	72	43	42	41	40	39	39	37
	3	71	71	71	71	72	72		43	42	41	40	39	38	
	4	71	71	71	71	72	72		43	41	40	40	39	38	
E70S-3															
Group A	1	72	78	79	78	78	78	78	51	49	50	52	52	52	53
	2	74	79	78	78	78	78	77	50	49	50	50	51	52	53
	3	75	79	78	79	78	78		50	49	51	51	52	52	
	4	77	79	78	78	78	78		49	50	52	51	53	52	
Control Groups CCB & CCD	1	69	69	70	70	70	70	70	46	48	52	55	55	55	55
	2	69	70	70	70	70	70	70	46	49	53	55	55	54	54
	3	69	70	70	70	70	70		47	50	53	55	55	55	
	4	69	70	70	70	70	70		48	51	54	55	55	55	
Control Group CCA	1	70	71	72	72	72	72	72	55	56	57	57	58	60	61
	2	70	72	72	72	72	72	72	56	56	57	57	58	61	61
	3	71	72	72	72	72	72		56	56	57	57	59	61	
	4	71	72	72	72	72	72		57	57	57	58	60	61	
E308-16															
Group A	1	74	80	80	79	79	79	79	59	70	59	59	60	60	60
	2	76	79	80	79	80	79	79	62	63	59	59	60	60	60
	3	77	80	80	79	79	79		65	60	59	59	60	60	
	4	79	79	79	79	79	79		72	60	59	60	60	60	
Control Groups CCB & CCD	1	72	72	72	72	71	71	70	61	58	56	58	59	60	60
	2	72	72	72	71	71	70	70	60	56	57	58	59	60	61
	3	72	73	72	71	71	71		60	55	57	59	60	60	
	4	72	72	72	71	71	71		59	55	57	59	60	60	
Control Group CCA	1	70	70	70	70	71	70	71	53	52	52	52	52	53	53
	2	70	70	70	70	70	71	71	53	53	52	52	52	53	53
	3	70	70	70	70	71	71		53	53	52	52	53	52	
	4	70	70	71	70	71	71		53	52	52	52	53	52	

Appendix 4 (Continued)

		Temperature (° F)							Humidity (%)						
		Hours							Hours						
Electrode	Reading	1	2	3	4	5	6	7	1	2	3	4	5	6	7
E7018															
Group A	1	67	75	76	78	78	77	76	42	44	44	43	43	44	44
	2	70	75	76	78	79	77	76	45	45	45	43	43	44	44
	3	72	75	76	78	79	76		45	45	44	43	44	44	
	4	73	75	76	79	78	76		45	45	44	43	43	44	
Control Groups CCB & CCD	1	65	67	68	70	71	71	71	38	39	41	4	40	40	41
	2	66	67	68	70	71	71	71	38	49	41	49	49	41	49
	3	66	68	69	70	71	71		39	40	41	40	40	40	
	4	67	68	69	70	71	71		40	40	41	40	40	40	
Control Group CCA	1	68	69	70	70	70	70	70	43	45	45	45	44	44	43
	2	68	69	70	70	70	70	70	43	45	45	45	44	44	43
	3	68	69	70	70	70	70		44	45	46	45	44	44	
	4	69	69	70	70	70	70		44	45	45	45	44	44	
E6010															
Group A	1	70	76	78	80	80	80	80	46	50	45	44	44	43	44
	2	72	78	78	80	80	81	80	51	47	46	43	43	44	42
	3	74	78	78	80	80	80		51	46	45	43	43	43	
	4	76	78	79	80	80	80		50	46	44	44	44	43	
Control Groups CCB & CCD	1	67	68	70	71	71	72	73	42	43	40	39	38	38	38
	2	66	68	70	70	72	73	73	42	42	40	38	38	38	37
	3	67	69	70	70	71	73		43	41	39	38	38	38	
	4	67	69	70	70	71	73		43	41	39	38	38	38	
Control Group CCA	1	68	68	70	70	70	70	70	40	41	41	41	40	40	39
	2	68	69	70	70	70	70	70	41	41	41	41	40	40	39
	3	68	69	70	70	70	70		41	41	41	41	40	40	
	4	68	69	70	70	70	70		41	41	41	40	40	39	
E70T-1															
Group A	1	70	77	80	79	79	80	80	43	42	40	40	40	40	40
	2	71	77	80	79	79	80	79	44	42	40	40	40	40	40
	3	74	79	80	79	79	80		43	40	40	40	40	40	
	4	76	79	79	79	79	80		42	40	40	40	40	40	
Control Groups CCB & CCD	1	67	67	69	70	72	73	72	36	35	36	35	35	34	33
	2	67	67	69	71	72	73	72	36	35	36	35	34	34	33
	3	68	68	70	71	73	73		36	35	36	34	34	33	
	4	67	68	70	72	73	73		36	35	36	35	34	33	
Control Group CCA	1	66	67	68	68	68	69	69	39	41	41	41	42	43	42
	2	67	67	68	68	68	69	69	40	41	42	41	43	43	42
	3	66	68	68	68	69	69		40	41	41	41	43	42	
	4	67	68	68	68	69	69		40	41	41	42	43	42	

(Continued)

Appendix 4 (Continued)

Electrode	Reading	Temperature (° F)							Humidity (%)							
		Hours							Hours							
		1	2	3	4	5	6	7	1	2	3	4	5	6	7	
Group A		E5356														
	1	77	80	80	76	74	75	74	55	52	50	54	55	55	57	
	2	77	80	79	75	75	74	74	56	51	52	54	55	55	58	
	3	79	80	78	75	75	73		53	51	52	54	55	56		
Control Groups CCB & CCD	4	79	80	76	75	74	74		53	51	54	55	55	56		
	1	73	74	75	73	73	73	73	54	50	51	53	55	55	55	
	2	73	75	75	73	73	73	73	54	52	51	53	55	55	56	
	3	73	75	75	73	73	73		54	51	52	53	55	55		
Control Group CCA	4	74	75	74	74	73	73		52	51	52	54	55	55		
	1	72	72	72	72	73	74	74	50	50	51	52	54	55	57	
	2	71	72	72	72	73	74	74	50	50	51	52	54	56	57	
	3	72	72	72	72	73	73		51	51	52	53	55	57		
	4	72	72	72	72	73	73		51	51	52	53	55	57		

Appendix 5
Elemental Chemical Analysis of Bulk Welding Fume
Used in the Hazleton Study

	E6010	E7018	E70S-3 ^a	E70T-1 ^a	E308-16	E5356 ^b
Al		1.0				44.3
Ca		20.6				
Cr					5.79	
Cu			0.33			0.1
F		18.1		0.72	13.6	
Fe	42.5	24.9	54.5	45.0	12.5	
K		9.79			18.8	
Mg						6.45
Mn	4.23	5.75	5.73	9.00	4.93	
Na	6.22	4.81		2.85	7.70	
Ni					1.23	
Si	6.62	3.23	1.96	7.27	2.87	
Ti				1.64		0.01
% Water Soluble	6.08	22.3	0.2	4.7	47.6	0.48

^aShielding Gas: Carbon Dioxide.^bShielding Gas: Argon.

2236-100/101

Appendix 5A
Individual Body Weights with Means and Standard Deviations (grams)
Toxicity Study of Welding Fumes in Rats
Control Group CCA

Animal Number	Pre-Exposure	Day Exposure			
	Day 1	Day 1	Day 7	Day 14	Day 15
MALES					
47201	288	279	311	340	311
47202	294	283	315	336	308
45603	282	266	313	277	264
45604	256	243	275	277	260
45605	257	247	312	340	304
45606	308	296	320	307	277
45607	277	261	292	313	285
45608	303	292	321	351	315
45609	295	276	298	344	304
45610	285	269	299	330	297
45611	319	303	346	385	342
45612	283	269	308	345	313
Mean	287.3	273.7	309.2	328.8	298.3
S.D.	18.68	18.42	17.49	30.95	23.36
FEMALES					
45803	199	189	208	228	202
45804	194	187	201	222	199
45805	200	191	213	230	205
45806	192	183	201	223	200
45607	192	184	205	215	195
45808	188	178	193	198	181
45809	191	184	193	210	189
45810	190	182	190	210	184
45811	207	199	227	250	226
45812	200	191	209	225	203
47301	202	192	206	218	195
47302	207	199	220	231	209
Mean	196.8	188.3	205.5	221.7	199.0
S.D.	6.55	6.54	11.04	13.15	11.95

(Continued)

Appendix 5A (Continued)
Fume E5356 — Group A

2236-100/101

Animal Number	Pre-Exposure	Day Postexposure			
	Day 1	Day 1	Day 7	Day 14	Day 15
MALES					
47203	254	246	300	334	301
47204	312	295	318	359	324
47205	311	303	353	373	345
47206	250	244	306	352	316
47207	305	292	318	347	317
Mean	286.4	276.0	319.0	353.4	320.6
S.D.	31.55	28.59	20.54	15.14	16.01
FEMALES					
47303	206	195	214	236	210
47304	216	203	225	241	215
47305	210	202	212	224	204
47306	190	177	196	207	184
47307	205	196	208	227	202
Mean	205.4	194.6	211.0	227.0	203.0
S.D.	9.63	10.45	10.49	13.10	11.79

Fume E70S-3 — Group A

Animal Number	Pre-Exposure	Day Postexposure			
	Day 1	Day 1	Day 7	Day 14	Day 15
MALES					
45618	270	254	286	298	282
45619	259	250	275	296	285
45620	249	236	262	293	267
45621	266	252	284	313	285
45622	273	257	290	319	290
Mean	263.4	249.8	279.4 ^{S-}	303.8	281.8
S.D.	9.61	8.14	11.17	11.48	8.76
FEMALES					
45818	188	176	194	212	192
45819	196	189	213	224	203
45820	196	184	212	214	198
45821	191	182	203	201	185
45822	183	176	199	214	196
Mean	190.8	181.4	204.2	213.0	194.8
S.D.	5.54	5.55	8.23	8.19	6.76

Appendix 5A (Continued)
Fume E70T-1 — Group A

2236-100/101

Animal Number	Pre-Exposure	Day Postexposure			
	Day 1	Day 1	Day 7	Day 14	Day 15
MALES					
45638	272	261	285	323	287
45639	301	287	330	387	354
45640	317	294	338	380	337
45641	259	251	275	313	283
45642	275	261	288	328	293
Mean	284.8	270.8	303.2	346.2	310.8
S.D.	23.58	18.61	28.67	34.56	32.44
FEMALES					
45838	212	196	218	227	205
45839	213	202	215	227	207
45840	211	200	220	233	209
45841	206	198	214	224	202
45842	206	198	212	225	202
Mean	209.6 ^{S*}	198.8	215.8	227.5	205.0
S.D.	3.36	2.28	3.19	3.49	3.08

Fume E308-16 — Group A

Animal Number	Pre-Exposure	Day Postexposure				
	Day 1	Day 1	Day 7 ^a	Day 14 ^a	Day 15 ^a	Found Dead
MALES						
45623	290	268				253
45624	294	263				223
45625	291	268				254
45626	283	259				237
45627	281	260				228
Mean	287.8	263.6				239.0
S.D.	5.54	4.28				14.16
FEMALES						
45823	200	182				173
45824	195	180				162
45825	175	162				122
45826	180	193				148
45827	196	180				178
Mean	189.2	179.4				156.6
S.D.	10.99	11.13				22.51

^a. All animals were found dead prior to this observation.

(Continued)

Appendix 5A (Continued)
Fume E6010 — Group A

2236-100/101

Animal Number	Pre-Exposure	Day Postexposure			
	Day 1	Day 1	Day 7	Day 14	Day 15
MALES					
45633	277	263	297	340	307
45634	295	277	310	347	317
45635	279	266	302	344	308
45636	266	251	296	335	301
45637	279	261	305	342	307
Mean	279.2	263.6	302.0	341.6	308.0
S.D.	10.35	9.37	5.79	4.51	5.74
FEMALES					
45833	199	185	209	225	199
45834	201	192	217	230	208
45835	192	175	196	217	194
45836	189	182	210	212	191
45837	191	179	196	212	189
Mean	194.4	182.6	205.6	219.2	196.2
S.D.	5.27	6.43	9.29	8.04	7.60

Fume E7018 — Group A

Animal Number	Pre-Exposure	Day Postexposure			
	Day 1	Day 1	Day 7	Day 14	Day 15
MALES					
45628	309	292	321	347	314
45629	240	231	279	308	278
45630	279	263	292	312	286
45631	315	300	337	362	333
45632	303	283	320	361	318
Mean	289.2	273.8	309.8	338.0	305.8
S.D.	30.71	27.62	23.64	26.28	23.03
FEMALES					
45828	186	176	193	203	185
25829	189	182	194	205	187
25830	200	188	208	221	204
45831	206	195	211	230	206
45832	205	186	205	225	196
Mean	197.2	185.4	202.2	216.8	195.6
S.D.	9.20	7.06	8.23	12.13	9.56

Appendix 5A (Continued)
Control Group CCA (Repeat)

2236-100/101

Animal Number	Pre-Exposure	Day Postexposure			
	Day 1	Day 1	Day 7	Day 14	Day 15
MALES					
45501	265	251	286	317	288
45502	240	233	295	330	299
45503	280	265	306	337	305
45504	255	246	277	300	271
45505	239	230	280	304	271
Mean	255.8	245.0	288.8	317.6	286.8
S.D.	17.34	14.20	11.82	16.01	15.66
FEMALES					
45551	198	188	211	221	197
45552	183	174	202	215	191
45553	191	185	200	213	190
45554	190	183	201	215	188
45555	161	160	205	217	194
Mean	184.6	178.0	203.8	216.2	192.0
S.D.	14.22	11.34	4.44	3.03	3.54

Fume E308-16 — Group A (Repeat)

Animal Number	Pre-Exposure	Day Postexposure			
	Day 1	Day 1	Day 7	Day 14	Day 15
MALES					
45506	250	241	298	356	320
45507	256	242	276	314	276
45508	274	261	292	337	301
45509	266	256	251	311	275
45510	261	246	268	316	276
Mean	261.4	249.2	277.0	326.8	289.6
S.D.	9.21	8.87	18.87	19.28	20.23
FEMALES					
45556	190	175	198	216	189
45557	194	180	199	221	191
45558	200	191	202	226	201
45559	192	179			
45560	190	179	201	227	199
Mean	193.2	180.8	200.0	222.5	195.0
S.D.	4.15	6.02	1.83	5.07	5.89

2236-100/101

Appendix 5B
Initial Body Weights with Means and Standard Deviations (grams)
Toxicity Study of Welding Fumes in Rats

Control Group CCB			Control Group CCD		
Animal Number	Day 1		Animal Number	Day 1	
	Pre-Exposure	Postexposure		Pre-Exposure	Postexposure
MALES					
45645	257	241	45717	271	257
45646	261	247	25718	256	241
45647	286	268	45719	278	255
45648	282	266	45720	297	280
45649	284	271	45721	294	281
45650	284	271	45722	307	292
45651	283	267	45723	276	258
45652	266	249	45724	281	270
45653	297	278	45725	275	259
45654	264	253	45726	261	245
47208	311	292	47220	325	311
47209	309	291	47221	317	301
Mean	282.0	266.2		286.5	270.8
S.D.	17.75	16.36		21.67	22.29
FEMALES					
45845	189	178	45917	185	172
45846	191	180	45918	186	173
45847	204	188	45919	194	182
45848	178	171	45920	184	173
45849	205	191	45921	200	194
45850	206	197	45922	190	182
45851	176	163	45923	189	176
45852	195	181	45924	197	185
45853	215	201	45925	202	190
45854	196	186	45926	205	196
47308	206	190	47320	205	193
47309	194	186	47321	213	200
Mean	196.3	184.3		195.8	184.7
S.D.	11.71	10.60		9.33	9.87

Appendix 5B (Continued)
Fume E5356

2236-100/101

Group B			Group C			Group D		
Day 1			Day 1			Day 1		
Animal Number	Pre-Exposure	Postexposure	Animal Number	Pre-Exposure	Postexposure	Animal Number	Pre-Exposure	Postexposure
MALES								
47210	289	278	47215	321	308	47222	311	293
47211	294	283	47216	308	287	47223	287	274
47212	318	304	47217	293	279	47224	320	304
47213	305	286	47218	303	287	47225	302	290
47214	300	287	47219	296	287	47226	308	290
Mean	301.2	287.6		304.2	289.6		305.6	290.2
S.D.	11.17	9.81		11.08	10.85		12.26	10.73
FEMALES								
47310	200	192	47315	185	176	47322	190	177
47311	211	200	47316	200	184	47323	189	179
47312	192	185	47317	200	186	47324	204	194
47313	191	181	47318	204	191	47325	198	188
47314	206	195	47319	191	184	47326	171	160
Mean	200.0	190.6		196.0	184.2		190.4	179.6
S.D.	8.69	7.64		7.78	5.50		12.46	12.93

Fume E70S-3

Group B			Group C			Group D		
Day 1			Day 1			Day 1		
Animal Number	Pre-Exposure	Postexposure	Animal Number	Pre-Exposure	Postexposure	Animal Number	Pre-Exposure	Postexposure
MALES								
45660	282	259	45690	256	244	45732	270	250
45661	279	264	45691	271	257	45733	274	261
45662	271	253	45692	257	244	45734	277	263
45663	274	260	45693	271	260	45735	275	264
45664	246	235	45694	275	260	45736	236	227
Mean	270.4	254.2		266.0	253.0		266.4	253.0
S.D.	14.29	11.43		8.83	8.31		17.18	15.57
FEMALES								
45860	192	184	45890	180	174	45932	206	194
45861	189	180	45891	196	184	45933	191	178
45862	194	185	45892	193	185	45934	181	174
45863	195	186	45893	181	175	45935	212	201
45864	197	188	45894	198	190	45936	177	166
Mean	193.4	184.6		189.6	181.6		193.4	182.6
S.D.	3.05	2.97		8.50	6.88		15.27	14.48

(Continued)

Appendix 5B (Continued)
Fume E70T-1

2236-100/101

Group B			Group C			Group D		
Animal Number	Day 1		Animal Number	Day 1		Animal Number	Day 1	
	Pre-Exposure	Postexposure		Pre-Exposure	Postexposure		Pre-Exposure	Postexposure
MALES								
45680	276	262	45710	281	270	45752	278	261
45681	286	267	45711	265	252	45753	276	264
45682	289	272	45712	285	267	45754	261	245
45683	294	276	45713	284	266	45755	309	287
45684	289	276	45714	267	252	45756	285	271
Mean	286.8	270.6		276.4	261.4		281.8	265.6
S.D.	6.69	6.07		9.63	8.71		17.54	15.29
FEMALES								
45880	199	186	45910	200	191	45952	200	191
45881	195	182	45911	214	206	45953	206	199
45882	211	198	45912	209	199	45954	202	186
45883	212	204	45913	187	180	45955	201	193
45884	212	198	45914	208	195	45956	210	201
Mean	205.8	193.6		203.6	194.2		203.8	194.0
S.D.	8.17	9.21		10.55	9.68		4.15	6.08

Fume E308-16

Group B			Group C			Group D		
Animal Number	Day 1		Animal Number	Day 1		Animal Number	Day 1	
	Pre-Exposure	Postexposure		Pre-Exposure	Postexposure		Pre-Exposure	Postexposure
MALES								
45665	272	251	45695	281	255	45737	284	260
45666	281	260	45696	274	246	45738	275	247
45667	275	252	45697	275	248	45739	292	276
45668	290	267	45698	285	265	45740	282	258
45669	292	266	45699	275	252	45741	287	266
Mean	282.0	259.2		278.0	253.2		284.0	261.4
S.D.	8.86	7.53		4.80	7.46		6.28	10.67
FEMALES								
45865	205	186	45895	189	175	45937	189	176
45866	188	174	45896	200	189	45938	171	160
45867	182	166	45897	181	164	45939	203	193
45868	188	170	45898	179	161	45940	198	184
45869	206	191	45899	197	167	45941	191	175
Mean	193.8	177.4		189.2	171.2		190.4	177.6
S.D.	10.96	10.67		9.34	11.23		12.20	12.22

Appendix 5B (Continued)
Fume E6010

2236-100/101

Group B			Group C			Group D		
Animal Number	Day 1		Animal Number	Day 1		Animal Number	Day 1	
	Pre-Exposure	Postexposure		Pre-Exposure	Postexposure		Pre-Exposure	Postexposure
MALES								
45675	302	283	45705	250	240	45747	285	265
45676	287	266	45706	272	253	45748	267	257
45677	279	266	45707	288	275	45749	266	251
45678	270	256	45708	275	261	45750	297	281
45679	291	272	45709	282	269	45751	261	245
Mean	285.8	268.6		273.4	259.6		275.2	259.8
S.D.	12.11	9.89		14.48	13.74		15.21	13.97
FEMALES								
45875	200	181	45905	196	187	45947	201	188
45876	191	176	45906	196	181	45948	200	189
45877	193	180	45907	190	181	45949	190	180
45878	180	167	45908	199	185	45950	181	175
45879	196	184	45909	185	174	45951	208	199
Mean	192.0	177.6		193.2	181.6		196.0	186.2
S.D.	7.52	6.58		5.63	4.98		10.56	9.20

Fume E7018

Group B			Group C			Group D		
Animal Number	Day 1		Animal Number	Day 1		Animal Number	Day 1	
	Pre-Exposure	Postexposure		Pre-Exposure	Postexposure		Pre-Exposure	Postexposure
MALES								
45670	294	261	45700	279	259	45742	302	286
45671	291	270	45701	285	264	45743	303	285
45672	301	286	45702	306	291	45744	311	290
45673	310	279	45703	283	268	45745	310	244
45674	288	270	45704	295	278	45746	306	280
Mean	296.8	273.2		289.6	272.0		306.4	277.0
S.D.	8.81	9.58		10.90	12.71		4.04	18.79
FEMALES								
45870	195	184	45900	189	178	45942	209	196
45871	207	189	45901	195	180	45943	191	179
45872	191	173	45902	195	186	45944	196	185
45873	204	195	45903	195	181	45945	202	190
45874	214	198	45904	192	177	45946	201	186
Mean	202.2	187.8		193.2	180.4		199.8	187.2
S.D.	9.26	9.88		2.68	3.51		6.76	6.30

(Continued)

Appendix 5B (Continued)
Fume E308-16 (Repeat Group)

2236-100/101

Group B			Group C			Group D		
Animal Number	Day 1		Animal Number	Day 1		Animal Number	Day 1	
	Pre-Exposure	Postexposure		Pre-Exposure	Postexposure		Pre-Exposure	Postexposure
MALES								
45516	259	243	45521	253	245	45531	275	258
45517	255	238	45522	258	242	45532	263	246
45518	276	255	45523	232	244	45533	277	264
45519	261	246	45524	261	244	45534	261	249
45520	272	246	45525	270	255	45535	268	259
Mean	264.6	245.6		254.8	246.0		268.8	255.2
S.D.	8.96	6.19		14.17	5.15		7.09	7.46
FEMALES								
45566	195	185	45571	197	187	45581	197	185
45567	199	186	45572	181	171	45582	190	180
45568	185	171	45573	202	188	45583	186	177
45569	195	181	45574	204	190	45584	200	188
45570	191	182	45575	193	178	45585	198	185
Mean	193.0	181.0		195.4	182.8		194.2	183.0
S.D.	5.29	5.96		9.13	8.04		5.93	4.42

Repeat Controls for Fume E308-16

Control Group CCB			Control Group CCD		
Animal Number	Day 1		Animal Number	Day 1	
	Prc-Exposure	Postexposure		Pre-Exposure	Postexposure
MALES					
45511	265	245	45526	262	246
45512	258	246	45527	253	240
45513	273	259	45528	264	251
45514	257	246	45529	264	248
45515	261	248	45530	276	260
Mean	262.8	248.8		263.8	249.0
S.D.	6.50	5.81		8.20	7.35
FEMALES					
45561	190	180	45576	185	172
45562	196	185	45577	190	180
45563	180	173	45578	196	186
45564	181	175	45579	186	174
45565	200	187	45580	194	183
Mean	189.4	180.0		190.2	179.0
S.D.	8.88	6.08		4.82	5.92

Key to Appendices 6-9

223610A—Subgroup A

Group 1 = Common Control
 Group 2 = E5356 Repeat
 Group 3 = E70S-3
 Group 4 = E308-16
 Group 5 = E7018
 Group 6 = E6010
 Group 7 = E70T-1

223610C—Subgroups C and D

Group 1 = Common Control
 Group 2 = E5356 Repeat
 Group 3 = E70S-3
 Group 4 = E308-16
 Group 5 = E7018
 Group 6 = E6010
 Group 7 = E70T-1

223610G—Subgroup A

Group 1 = Common Control
 Group 2 = E308-16 Repeat

Standard Key to Individual Gross Pathology Findings

Symbols and Notations

G = This Animal Has Gross Observations Noted
 U = Organ/Tissue Not Macroscopically Remarkable
 — = Keyword/Phrase Not Present or Observed
 P = Indicates Presence
 PC = Free-Text Comment ("C") Accompanies the
 Observation Where 'P' Indicates Presence
 H- = Finding Noted During Processing of Tissues in
 Histology (Precedes Keyword)
 PIN = Permanent Identification Number
 HAN = Histology Accession Number

Locations of Tissue Masses Observed Grossly

DFL = Dorsal-Front-Left	VFL = Ventral-Front-Left
DFR = Dorsal-Front-Right	VFR = Ventral-Front-Right
DHL = Dorsal-Hind-Left	VHL = Ventral-Hind-Left
DHR = Dorsal-Hind-Right	VHR = Ventral-Hind-Right
DFM = Dorsal-Front-Mid	VFM = Ventral-Front-Mid
DHM = Dorsal-Hind-Mid	VHM = Ventral-Hind-Mid

The above locations are used in conjunction with the keywords MASS and SMALL MASS.

Appendix 6
Individual Gross Pathology Findings
Toxicity Study of Welding Fumes in Rats

2236-100/101

Hazleton Laboratories America, Inc.
 Department of Pathology
 Vienna, Virginia

Path/Tox System Output
 Toxicity Study of Welding Fumes
 INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84

Study Number: 223610A

SD: 11 Sex: Male Group: 1	Group:	1	1	1	1	1	1	1	1	1	1	1	
		0	0	0	0	0	0	0	0	0	0	0	
Table Includes:		4	4	4	4	4	4	4	4	4	4	4	
Sex = All; Group = All; Weeks = All		7	7	5	5	5	5	5	5	5	5	5	
Death = All; Subset = All		2	2	6	6	6	6	6	6	6	6	6	
		0	0	0	0	0	0	0	0	1	1	1	
Organ and Keyword(s) or Phrase		1	2	3	4	5	6	7	8	9	0	1	2
Top of List	Codes:	T	T	O	O	3	3	4	4	5G	5G	T	T
Brain (BR)		U	U	U	U	U	U	U	U	U	U	U	U
Adrenals (AD)		U	U	U	U	U	U	U	U	U	U	U	U
Thyroid (TY)		U	U	U	U	U	U	U	U	U	U	U	U
Trachea (TR)		U	U	U	U	U	U	U	U	U	U	U	U
Lung w/Bronchi (LU)													
Failure to Collapse		—	—	—	—	—	—	—	—	—	—	—	—
Dark		—	—	—	—	—	—	—	—	—	—	—	—
Pale Focus (I)/ Area (S)		—	—	—	—	—	—	—	—	—	—	—	—
Mottled		—	—	—	—	—	—	—	—	—	—	—	—
Dark Focus (I)/ Area (S)		—	—	—	—	—	—	—	—	—	—	—	—
Heart (HT)													
Pale Focus (I)/ Area (S)		—	—	—	—	—	—	—	—	—	—	—	—
Spleen (SP)													
Pale		—	—	—	—	—	—	—	—	—	—	—	—
Pale Film on Capsule		—	—	—	—	—	—	—	PC	—	—	—	—
Liver (LI)													
Dark Focus (I)/ Area (S)		—	—	—	—	—	—	—	—	—	—	—	—
Pale Focus (I)/ Area (S)		—	—	—	—	—	—	—	—	—	—	—	—
Kidneys (KD)													
Dark Focus (I)/ Area (S)		—	—	—	—	—	—	—	—	—	—	—	—
Fluid Under Capsule		—	—	—	—	—	—	—	—	—	—	—	—
Fluid Filled		—	—	—	—	—	—	—	—	—	—	—	—
Dilated Pelvis(es)		—	—	—	—	—	—	—	—	PC	—	—	—
Granular Material		—	—	—	—	—	—	—	—	—	—	—	—
Granular/Pitted/Rough		—	—	—	—	—	—	—	—	—	—	—	—
Stomach (ST)													
Pale Focus (I)/ Area (S)		—	—	—	—	—	—	—	—	—	—	—	—
Mucosa, Filmy Material		—	—	—	—	—	—	—	—	—	—	—	—
Dark Focus (I)/ Area (S)		—	—	—	—	—	—	—	—	—	—	—	—
Duodenum (DU)		U	U	U	U	U	U	U	U	U	U	U	U
Jejunum (JE)		U	U	U	U	U	U	U	U	U	U	U	U
Ileum (IL)		U	U	U	U	U	U	U	U	U	U	U	U
Pancreas (PA)		U	U	U	U	U	U	U	U	U	U	U	U
Cecum (CE)													
Dark Focus (I)/ Area (S)		—	—	—	—	—	—	—	—	—	—	—	—

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84

Study Number: 223610A

SD: 11 Sex: Male Group: 1	Group:	1	1	1	1	1	1	1	1	1	1	1	1
Table Includes:		0	0	0	0	0	0	0	0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4	4	4	4	4	4	4	4
Death = All; Subset = All		7	7	5	5	5	5	5	5	5	5	5	5
		2	2	6	6	6	6	6	6	6	6	6	6
		0	0	0	0	0	0	0	0	1	1	1	1
Organ and Keyword(s) or Phrase		1	2	3	4	5	6	7	8	9	0	1	2
	Codes:	T	T	O	O	3	3	4	4	5G	5G	T	T
Colon (CO)		U	U	U	U	U	U	U	U	U	U	U	U
Rectum (RE)		U	U	U	U	U	U	U	U	U	U	U	U
Testes w/Epidid (TP)		U	U	U	U	U	U	U	U	U	U	U	U
Prostate (PR)		U	U	U	U	U	U	U	U	U	U	U	U
Urinary Bladder (UB)													
Intraluminal Fluid		—	—	—	—	—	—	—	—	—	—	—	—
Intraluminal Material		—	—	—	—	—	—	—	—	—	—	—	—
Ovaries (OV)													
Uterus (UT)													
Intraluminal Fluid													
Nasal Turbinates (NT)		U	U	U	U	U	U	U	U	U	U	U	U
Mesenteric L.N. (MS)													
Enlarged		—	—	—	—	—	—	—	—	—	—	—	—
Peritoneal Cavit (PC)		U	U	U	U	U	U	U	U	U	U	U	U
Lymph Node, Other (LN)													
Dark		—	—	—	—	—	—	—	—	—	—	—	—
Thymus (TH)													
Dark Focus (I)/Area (S)		—	—	—	—	—	—	—	—	—	—	—	—
End of List													

PIN	HAN	Organ	Keyword or Phrase	Free-Text Comment
045609	255961	Spleen	Pale Film on Capsule	7 × 5 mm
045610	255962	Kidneys	Dilated Pelvis(es)	Right, Slightly

(Continued)

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 20-Feb-84
Study Number: 223610E

SD: 12 Sex: Male Group: 2	Group:	1	1	1	1	1
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = T; Subset = All		7	7	7	7	7
		2	2	2	2	2
		0	0	0	0	0
Organ and Keyword(s) or Phrase		3	4	5	6	7
Top of List						
Brain (BR)	Codes:	T	T	T	T	T
Adrenals (AD)		U	U	U	U	U
Thyroid (TY)		U	U	U	U	U
Trachea (TR)		U	U	U	U	U
Lung w/Bronchi (LU)		U	U	U	U	U
Heart (HT)		U	U	U	U	U
Spleen (SP)		U	U	U	U	U
Liver (LI)		U	U	U	U	U
Kidneys (KD)		U	U	U	U	U
Stomach (ST)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Duodenum (DU)		U	U	U	U	U
Jejunum (JE)		U	U	U	U	U
Ileum (IL)		U	U	U	U	U
Pancreas (PA)		U	U	U	U	U
Cecum (CE)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Colon (CO)		U	U	U	U	U
Rectum (RE)		U	U	U	U	U
Testes w/Epidid (TP)		U	U	U	U	U
Prostate (PR)		U	U	U	U	U
Urinary Bladder (UB)		U	U	U	U	U
Ovaries (OV)						
Uterus (UT)						
Intraluminal Fluid						
Nasal Turbinates (NT)		U	U	U	U	U
Thymus (TH)						
Dark		—	—	—	—	—
Peritoneal Cavit (PC)		U	U	U	U	U
End of List						

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes

Printed: 27-Mar-84

INDIVIDUAL GROSS PATHOLOGY FINDINGS

Study Number: 223610A

SD: 13 Sex: Male Group: 3	Group:	3	3	3	3	3
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = All; Subset = All		5	5	5	5	5
		6	6	6	6	6
		1	1	2	2	2
Organ and Keyword(s) or Phrase		8	9	0	1	2
Top of List	Codes:	2G	2	2G	2G	2G
Brain (BR)		U	U	U	U	U
Adrenals (AD)		U	U	U	U	U
Thyroid (TY)		U	U	U	U	U
Trachea (TR)		U	U	U	U	U
Lung w/ Bronchi (LU)						
Failure to Collapse		—	—	—	—	—
Dark		—	—	PC	—	PC
Pale Focus (I)/ Area (S)		—	—	—	—	—
Mottled		PC	—	—	PC	—
Dark Focus (I)/ Area (S)		—	—	—	—	—
Heart (HT)						
Pale Focus (I)/ Area (S)		PC	—	—	—	—
Spleen (SP)						
Pale		—	—	—	—	—
Pale Film on Capsule		—	—	—	—	—
Liver (LI)						
Dark Focus (I)/ Area (S)		—	—	—	—	—
Pale Focus (I)/ Area (S)		—	—	—	—	—
Kidneys (KD)						
Dark Focus (I)/ Area (S)		—	—	—	—	—
Fluid Under Capsule		—	—	—	—	—
Fluid Filled		—	—	—	—	—
Dilated Pelvis(es)		—	—	—	—	—
Granular Material		—	—	—	—	—
Granular/Pitted/Rough		—	—	—	—	—
Stomach (ST)						
Pale Focus (I)/ Area (S)		—	—	—	—	—
Mucosa, Filmy Material		—	—	—	—	—
Dark Focus (I)/ Area (S)		—	—	—	—	—
Duodenum (DU)		U	U	U	U	U
Jejunum (JE)		U	U	U	U	U
Ileum (IL)		U	U	U	U	U
Pancreas (PA)		U	U	U	U	U
Cecum (CE)						
Dark Focus (I)/ Area (S)		—	—	—	—	—
Colon (CO)		U	U	U	U	U

(Continued)

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84

Study Number: 223610A

SD: 13 Sex: Male Group: 3	Group:	3	3	3	3	3
		0	0	0	0	0
Table Includes:		4	4	4	4	4
Sex = All; Group = All; Weeks = All		5	5	5	5	5
Death = All; Subset = All		6	6	6	6	6
		1	1	2	2	2
Organ and Keyword(s) or Phrase		8	9	0	1	2
	Codes:	2G	2	2G	2G	2G
Rectum (RE)		U	U	U	U	U
Testes w/Epidid (TP)		U	U	U	U	U
Prostate (PR)		U	U	U	U	U
Urinary Bladder (UB)						
Intraluminal Fluid		—	—	—	—	—
Intraluminal Material		—	—	—	—	—
Ovaries (OV)						
Uterus (UT)						
Intraluminal Fluid						
Nasal Turbinates (NT)		U	U	U	U	U
Mesenteric L.N. (MS)						
Enlarged		—	—	—	—	—
Peritoneal Cavit (PC)		U	U	U	U	U
Lymph Node, Other (LN)						
Dark		—	—	—	—	—
Thymus (TH)						
Dark Focus (I)/Area (S)		—	—	—	—	—
End of List						

PIN	HAN	Organ	Keyword or Phrase	Free-Text Comment
045618	255970	Lung w/Bronchi	Mottled	All Lobes, Slightly, Light Gray, Light Red
045618	255970	Heart	Pale Focus (I)/Area (S)	Linear, 5 mm Long, at Junction of Right Atrium and Ventricle
045620	255972	Lung w/Bronchi	Dark	All Lobes, Slightly
045621	255973	Lung w/Bronchi	Mottled	All Lobes, Light Red, Tan
045622	255974	Lung w/Bronchi	Dark	All Lobes, Slightly

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84

Study Number: 223610A

SD: 14 Sex: Male Group: 4	Group:	4	4	4	4	4
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = All; Subset = All		5	5	5	5	5
		6	6	6	6	6
		2	2	2	2	2
Organ and Keyword(s) or Phrase		3	4	5	6	7
Top of List	Codes:	DG	DG	DG	DG	DG
Brain (BR)		U	U	U	U	U
Adrenals (AD)		U	U	U	U	U
Thyroid (TY)		U	U	U	U	U
Trachea (TR)		U	U	U	U	U
Lung w/Bronchi (LU)						
Failure to Collapse		PC	PC	PC	PC	PC
Dark		PC	PC	—	—	—
Pale Focus (I)/Area (S)		PC	—	—	—	—
Mottled		—	—	PC	PC	PC
Dark Focus (I)/Area (S)		—	—	—	—	—
Heart (HT)						
Pale Focus (I)/Area (S)		—	—	—	—	—
Spleen (SP)						
Pale		—	—	—	—	—
Pale Film on Capsule		—	—	—	—	—
Liver (LI)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Pale Focus (I)/Area (S)		PC	—	PC	—	—
Kidneys (KD)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Fluid Under Capsule		—	—	—	—	—
Fluid Filled		—	—	—	—	—
Dilated Pelvis(es)		—	—	—	—	—
Granular Material		—	—	—	—	—
Granular/Pitted/Rough		—	—	—	—	—
Stomach (ST)						
Pale Focus (I)/Area (S)		—	—	—	—	PC
Mucosa, Filmy Material		—	—	—	—	—
Dark Focus (I)/Area (S)		—	—	—	—	—
Duodenum (DU)		U	U	U	U	U
Jejunum (JE)		U	U	U	U	U
Ileum (IL)		U	U	U	U	U
Pancreas (PA)		U	U	U	U	U
Cecum (CE)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Colon (CO)		U	U	U	U	U

(Continued)

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84
Study Number: 223610A

SD: 14 Sex: Male Group: 4	Group:	4	4	4	4	4
		0	0	0	0	0
Table Includes:		4	4	4	4	4
Sex = All; Group = All; Weeks = All		5	5	5	5	5
Death = All; Subset = All		6	6	6	6	6
		2	2	2	2	2
Organ and Keyword(s) or Phrase		3	4	5	6	7
	Codes:	DG	DG	DG	DG	DG
Rectum (RE)		U	U	U	U	U
Testes w/Epidid (TP)		U	U	U	U	U
Prostate (PR)		U	U	U	U	U
Urinary Bladder (UB)						
Intraluminal Fluid		—	—	—	—	—
Intraluminal Material		—	—	—	—	—
Ovaries (OV)						
Uterus (UT)						
Intraluminal Fluid						
Nasal Turbinates (NT)		U	U	U	U	U
Mesenteric L.N. (MS)						
Enlarged		—	—	—	—	—
Peritoneal Cavit (PC)		U	U	U	U	U
Lymph Node, Other (LN)						
Dark		—	—	—	—	—
Thymus (TH)						
Dark Focus (I)/Area (S)		—	—	—	—	—
End of List						

PIN	HAN	Organ	Keyword or Phrase	Free-Text Comment
045623	255975	Lung w/Bronchi	Failure to Collapse	All Lobes
045623	255975	Lung w/Bronchi	Dark	All Lobes, Dark Red
045623	255975	Lung w/Bronchi	Pale Focus (I)/Area (S)	All Lobes, Tan Patches
045623	255975	Liver	Pale Focus (I)/Area (S)	Papillary Processes, Two, Tan, 7 × 4 mm
045624	255976	Lung w/Bronchi	Failure to Collapse	All Lobes
045624	255976	Lung w/Bronchi	Dark	Anterior Lobes, Dark Red
045625	255977	Lung w/Bronchi	Failure to Collapse	All Lobes
045625	255977	Lung w/Bronchi	Mottled	All Lobes, Dark Red, Black
045625	255977	Liver	Pale Focus (I)/Area (S)	Median Lobe, Diaphragmatic Surface, One, Tan, 5 × 5 mm
045626	255978	Lung w/Bronchi	Failure to Collapse	All Lobes
045626	255978	Lung w/Bronchi	Mottled	All Lobes, Dark Red, Black
045627	255979	Lung w/Bronchi	Failure to Collapse	All Lobes
045627	255979	Lung w/Bronchi	Mottled	All Lobes, Dark Red, Black
045627	255979	Stomach	Pale Focus (I)/Area (S)	Entire Glandular Region

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84

Study Number: 223610A

SD: 15 Sex: Male Group: 5 Group:	5	5	5	5	5
Table Includes:	0	0	0	0	0
Sex = All; Group = All; Weeks = All	4	4	4	4	4
Death = All; Subset = All	5	5	5	5	5
	6	6	6	6	6
	2	2	3	3	3
Organ and Keyword(s) or Phrase	8	9	0	1	2
Top of List	Codes:	4	4	4	4
Brain (BR)	U	U	U	U	4G
Adrenals (AD)	U	U	U	U	U
Thyroid (TY)	U	U	U	U	U
Trachea (TR)	U	U	U	U	U
Lung w/Bronchi (LU)					
Failure to Collapse	—	—	—	—	—
Dark	—	—	—	—	—
Pale Focus (I)/Area (S)	—	—	—	—	—
Mottled	—	—	—	—	—
Dark Focus (I)/Area (S)	—	—	—	—	—
Heart (HT)					
Pale Focus (I)/Area (S)	—	—	—	—	—
Spleen (SP)					
Pale	—	—	—	—	—
Pale Film on Capsule	—	—	—	—	—
Liver (LI)					
Dark Focus (I)/Area (S)	—	—	—	—	—
Pale Focus (I)/Area (S)	—	—	—	—	—
Kidneys (KD)					
Dark Focus (I)/Area (S)	—	—	—	—	—
Fluid Under Capsule	—	—	—	—	—
Fluid Filled	—	—	—	—	—
Dilated Pelvis(es)	—	—	—	—	PC
Granular Material	—	—	—	—	—
Granular/Pitted/Rough	—	—	—	—	—
Stomach (ST)					
Pale Focus (I)/Area (S)	—	—	—	—	—
Mucosa, Filmy Material	—	—	—	—	—
Dark Focus (I)/Area (S)	—	—	—	—	—
Duodenum (DU)	U	U	U	U	U
Jejunum (JE)	U	U	U	U	U
Ileum (IL)	U	U	U	U	U
Pancreas (PA)	U	U	U	U	U
Cecum (CE)					
Dark Focus (I)/Area (S)	—	—	—	—	—
Colon (CO)	U	U	U	U	U

(Continued)

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84
Study Number: 223610A

SD: 15 Sex: Male Group: 5	Group:	5	5	5	5	5
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = All; Subset = All		5	5	5	5	5
		6	6	6	6	6
		2	2	3	3	3
Organ and Keyword(s) or Phrase		8	9	0	1	2
	Codes:	4	4	4	4	4G
Rectum (RE)		U	U	U	U	U
Testes w/Epidid (TP)		U	U	U	U	U
Prostate (PR)		U	U	U	U	U
Urinary Bladder (UB)						
Intraluminal Fluid		—	—	—	—	—
Intraluminal Material		—	—	—	—	—
Ovaries (OV)						
Uterus (UT)						
Intraluminal Fluid						
Nasal Turbinates (NT)		U	U	U	U	U
Mesenteric L.N. (MS)						
Enlarged		—	—	—	—	—
Peritoneal Cavit (PC)		U	U	U	U	U
Lymph Node, Other (LN)						
Dark		—	—	—	—	PC
Thymus (TH)						
Dark Focus (I)/Area (S)		—	—	—	—	—
End of List						

PIN	HAN	Organ	Keyword or Phrase	Free-Text Comment
045632	255984	Kidneys	Dilated Pelvis(es)	Right
045632	255984	Lymph Node, Other	Dark	Cervical, Dark Red

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84
Study Number: 223610A

SD: 16 Sex: Male Group: 6	Group:	6	6	6	6	6
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = All; Subset = All		5	5	5	5	5
		6	6	6	6	6
		3	3	3	3	3
Organ and Keyword(s) or Phrase		3	4	5	6	7
Top of List						
Brain (BR)	Codes:	5G	5	5	5	5G
		U	U	U	U	U
Adrenals (AD)		U	U	U	U	U
Thyroid (TY)		U	U	U	U	U
Trachea (TR)		U	U	U	U	U
Lung w/Bronchi (LU)						
Failure to Collapse		—	—	—	—	—
Dark		PC	—	—	—	PC
Pale Focus (I)/Area (S)		—	—	—	—	—
Mottled		—	—	—	—	—
Dark Focus (I)/Area (S)		—	—	—	—	—
Heart (HT)						
Pale Focus (I)/Area (S)		—	—	—	—	—
Spleen (SP)						
Pale		—	—	—	—	—
Pale Film on Capsule		—	—	—	—	—
Liver (LI)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Pale Focus (I)/Area (S)		—	—	—	—	—
Kidneys (KD)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Fluid Under Capsule		—	—	—	—	—
Fluid Filled		—	—	—	—	—
Dilated Pelvis(es)		—	—	—	—	—
Granular Material		—	—	—	—	—
Granular/Pitted/Rough		—	—	—	—	—
Stomach (ST)						
Pale Focus (I)/Area (S)		—	—	—	—	—
Mucosa, Filmy Material		—	—	—	—	—
Dark Focus (I)/Area (S)		—	—	—	—	—
Duodenum (DU)		U	U	U	U	U
Jejunum (JE)		U	U	U	U	U
Ileum (IL)		U	U	U	U	U
Pancreas (PA)		U	U	U	U	U
Cecum (CE)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Colon (CO)		U	U	U	U	U

(Continued)

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84
Study Number: 223610A

SD: 16 Sex: Male Group: 6	Group:	6	6	6	6	6
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = All; Subset = All		5	5	5	5	5
		6	6	6	6	6
		3	3	3	3	3
Organ and Keyword(s) or Phrase		3	4	5	6	7
		Codes:	5G	5	5	5G
Rectum (RE)		U	U	U	U	U
Testes w/Epidid (TP)		U	U	U	U	U
Prostate (PR)		U	U	U	U	U
Urinary Bladder (UB)						
Intraluminal Fluid		—	—	—	—	—
Intraluminal Material		—	—	—	—	—
Ovaries (OV)						
Uterus (UT)						
Intraluminal Fluid						
Nasal Turbinates (NT)		U	U	U	U	U
Mesenteric L.N. (MS)						
Enlarged		—	—	—	—	—
Peritoneal Cavit (PC)		U	U	U	U	U
Lymph Node, Other (LN)						
Dark		—	—	—	—	—
Thymus (TH)						
Dark Focus (I)/ Area (S)		—	—	—	—	—
** End of List **						

PIN	HAN	Organ	Keyword or Phrase	Free-Text Comment
045633	255985	Lung w/Bronchi	Dark	All Lobes, Light Brown
045637	255989	Lung w/Bronchi	Dark	All Lobes, Light Brown

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84

Study Number: 223610A

SD: 17 Sex: Male Group: 7	Group:	7	7	7	7	7
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = All; Subset = All		5	5	5	5	5
		6	6	6	6	6
		3	3	4	4	4
Organ and Keyword(s) or Phrase		8	9	0	1	2
Top of List	Codes:	T	T	TG	T	T
Brain (BR)		U	U	U	U	U
Adrenals (AD)		U	U	U	U	U
Thyroid (TY)		U	U	U	U	U
Trachea (TR)		U	U	U	U	U
Lung w/Bronchi (LU)						
Failure to Collapse		—	—	—	—	—
Dark		—	—	—	—	—
Pale Focus (I)/Area (S)		—	—	—	—	—
Mottled		—	—	—	—	—
Dark Focus (I)/Area (S)		—	—	PC	—	—
Heart (HT)						
Pale Focus (I)/Area (S)		—	—	—	—	—
Spleen (SP)						
Pale		—	—	—	—	—
Pale Film on Capsule		—	—	—	—	—
Liver (LI)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Pale Focus (I)/Area (S)		—	—	—	—	—
Kidneys (KD)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Fluid Under Capsule		—	—	—	—	—
Fluid Filled		—	—	—	—	—
Dilated Pelvis(es)		—	—	—	—	—
Granular Material		—	—	—	—	—
Granular/Pitted/Rough		—	—	—	—	—
Stomach (ST)						
Pale Focus (I)/Area (S)		—	—	—	—	—
Mucosa, Filmy Material		—	—	—	—	—
Dark Focus (I)/Area (S)		—	—	—	—	—
Duodenum (DU)		U	U	U	U	U
Jejunum (JE)		U	U	U	U	U
Ileum (IL)		U	U	U	U	U
Pancreas (PA)		U	U	U	U	U
Cecum (CE)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Colon (CO)		U	U	U	U	U

(Continued)

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84

Study Number: 223610A

SD: 17 Sex: Male Group: 7	Group:	7	7	7	7	7
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = All; Subset = All		5	5	5	5	5
		6	6	6	6	6
		3	3	4	4	4
Organ and Keyword(s) or Phrase		8	9	0	1	2
	Codes:	T	T	TG	T	T
Rectum (RE)		U	U	U	U	U
Testes w/Epidid (TP)		U	U	U	U	U
Prostate (PR)		U	U	U	U	U
Urinary Bladder (UB)						
Intraluminal Fluid		—	—	—	—	—
Intraluminal Material		—	—	—	—	—
Ovaries (OV)						
Uterus (UT)						
Intraluminal Fluid						
Nasal Turbinates (NT)		U	U	U	U	U
Mesenteric L.N. (MS)						
Enlarged		—	—	—	—	—
Peritoneal Cavit (PC)		U	U	U	U	U
Lymph Node, Other (LN)						
Dark		—	—	—	—	—
Thymus (TH)						
Dark Focus (I)/Area (S)		—	—	PC	—	—
End of List						

PIN	HAN	Organ	Keyword or Phrase	Free-Text Comment
045640	255992	Lung w/Bronchi	Dark Focus (I)/Area (S)	Right Apical Lobe, Dark Brown
045640	255992	Thymus	Dark Focus (I)/Area (S)	Numerous, Dark Red, Pinpoint

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS OBSERVATIONS

Printed: 06-Apr-84

Study Number: 223610G

SD: 11 Sex: Male Group: 1	Group:	1	1	1	1	1
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = T; Subset = All		5	5	5	5	5
		5	5	5	5	5
		0	0	0	0	0
Organ and Keyword(s) or Phrase		1	2	3	4	5
Top of List		Codes:	TG	TG	TG	T
Brain (BR)						
Indentation (Dorsal Surface)		—	—	—	—	—
Adrenals (AD)		U	U	U	U	U
Thyroid (TY)		U	U	U	U	U
Trachea (TR)		U	U	U	U	U
Lung (LU)						
Mottled		—	—	—	—	—
Dark Focus (I)/Area (S)		—	—	—	—	—
Dark		—	—	—	—	—
H-Collapsed		—	—	—	—	—
Heart (HT)		U	U	U	U	U
Spleen (SP)		U	U	U	U	U
Liver (LI)						
Pale Focus (I)/Area (S)		—	—	—	—	—
Kidneys (KD)						
Dilated Pelvis(es)		PC	PC	PC	—	—
Stomach (ST)		U	U	U	U	U
Duodenum (DU)		U	U	U	U	U
Jejunum (JE)		U	U	U	U	U
Ileum (IL)		U	U	U	U	U
Pancreas (PA)		U	U	U	U	U
Cecum (CE)		U	U	U	U	U
Colon (CO)		U	U	U	U	U
Rectum (RE)		U	U	U	U	U
Testes w/Epidid (TP)		U	U	U	U	U
Prostate (PR)		U	U	U	U	U
Urinary Bladder (UB)		U	U	U	U	U
Ovaries (OV)						
Uterus (UT)						
Nasal Turbinates (NT)		U	U	U	U	U
Bone(s), Other (OB)						
Perforation(s)		—	—	—	—	—
End of List						

(Continued)

PIN	HAN	Organ	Keyword or Phrase	Free-Text Comment
045501	258016	Kidneys	Dilated Pelvis(es)	Left, Slightly
045502	258017	Kidneys	Dilated Pelvis(es)	Right, Moderately
045503	258018	Kidneys	Dilated Pelvis(es)	Right, Slightly

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS OBSERVATIONS

Printed: 06-Apr-84

Study Number: 223610G

SD: 12 Sex: Male Group: 2	Group:	2	2	2	2	2
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = T; Subset = All		5	5	5	5	5
		5	5	5	5	5
		0	0	0	0	1
Organ and Keyword(s) or Phrase		6	7	8	9	0
Top of List	Codes:	T	TG	TG	TG	TG
Brain (BR)						
Indentation (Dorsal Surface)		—	—	—	—	—
Adrenals (AD)		U	U	U	U	U
Thyroid (TY)		U	U	U	U	U
Trachea (TR)		U	U	U	U	U
Lung (LU)						
Mottled		—	PC	—	—	—
Dark Focus (I)/Area (S)		—	—	—	PC	—
Dark		—	—	PC	—	PC
H-Collapsed		—	—	—	—	—
Heart (HT)		U	U	U	U	U
Spleen (SP)		U	U	U	U	U
Liver (LI)						
Pale Focus (I)/Area (S)		—	—	PC	—	—
Kidneys (KD)						
Dilated Pelvis(es)		—	—	—	PC	—
Stomach (ST)		U	U	U	U	U
Duodenum (DU)		U	U	U	U	U
Jejunum (JE)		U	U	U	U	U
Ileum (IL)		U	U	U	U	U
Pancreas (PA)		U	U	U	U	U
Cecum (CE)		U	U	U	U	U
Colon (CO)		U	U	U	U	U
Rectum (RE)		U	U	U	U	U
Testes w/Epidid (TP)		U	U	U	U	U
Prostate (PR)		U	U	U	U	U

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS OBSERVATIONS

Printed: 06-Apr-84

Study Number: 223610G

SD: 12 Sex: Male Group: 2	Group:	2	2	2	2	2
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = T; Subset = All		5	5	5	5	5
		5	5	5	5	5
		0	0	0	0	1
Organ and Keyword(s) or Phrase		6	7	8	9	0
	Codes:	T	TG	TG	TG	TG
Urinary Bladder (UB)		U	U	U	U	U
Ovaries (OV)						
Uterus (UT)						
Nasal Turbinates (NT)		U	U	U	U	U
Bone(s), Other (OB)						
Perforation(s)		—	—	—	—	—

End of List

PIN	HAN	Organ	Keyword or Phrase	Free-Text Comment
045507	258022	Lung	Mottled	Left Lobe, Anterior Portion, Tan and Light Pink, Minimal
045508	258023	Lung	Dark	All Lobes
045508	258023	Liver	Pale Focus (I)/Area (S)	Left and Right Lateral Lobes, One Each, Tan, Pinpoint
045509	258024	Lung	Dark Focus (I)/Area (S)	Left Lobe, Posterior Margin, Black, 1 x 1 mm
045509	258024	Kidneys	Dilated Pelvis(es)	Right, Moderately
045510	258025	Lung	Dark	All Lobes

(Continued)

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84
Study Number: 223610A

SD: 21	Sex: Female	Group: 1	Group:	1	1	1	1	1	1	1	1	1	1			
Table Includes:				0	0	0	0	0	0	0	0	0	0			
Sex = All; Group = All; Weeks = All				4	4	4	4	4	4	4	4	4	4			
Death = All; Subset = All				7	7	5	5	5	5	5	5	5	5			
				3	3	8	8	8	8	8	8	8	8			
				0	0	0	0	0	0	0	0	1	1			
Organ and Keyword(s) or Phrase				1	2	3	4	5	6	7	8	9	0	1	2	
Top of List				Codes:	TG	T	OG	OG	3	3	4G	4	5	5G	T	T
Brain (BR)					U	U	U	U	U	U	U	U	U	U	U	U
Adrenals (AD)					U	U	U	U	U	U	U	U	U	U	U	U
Thyroid (TY)					U	U	U	U	U	U	U	U	U	U	U	U
Trachea (TR)					U	U	U	U	U	U	U	U	U	U	U	U
Lung w/Bronchi (LU)																
Failure to Collapse					---	---	---	---	---	---	---	---	---	---	---	---
Dark					---	---	---	---	---	---	---	---	---	---	---	---
Pale Focus (I)/Area (S)					---	---	---	---	---	---	---	---	---	---	---	---
Mottled					---	---	---	---	---	---	---	---	---	---	---	---
Dark Focus (I)/Area (S)					---	---	---	---	---	---	---	---	---	---	---	---
Heart (HT)																
Pale Focus (I)/Area (S)					---	---	---	---	---	---	---	---	---	---	---	---
Spleen (SP)																
Pale					---	---	---	---	---	---	---	---	---	---	---	---
Pale Film on Capsule					---	---	---	---	---	---	---	---	---	---	---	---
Liver (LI)																
Dark Focus (I)/Area (S)					---	---	---	---	---	---	---	---	---	---	---	---
Pale Focus (I)/Area (S)					---	---	---	---	---	---	---	---	---	PC	---	---
Kidneys (KD)																
Dark Focus (I)/Area (S)					---	---	---	---	---	---	---	---	---	---	---	---
Fluid Under Capsule					---	---	---	---	---	---	---	---	---	---	---	---
Fluid Filled					---	---	---	---	---	---	---	---	---	---	---	---
Dilated Pelvis(es)					---	---	PC	---	---	---	PC	---	---	---	---	---
Granular Material					---	---	---	---	---	---	---	---	---	---	---	---
Granular/Pitted/Rough					---	---	---	PC	---	---	---	---	---	---	---	---
Stomach (ST)																
Pale Focus (I)/Area (S)					---	---	---	---	---	---	---	---	---	---	---	---
Mucosa, Filmy Material					---	---	---	---	---	---	---	---	---	---	---	---
Dark Focus (I)/Area (S)					PC	---	---	---	---	---	---	---	---	---	---	---
Duodenum (DU)					U	U	U	U	U	U	U	U	U	U	U	U
Jejunum (JE)					U	U	U	U	U	U	U	U	U	U	U	U
Ileum (IL)					U	U	U	U	U	U	U	U	U	U	U	U
Pancreas (PA)					U	U	U	U	U	U	U	U	U	U	U	U
Cecum (CE)																
Dark Focus (I)/Area (S)					---	---	---	---	---	---	---	---	---	---	---	---

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84

Study Number: 223610A

SD: 21 Sex: Female Group: 1	Group:	1	1	1	1	1	1	1	1	1	1	1	1
Table Includes:		0	0	0	0	0	0	0	0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4	4	4	4	4	4	4	4
Death = All; Subset = All		7	7	5	5	5	5	5	5	5	5	5	5
		3	3	8	8	8	8	8	8	8	8	8	8
		0	0	0	0	0	0	0	0	0	1	1	1
Organ and Keyword(s) or Phrase		1	2	3	4	5	6	7	8	9	0	1	2
	Codes:	TG	T	OG	OG	3	3	4G	4	5	5G	T	T
Colon (CO)		U	U	U	U	U	U	U	U	U	U	U	U
Rectum (RE)		U	U	U	U	U	U	U	U	U	U	U	U
Testes w/Epidid (TP)													
Prostate (PR)													
Urinary Bladder (UB)													
Intraluminal Fluid		—	—	—	—	—	—	—	—	—	—	—	—
Intraluminal Material		—	—	—	—	—	—	—	—	—	—	—	—
Ovaries (OV)		U	U	U	U	U	U	U	U	U	U	U	U
Uterus (UT)													
Intraluminal Fluid		PC	—	PC	—	—	—	—	—	—	—	—	—
Nasal Turbinates (NT)		U	U	U	U	U	U	U	U	U	U	U	U
Mesenteric L.N. (MS)													
Enlarged		—	—	—	—	—	—	—	—	—	—	—	—
Peritoneal Cavit (PC)		U	U	U	U	U	U	U	U	U	U	U	U
Lymph Node, Other (LN)													
Dark		—	—	—	—	—	—	—	—	—	—	—	—
Thymus (TH)													
Dark Focus (I)/Area (S)		—	—	—	—	—	—	—	—	—	—	—	—

End of List

PIN	HAN	Organ	Keyword or Phrase	Free-Text Comment
045803	255997	Kidneys	Dilated Pelvis(es)	Both
045803	255997	Uterus	Intraluminal Fluid	Both Horns, Clear
045804	255998	Kidneys	Granular/Pitted/Rough	Pitted, Right Cortex, 3 × 1 mm, One Focus
045807	256001	Kidneys	Dilated Pelvis(es)	Both
045810	256004	Liver	Pale Focus (I)/Area (S)	Median Lobe at Cleft, Tan, 3 × 2 mm
047301	256837	Stomach	Dark Focus (I)/Area (S)	Glandular Mucosa, Dark Red, 2 × 1 mm
047301	256837	Uterus	Intraluminal Fluid	Both Horns, Clear

(Continued)

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 20-Feb-84

Study Number: 223610E

SD: 22 Sex: Female Group: 2	Group:	2	2	2	2	2
		0	0	0	0	0
Table Includes:		4	4	4	4	4
Sex = All; Group = All; Weeks = All		7	7	7	7	7
Death = T; Subset = All		3	3	3	3	3
		0	0	0	0	0
Organ and Keyword(s) or Phrase		3	4	5	6	7
Top of List		Codes:	TG	TG	T	TG
Brain (BR)			U	U	U	U
Adrenals (AD)			U	U	U	U
Thyroid (TY)			U	U	U	U
Trachea (TR)			U	U	U	U
Lung w/Bronchi (LU)			U	U	U	U
Heart (HT)			U	U	U	U
Spleen (SP)			U	U	U	U
Liver (LI)			U	U	U	U
Kidneys (KD)			U	U	U	U
Stomach (ST)						
Dark Focus (I)/Area (S)			—	—	—	—
Duodenum (DU)			U	U	U	U
Jejunum (JE)			U	U	U	U
Ileum (IL)			U	U	U	U
Pancreas (PA)			U	U	U	U
Cecum (CE)						
Dark Focus (I)/Area (S)			—	PC	—	—
Colon (CO)			U	U	U	U
Rectum (RE)			U	U	U	U
Testes w/Epidid						
Prostate (PR)						
Urinary Bladder (UB)			U	U	U	U
Ovaries (OV)			U	U	U	U
Uterus (UT)						
Intraluminal Fluid			PC	—	—	PC
Nasal Turbinates (NT)			U	U	U	U
Thymus (TH)						
Dark			—	PC	—	—
Peritoneal Cavit (PC)			U	U	U	U
End of List						

PIN	HAN	Organ	Keyword or Phrase	Free-Text Comment
047303	256839	Uterus	Intraluminal Fluid	Both Horns, Clear
047304	256840	Cecum	Dark Focus (I)/Area (S)	Red, 5 × 5 mm
047304	256840	Thymus	Dark	Dark Red
047306	256842	Uterus	Intraluminal Fluid	Both Horns, Clear

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84

Study Number: 223610A

SD: 23 Sex: Female Group: 3	Group:	3	3	3	3	3
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = All; Subset = All		5	5	5	5	5
		8	8	8	8	8
		1	1	2	2	2
Organ and Keyword(s) or Phrase		8	9	0	1	2
Top of List	Codes:	2	2	2G	2	2
Brain (BR)		U	U	U	U	U
Adrenals (AD)		U	U	U	U	U
Thyroid (TY)		U	U	U	U	U
Trachea (TR)		U	U	U	U	U
Lung w/Bronchi (LU)						
Failure to Collapse		—	—	—	—	—
Dark		—	—	—	—	—
Pale Focus (I)/Area (S)		—	—	—	—	—
Mottled		—	—	—	—	—
Dark Focus (I)/Area (S)		—	—	—	—	—
Heart (HT)						
Pale Focus (I)/Area (S)		—	—	—	—	—
Spleen (SP)						
Pale		—	—	—	—	—
Pale Film on Capsule		—	—	—	—	—
Liver (LI)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Pale Focus (I)/Area (S)		—	—	—	—	—
Kidneys (KD)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Fluid Under Capsule		—	—	—	—	—
Fluid Filled		—	—	—	—	—
Dilated Pelvis(es)		—	—	PC	—	—
Granular Material		—	—	PC	—	—
Granular/Pitted/Rough		—	—	—	—	—
Stomach (ST)						
Pale Focus (I)/Area (S)		—	—	—	—	—
Mucosa, Filmy Material		—	—	—	—	—
Dark Focus (I)/Area (S)		—	—	—	—	—
Duodenum (DU)		U	U	U	U	U
Jejunum (JE)		U	U	U	U	U
Ileum (IL)		U	U	U	U	U
Pancreas (PA)		U	U	U	U	U
Cecum (CE)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Colon (CO)		U	U	U	U	U

(Continued)

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84

Study Number: 223610A

SD: 23 Sex: Female Group: 3	Group:	3	3	3	3	3
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = All; Subset = All		5	5	5	5	5
		8	8	8	8	8
		1	1	2	2	2
Organ and Keyword(s) or Phrase		8	9	0	1	2
	Codes:	2	2	2G	2	2
Rectum (RE)		U	U	U	U	U
Testes w/Epidid (TP)						
Prostate (PR)						
Urinary Bladder (UB)						
Intraluminal Fluid		—	—	—	—	—
Intraluminal Material		—	—	—	—	—
Ovaries (OV)		U	U	U	U	U
Uterus (UT)						
Intraluminal Fluid		—	—	—	—	—
Nasal Turbinates (NT)		U	U	U	U	U
Mesenteric L.N. (MS)						
Enlarged		—	—	—	—	—
Peritoneal Cavit (PC)		U	U	U	U	U
Lymph Node, Other (LN)						
Dark		—	—	—	—	—
Thymus (TH)						
Dark Focus (I)/Area (S)		—	—	—	—	—
End of List						

PIN	HAN	Organ	Keyword or Phrase	Free-Text Comment
045820	256014	Kidneys	Dilated Pelvis(es)	Both
045820	256104	Kidneys	Granular Material	Right Pelvis, White, Pinpoint

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84

Study Number: 223610A

SD: 24 Sex: Female Group: 4	Group:	4	4	4	4	4
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = All; Subset = All		5	5	5	5	5
		8	8	8	8	8
		2	2	2	2	2
Organ and Keyword(s) or Phrase		3	4	5	6	7
Top of List		Codes:	DG	DG	DG	DG
Brain (BR)			U	U	U	U
Adrenals (AD)			U	U	U	U
Thyroid (TY)			U	U	U	U
Trachea (TR)			U	U	U	U
Lung w/ Bronchi (LU)						
Failure to Collapse			PC	PC	PC	PC
Dark			—	—	—	—
Pale Focus (I)/ Area (S)			—	—	—	—
Mottled			PC	PC	PC	PC
Dark Focus (I)/ Area (S)			—	—	—	—
Heart (HT)						
Pale Focus (I)/ Area (S)			—	—	—	—
Spleen (SP)						
Pale			P	—	—	—
Pale Film on Capsule			—	—	—	—
Liver (LI)						
Dark Focus (I)/ Area (S)			—	—	—	—
Pale Focus (I)/ Area (S)			PC	—	—	—
Kidneys (KD)						
Dark Focus (I)/ Area (S)			—	—	—	—
Fluid Under Capsule			—	—	—	—
Fluid Filled			PC	—	—	—
Dilated Pelvis(es)			PC	PC	—	—
Granular Material			—	—	—	—
Granular/Pitted/Rough			—	—	—	—
Stomach (ST)						
Pale Focus (I)/ Area (S)			—	—	—	PC
Mucosa, Filmy Material			—	—	—	—
Dark Focus (I)/ Area (S)			—	—	—	—
Duodenum (DU)			U	U	U	U
Jejunum (JE)			U	U	U	U
Ileum (IL)			U	U	U	U
Pancreas (PA)			U	U	U	U
Cecum (CE)						
Dark Focus (I)/ Area (S)			—	—	—	—
Colon (CO)			U	U	U	U

(Continued)

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84

Study Number: 223610A

SD: 24 Sex: Female Group: 4	Group:	4	4	4	4	4
		0	0	0	0	0
Table Includes:		4	4	4	4	4
Sex = All; Group = All; Weeks = All		5	5	5	5	5
Death = All; Subset = All		8	8	8	8	8
		2	2	2	2	2
Organ and Keyword(s) or Phrase		3	4	5	6	7
	Codes:	DG	DG	DG	DG	DG
Rectum (RE)		U	U	U	U	U
Testes w/Epidid (TP)						
Prostate (PR)						
Urinary Bladder (UB)						
Intraluminal Fluid		—	—	—	—	—
Intraluminal Material		—	—	—	—	—
Ovaries (OV)		U	U	U	U	U
Uterus (UT)						
Intraluminal Fluid		—	—	—	—	—
Nasal Turbinates (NT)		U	U	U	U	U
Mesenteric L.N. (MS)						
Enlarged		—	—	—	—	—
Peritoneal Cavit (PC)		U	U	U	U	U
Lymph Node, Other (LN)						
Dark		—	—	—	—	—
Thymus (TH)						
Dark Focus (I)/Area (S)		—	—	—	—	—
** End of List **						

PIN	HAN	Organ	Keyword or Phrase	Free-Text Comment
045823	256017	Lung w/Bronchi	Failure to Collapse	All Lobes
045823	256017	Lung w/Bronchi	Mottled	All Lobes, Dark Red, Black
045823	256017	Liver	Pale Focus (I)/Area (S)	Median Lobe, Diaphragmatic Surface, One, Tan, 3×2 mm
045823	256017	Kidneys	Fluid Filled	Right, Clear
045823	256017	Dilated Pelvis(es)	Right, Greatly	
045824	256018	Lung w/Bronchi	Failure to Collapse	All Lobes
045824	256018	Lung w/Bronchi	Mottled	All Lobes, Red and Black
045824	256018	Kidneys	Dilated Pelvis(es)	Both, Right Greatly, Left Slightly
045825	256019	Lung w/Bronchi	Failure to Collapse	All Lobes
045825	256019	Lung w/Bronchi	Mottled	All Lobes, Dark Red, Black
045826	256020	Lung w/Bronchi	Failure to Collapse	All Lobes
045826	256020	Lung w/Bronchi	Mottled	All Lobes, Dark Red, Black
045826	256020	Stomach	Pale Focus (I)/Area (S)	Glandular Mucosa, Fundic Portion
045827	256021	Lung w/Bronchi	Mottled	All Lobes, Dark Red, Black

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84

Study Number: 223610A

SD: 25 Sex: Female Group: 5	Group:	5	5	5	5	5
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = All; Subset = All		5	5	5	5	5
		8	8	8	8	8
		2	2	3	3	3
Organ and Keyword(s) or Phrase		8	9	0	1	2
Top of List						
Brain (BR)	Codes:	4	4	4	4G	4
		U	U	U	U	U
Adrenals (AD)		U	U	U	U	U
Thyroid (TY)		U	U	U	U	U
Trachea (TR)		U	U	U	U	U
Lung w/Bronchi (LU)						
Failure to Collapse		—	—	—	—	—
Dark		—	—	—	—	—
Pale Focus (I)/Area (S)		—	—	—	—	—
Mottled		—	—	—	—	—
Dark Focus (I)/Area (S)		—	—	—	—	—
Heart (HT)						
Pale Focus (I)/Area (S)		—	—	—	—	—
Spleen (SP)						
Pale		—	—	—	—	—
Pale Film on Capsule		—	—	—	—	—
Liver (LI)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Pale Focus (I)/Area (S)		—	—	—	—	—
Kidneys (KD)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Fluid Under Capsule		—	—	—	—	—
Fluid Filled		—	—	—	—	—
Dilated Pelvis(es)		—	—	—	—	—
Granular Material		—	—	—	—	—
Granular/Pitted/Rough		—	—	—	—	—
Stomach (ST)						
Pale Focus (I)/Area (S)		—	—	—	—	—
Mucosa, Filmy Material		—	—	—	—	—
Dark Focus (I)/Area (S)		—	—	—	—	—
Duodenum (DU)		U	U	U	U	U
Jejunum (JE)		U	U	U	U	U
Ileum (IL)		U	U	U	U	U
Pancreas (PA)		U	U	U	U	U
Cecum (CE)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Colon (CO)		U	U	U	U	U

(Continued)

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Appendix 6 (Continued)

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Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84

Study Number: 223610A

SD: 25 Sex: Female Group: 5 Group:	5	5	5	5	5
Table Includes:	0	0	0	0	0
Sex = All; Group = All; Weeks = All	4	4	4	4	4
Death = All; Subset = All	5	5	5	5	5
	8	8	8	8	8
	2	2	3	3	3
Organ and Keyword(s) or Phrase	8	9	0	1	2
	Codes:	4	4	4	4G
Rectum (RE)	U	U	U	U	U
Testes w/Epidid (TP)					
Prostate (PR)					
Urinary Bladder (UB)					
Intraluminal Fluid	—	—	—	—	—
Intraluminal Material	—	—	—	—	—
Ovaries (OV)	—	—	—	—	—
Uterus (UT)					
Intraluminal Fluid	—	—	—	PC	—
Nasal Turbinates (NT)	U	U	U	U	U
Mesenteric L.N. (MS)					
Enlarged	—	—	—	—	—
Peritoneal Cavit (PC)	U	U	U	U	U
Lymph Node, Other (LN)					
Dark	—	—	—	—	—
Thymus (TH)					
Dark Focus (I)/ Area (S)	—	—	—	—	—

End of List

PIN	HAN	Organ	Keyword or Phrase	Free-Text Comment
045831	256025	Uterus	Intraluminal Fluid	Both Horns, Clear

Appendix 6 (Continued)

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Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84

Study Number: 223610A

SD: 26 Sex: Female Group: 6	Group:	6	6	6	6	6
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = All; Subset = All		5	5	5	5	5
		8	8	8	8	8
		3	3	3	3	3
Organ and Keyword(s) or Phrase		3	4	5	6	7
Top of List						
Brain (BR)	Codes:	5	5	5G	5G	5G
		U	U	U	U	U
Adrenals (AD)		U	U	U	U	U
Thyroid (TY)		U	U	U	U	U
Trachea (TR)		U	U	U	U	U
Lung w/Bronchi (LU)						
Failure to Collapse		—	—	—	—	—
Dark		—	—	—	—	—
Pale Focus (I)/Area (S)		—	—	—	—	—
Mottled		—	—	—	—	—
Dark Focus (I)/Area (S)		—	—	PC	—	—
Heart (HT)						
Pale Focus (I)/Area (S)		—	—	—	—	—
Spleen (SP)						
Pale		—	—	—	—	—
Pale Film on Capsule		—	—	—	—	—
Liver (LI)						
Dark Focus (I)/Area (S)		—	—	PC	—	—
Pale Focus (I)/Area (S)		—	—	—	PC	—
Kidneys (KD)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Fluid Under Capsule		—	—	—	—	—
Fluid Filled		—	—	—	—	—
Dilated Pelvis(es)		—	—	—	—	—
Granular Material		—	—	—	—	—
Granular/Pitted/Rough		—	—	—	—	—
Stomach (ST)						
Pale Focus (I)/Area (S)		—	—	—	—	—
Mucosa, Filmy Material		—	—	—	—	—
Dark Focus (I)/Area (S)		—	—	—	—	—
Duodenum (DU)		U	U	U	U	U
Jejunum (JE)		U	U	U	U	U
Ileum (IL)		U	U	U	U	U
Pancreas (PA)		U	U	U	U	U
Cecum (CE)						
Dark Focus (I)/Area (S)		—	—	—	—	—
Colon (CO)		U	U	U	U	U

(Continued)

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84

Study Number: 223610A

SD: 26 Sex: Female Group: 6	Group:	6	6	6	6	6
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = All; Subset = All		5	5	5	5	5
		8	8	8	8	8
		3	3	3	3	3
Organ and Keyword(s) or Phrase		3	4	5	6	7
	Codes:	5	5	5G	5G	5G
Rectum (RE)		U	U	U	U	U
Testes w/Epidid (TP)						
Prostate (PR)						
Urinary Bladder (UB)						
Intraluminal Fluid		—	—	—	—	—
Intraluminal Material		—	—	—	—	—
Ovaries (OV)		U	U	U	U	U
Uterus (UT)						
Intraluminal Fluid		—	—	PC	—	PC
Nasal Turbinates (NT)		U	U	U	U	U
Mesenteric L.N. (MS)						
Enlarged		—	—	—	—	—
Peritoneal Cavit (PC)		U	U	U	U	U
Lymph Node, Other (LN)						
Dark		—	—	—	—	—
Thymus (TH)						
Dark Focus (I)/Area (S)		—	—	—	—	—
End of List						

PIN	HAN	Organ	Keyword or Phrase	Free-Text Comment
045835	256029	Lung w/Bronchi	Dark Focus (I)/Area (S)	Right Cardiac Lobe at Margin, Dark Red, 2×2 mm
045835	256029	Liver	Dark Focus (I)/Area (S)	Left Lateral Lobe at Margin, Dark Red, 3×3 mm
045835	256029	Uterus	Intraluminal Fluid	Both Horns, Clear
045836	256030	Liver	Pale Focus (I)/Area (S)	Median Lobe at Cleft, Tan, 1 mm
045837	256031	Uterus	Intraluminal Fluid	Both Horns, Clear

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes

Printed: 27-Mar-84

INDIVIDUAL GROSS PATHOLOGY FINDINGS

Study Number: 223610A

SD: 27 Sex: Female Group: 7	Group:	7	7	7	7	7
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = All; Subset = All		5	5	5	5	5
		8	8	8	8	8
		3	3	4	4	4
Organ and Keyword(s) or Phrase		8	9	0	1	2
Top of List		Codes:	TG	TG	TG	TG
Brain (BR)			U	U	U	U
Adrenals (AD)			U	U	U	U
Thyroid (TY)			U	U	U	U
Trachea (TR)			U	U	U	U
Lung w/Bronchi (LU)						
Failure to Collapse			—	—	—	—
Dark			—	—	—	—
Pale Focus (I)/Area (S)			—	—	—	—
Mottled			—	—	—	—
Dark Focus (I)/Area (S)			—	—	—	—
Heart (HT)						
Pale Focus (I)/Area (S)			—	—	—	—
Spleen (SP)						
Pale			—	—	—	—
Pale Film on Capsule			—	—	—	—
Liver (LI)						
Dark Focus (I)/Area (S)			—	—	—	—
Pale Focus (I)/Area (S)			PC	—	—	—
Kidneys (KD)						
Dark Focus (I)/Area (S)			—	—	—	—
Fluid Under Capsule			—	—	—	—
Fluid Filled			—	—	—	—
Dilated Pelvis(es)			—	PC	PC	—
Granular Material			—	—	PC	—
Granular/Pitted/Rough			—	—	—	—
Stomach (ST)						
Pale Focus (I)/Area (S)			—	—	—	—
Mucosa, Filmy Material			—	—	—	—
Dark Focus (I)/Area (S)			—	—	—	—
Duodenum (DU)			U	U	U	U
Jejunum (JE)			U	U	U	U
Ileum (IL)			U	U	U	U
Pancreas (PA)			U	U	U	U
Cecum (CE)						
Dark Focus (I)/Area (S)			—	—	—	—
Colon (CO)			U	U	U	U

(Continued)

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS PATHOLOGY FINDINGS

Printed: 27-Mar-84

Study Number: 223610A

SD: 27 Sex: Female Group: 7	Group:	7	7	7	7	7
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = All; Subset = All		5	5	5	5	5
		8	8	8	8	8
		3	3	4	4	4
Organ and Keyword(s) or Phrase		8	9	0	1	2
	Codes:	TG	TG	TG	TG	TG
Rectum (RE)		U	U	U	U	U
Testes w/Epidid (TP)						
Prostate (PR)						
Urinary Bladder (UB)						
Intraluminal Fluid		—	—	—	—	—
Intraluminal Material		—	—	—	—	—
Ovaries (OV)		U	U	U	U	U
Uterus (UT)						
Intraluminal Fluid		—	—	—	—	PC
Nasal Turbinates (NT)		U	U	U	U	U
Mesenteric L.N. (MS)						
Enlarged		—	—	—	—	—
Peritoneal Cavit (PC)		U	U	U	U	U
Lymph Node, Other (LN)						
Dark		—	—	—	—	—
Thymus (TH)						
Dark Focus (I)/Area (S)		—	PC	—	—	—

** End of List **

PIN	HAN	Organ	Keyword or Phrase	Free-Text Comment
045838	256032	Liver	Pale Focus (I)/Area (S)	Median Lobe at Cleft, Tan, 1 mm
045839	256033	Kidneys	Dilated Pelvis(es)	Right, Slightly
045839	256033	Thymus	Dark Focus (I)/Area (S)	Few, Dark Red, Pinpoint
045840	256034	Kidneys	Dilated Pelvis(es)	Both, Greatly
045840	256034	Kidneys	Granular Material	Right Pelvis, Tan
045841	256035	Lung w/Bronchi	Dark	All Lobes
045841	256035	Liver	Pale Focus (I)/Area (S)	Median Lobe at Cleft, 2 × 2 mm
045841	256035	Stomach	Dark Focus (I)/Area (S)	Glandular Mucosa, Dark Red, 2 × 1 mm
045842	256036	Uterus	Intraluminal Fluid	Both Horns

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS OBSERVATIONS

Printed: 06-Apr-84

Study Number: 223610G

SD: 21 Sex: Female Group: 1	Group:	1	1	1	1	1
Table Includes:		0	0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4	4
Death = T; Subset = All		5	5	5	5	5
		5	5	5	5	5
		5	5	5	5	5
Organ and Keyword(s) or Phrase		1	2	3	4	5
Top of List						
	Codes:	TG	T	TG	T	TG
Brain (BR)						
Indentation (Dorsal Surface)		—	—	—	—	PC
Adrenals (AD)		U	U	U	U	U
Thyroid (TY)		U	U	U	U	U
Trachea (TR)		U	U	U	U	U
Lung (LU)						
Mottled		—	—	—	—	—
Dark Focus (I)/ Area (S)		—	—	PC	—	—
Dark		—	—	—	—	—
H-Collapsed		PC	—	—	—	—
Heart (HT)		U	U	U	U	U
Spleen (SP)		U	U	U	U	U
Liver (LI)						
Pale Focus (I)/ Area (S)		—	—	—	—	—
Kidneys (KD)						
Dilated Pelvis(es)		—	—	—	—	—
Stomach (ST)		U	U	U	U	U
Duodenum (DU)		U	U	U	U	U
Jejunum (JE)		U	U	U	U	U
Ileum (IL)		U	U	U	U	U
Pancreas (PA)		U	U	U	U	U
Cecum (CE)		U	U	U	U	U
Colon (CO)		U	U	U	U	U
Rectum (RE)		U	U	U	U	U
Testes w/Epidid (TP)						
Prostate (PR)						
Urinary Bladder (UB)		U	U	U	U	U
Ovaries (OV)		U	U	U	U	U
Uterus (UT)		U	U	U	U	U
Nasal Turbinates (NT)		U	U	U	U	U
Bone(s), Other (OB)						
Perforation(s)		—	—	—	—	PC
End of List						

(Continued)

PIN	HAN	Organ	Keyword or Phrase	Free-Text Comment
045551	258026	Lung	H-Collapsed	Right Apical Lobe
045553	258028	Lung	Dark Focus (I)/ Area (S)	All Lobes, Few, Dark Red, 1 mm
045555	258030	Brain	Indentation (Dorsal Surface)	Right Cerebrum, 1.0 × 0.8 cm, Fluid Filled
045555	258030	Bone(s), Other	Perforation(s)	Skull Cap Over Brain Lesion, 4 × 4 mm

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS OBSERVATIONS

Printed: 06-Apr-84

Study Number: 223610G

SD: 22 Sex: Female Group: 2	Group:	2	2	2	2
Table Includes:		0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4
Death = T; Subset = All		5	5	5	5
		5	5	5	5
		5	5	5	6
Organ and Keyword(s) or Phrase		6	7	8	0
Top of List	Codes:	TG	TG	T	T
Brain (BR)					
Indentation (Dorsal Surface)		—	—	—	—
Adrenals (AD)		U	U	U	U
Thyroid (TY)		U	U	U	U
Trachea (TR)		U	U	U	U
Lung (LU)					
Mottled		—	PC	—	—
Dark Focus (I)/ Area (S)		—	—	—	—
Dark		PC	—	—	—
H-Collapsed		—	—	—	—
Heart (HT)		U	U	U	U
Spleen (SP)		U	U	U	U
Liver (LI)					
Pale Focus (I)/ Area (S)		—	—	—	—
Kidneys (KD)					
Dilated Pelvis(es)		—	—	—	—
Stomach (ST)		U	U	U	U
Duodenum (DU)		U	U	U	U
Jejunum (JE)		U	U	U	U
Ileum (IL)		U	U	U	U
Pancreas (PA)		U	U	U	U
Cecum (CE)		U	U	U	U
Colon (CO)		U	U	U	U
Rectum (RE)		U	U	U	U
Testes w/Epidid (TP)					
Prostate (PR)					

Appendix 6 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL GROSS OBSERVATIONS

Printed: 06-Apr-84

Study Number: 223610G

SD: 22 Sex: Female Group: 2	Group:	2	2	2	2
Table Includes:		0	0	0	0
Sex = All; Group = All; Weeks = All		4	4	4	4
Death = T; Subset = All		5	5	5	5
		5	5	5	5
		5	5	5	6
Organ and Keyword(s) or Phrase		6	7	8	0
	Codes:	TG	TG	T	T
Urinary Bladder (UB)		U	U	U	U
Ovaries (OV)		U	U	U	U
Uterus (UT)		U	U	U	U
Nasal Turbinates (NT)		U	U	U	U
Bone(s), Other (OB)					
Perforation(s)		—	—	—	—
End of List					

PIN	HAN	Organ	Keyword or Phrase	Free-Text Comment
045556	258031	Lung	Dark	All Lobes
045557	258032	Lung	Mottled	All Lobes, Light Brown and Pink

2236-100/101

Appendix 7
Individual Terminal Body Weights, Organ Weights, and Organ/Body Weight Ratios
Toxicity Study of Welding Fumes in Rats

Hazleton Laboratories America, Inc.
 Department of Pathology
 Vienna, Virginia

Path/Tox System Output
 Toxicity Study of Welding Fumes
 INDIVIDUAL ABSOLUTE ORGAN WEIGHTS (g)

Printed: 27-Mar-84
 Study Number: 223610A

Table Includes:

Sex = All; Group = All; Weeks = All
 Death = All; Subset = All

Organ Abbreviations:

BR — Brain, LU — Lung, KD — Kidneys
 HT — Heart, LI — Liver

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	BR	LU	KD	HT	LI
M	1	047201	311.0	1.94	1.38	2.55	1.07	8.72
M	1	047202	308.0	1.94	1.27	2.35	0.92	8.72
M	1	045603	264.0	2.39	1.29	2.71	1.19	7.57
M	1	045604	260.0	1.80	1.25	2.14	0.85	7.31
M	1	045605	304.4	1.99	1.39	2.65	0.89	9.06
M	1	045606	277.3	1.95	1.21	2.38	0.91	7.85
M	1	045607	285.0	2.07	1.32	2.49	1.00	9.00
M	1	045608	315.0	2.03	1.48	2.48	1.00	9.15
M	1	045609	304.0	2.12	1.48	2.77	0.94	9.90
M	1	045610	297.0	2.03	1.37	2.76	1.01	8.96
M	1	045611	342.0	2.06	1.57	3.04	1.02	11.19
M	1	045612	313.0	1.97	1.42	2.45	0.99	8.37
Number in Group:			12	12	12	12	12	12
Mean:			298.4	2.02	1.37	2.56	0.98	8.82
Standard Deviation:			23.3	0.14	0.11	0.24	0.09	1.04
M	2	047203	301.0	2.06	1.38	2.20	0.87	9.14
M	2	047204	324.0	1.91	1.46	2.57	0.86	9.38
M	2	047205	345.0	2.05	1.75	2.70	1.10	10.01
M	2	047206	316.0	2.10	1.61	2.49	0.97	9.38
M	2	047207	317.0	2.07	1.58	2.55	0.97	8.50
Number in Group:			5	5	5	5	5	5
Mean:			320.6	2.04	1.56 ^{S+}	2.50	0.95	9.28
Standard Deviation:			16.0	0.07	0.14	0.18	0.10	0.55
M	3	045618	282.0	1.86	1.38	2.20	0.80	7.40
M	3	045619	285.0	1.98	1.30	2.26	0.82	8.10
M	3	045620	267.0	1.86	1.11	2.40	0.87	7.08
M	3	045621	285.0	1.78	1.26	2.26	0.94	8.71
M	3	045622	290.0	1.96	1.21	2.37	0.90	8.24
Number in Group:			5	5	5	5	5	5
Mean:			281.8	1.89	1.25	2.30	0.87 ^{S-}	7.90
Standard Deviation:			8.8	0.08	0.10	0.08	0.06	0.66
M	4	045623	253.1					
M	4	045624	223.2					
M	4	045625	253.6					
M	4	045626	236.5					
M	4	045627	228.5					
Number in Group:			5					
Mean:			239.0					
Standard Deviation:			13.9					

Appendix 7 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL ABSOLUTE ORGAN WEIGHTS (g)

Printed: 27-Mar-84

Study Number: 223610A

Table Includes:

Sex = All; Group = All; Weeks = All
Death = All; Subset = All

Organ Abbreviations:

BR — Brain, LU — Lung, KD — Kidneys
HT — Heart, LI — Liver

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	BR	LU	KD	HT	LI
M	5	045628	314.0	2.17	1.39	2.27	0.79	9.06
M	5	045629	278.0	1.93	1.23	2.18	0.86	7.54
M	5	045630	286.0	2.03	1.35	2.27	0.80	8.04
M	5	045631	333.0	2.02	1.63	2.63	0.92	9.25
M	5	045632	318.0	1.87	1.37	2.71	0.95	9.64
Number in Group:			5	5	5	5	5	5
Mean:			305.8	2.00	1.39	2.41	0.87 ^{S-}	8.71
Standard Deviation:			23.0	0.12	0.15	0.24	0.07	0.88
M	6	045633	307.0	1.98		2.49	0.99	9.30
M	6	045634	317.0	2.15	1.57	2.50	0.93	9.90
M	6	045635	308.0	2.02	1.59	2.66	0.94	9.20
M	6	045636	301.0	1.98	1.57	2.46	0.99	8.71
M	6	045637	307.0	2.16	1.73	3.01	0.97	9.16
Number in Group:			5	5	4	5	5	5
Mean:			308.0	2.06	1.62 ^{S+}	2.63	0.96	9.25
Standard Deviation:			5.7	0.09	0.08	0.23	0.03	0.43
M	7	045638	287.0	1.93	1.41	2.43	0.88	8.48
M	7	045639	354.0	2.04	1.76	2.90	1.05	9.54
M	7	045640	337.0	1.98	1.48	2.89	1.03	9.63
M	7	045641	283.0	1.85	1.26	2.24	0.84	7.82
M	7	045642	293.0	1.98	1.44	2.09	0.90	8.29
Number in Group:			5	5	5	5	5	5
Mean:			310.8	1.96	1.47	2.51	0.94	8.75
Standard Deviation:			32.4	0.07	0.18	0.37	0.09	0.80

(Continued)

Appendix 7 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Acute Inhalation Toxicity of Welding Fumes
Project 2236-101
ABSOLUTE ORGAN WEIGHTS (g)

Printed: 06-Apr-84

Study Number: 223610G

Table Includes:

Sex = All; Group = All; Weeks = All
Death = T; Subset = All

Organ Abbreviations:

LU — Lung, HT — Heart, LI — Liver
KD — Kidneys, BR — Brain

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	LU	HT	LI	KD	BR
M	1	045501	288.0	1.33	0.91	7.82	2.45	1.99
M	1	045502	299.0	1.49	0.94	9.65	2.59	1.70
M	1	045503	305.0	1.37	0.90	9.58	2.70	1.91
M	1	045504	271.0	1.30	0.91	6.76	2.17	1.79
M	1	045505	271.0	1.39	0.86	8.75	2.34	1.85
Number in Group:			5	5	5	5	5	5
Mean:			286.8	1.37	0.91	8.51	2.45	1.85
Standard Deviation:			15.7	0.07	0.03	1.23	0.21	0.11
M	2	045506	320.0	1.91	1.03	9.69	3.10	1.95
M	2	045507	276.0	1.44	1.02	9.47	2.74	1.91
M	2	045508	301.0	1.75	0.94	8.60	2.33	1.99
M	2	045509	275.0	1.35	0.83	8.72	2.58	1.87
M	2	045510	276.0	1.50	1.01	8.73	2.29	1.84
Number in Group:			5	5	5	5	5	5
Mean:			289.6	1.59	0.97	9.04	2.61	1.91
Standard Deviation:			20.2	0.23	0.08	0.50	0.33	0.06

Appendix 7 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL ABSOLUTE ORGAN WEIGHTS (g)

Printed: 27-Mar-84

Study Number: 223610A

Table Includes:

Sex = All; Group = All; Weeks = All
Death = All; Subset = All

Organ Abbreviations:

BR — Brain, LU — Lung, KD — Kidneys
HT — Heart, LI — Liver

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	BR	LU	KD	HT	LI
F	1	047301	195.0	1.80	1.11	1.58	0.64	6.14
F	1	047302	209.0	1.99	1.07	1.85	0.76	6.55
F	1	045803	202.0	1.81	1.05	1.88	0.72	6.92
F	1	045804	199.0	2.02	1.14	1.65	0.70	6.35
F	1	045805	205.1	1.96	1.05	1.66	0.66	6.41
F	1	045806	200.1	1.84	1.11	1.71	0.80	7.02
F	1	045807	195.0	1.76	0.98	1.53	0.66	5.93
F	1	045808	181.0	1.76	1.01	1.56	0.62	5.77
F	1	045809	189.0	1.91	1.05	1.68	0.74	5.79
F	1	045810	184.0	1.90	1.09	1.87	0.69	5.74
F	1	045811	226.0	1.82	1.19	1.82	0.78	7.63
F	1	045812	203.0	1.87	1.26	1.77	0.74	6.57
Number in Group:			12	12	12	12	12	12
Mean:			199.0	1.87	1.09	1.71	0.71	6.40
Standard Deviation:			12.0	0.09	0.08	0.12	0.06	0.58
F	2	047303	210.0	1.83	1.34	1.68	0.75	6.90
F	2	047304	215.0	1.88	1.34	1.82	0.80	6.12
F	2	047305	204.0	1.80	1.34	1.69	0.71	6.34
F	2	047306	184.0	1.85	1.25	1.56	0.61	5.23
F	2	047307	202.0	1.82	1.29	1.66	0.69	6.44
Number in Group:			5	5	5	5	5	5
Mean:			203.0	1.84	1.31	1.68	0.71	6.21
Standard Deviation:			11.8	0.03	0.04	0.09	0.07	0.62
F	3	045838	192.0	1.85	1.06	1.83	0.66	5.86
F	3	045819	203.0	1.98	1.07	1.71	0.69	6.30
F	3	045820	198.0	1.85	1.12	1.76	0.65	6.76
F	3	045821	185.0	1.87	1.06	1.46	0.60	4.88
F	3	045822	196.0	1.88	1.03	1.65	0.63	6.30
Number in Group:			5	5	5	5	5	5
Mean:			194.8	1.88	1.07	1.68	0.64	6.02
Standard Deviation:			6.8	0.06	0.03	0.14	0.03	0.71

(Continued)

Appendix 7 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL ABSOLUTE ORGAN WEIGHTS (g)

Printed: 27-Mar-84
Study Number: 223610A

Table Includes:

Sex = All; Group = All; Weeks = All
Death = All; Subset = All

Organ Abbreviations:

BR — Brain, LU — Lung, KD — Kidneys
HT — Heart, LI — Liver

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	BR	LU	KD	HT	LI
F	4	045823	173.2					
F	4	045824	162.2					
F	4	045825	122.3					
F	4	045826	148.1					
F	4	045827	177.5					
Number in Group:			5					
Mean:			156.7					
Standard Deviation:			22.3					
F	5	045828	185.0	1.77	1.15	1.46	0.63	5.68
F	5	045829	187.0	1.75	1.14	1.78	0.73	5.66
F	5	045830	204.0	1.95	1.12	1.78	0.76	6.37
F	5	045831	206.0	1.77	1.24	1.81	0.77	6.72
F	5	045832	196.0	1.76	1.35	1.66	0.69	6.33
Number in Group:			5	5	5	5	5	5
Mean:			195.6	1.80	1.20 ^{S+}	1.70	0.72	6.15
Standard Deviation:			9.6	0.09	0.10	0.14	0.06	0.47
F	6	045833	199.0	1.73	1.19	1.59	0.71	5.78
F	6	045834	208.0	1.90	1.22	1.75	0.72	6.37
F	6	045835	194.0	1.85	1.04	1.54	0.59	5.81
F	6	045836	191.0	1.93	1.22	1.56	0.67	5.98
F	6	045837	189.0	1.83	1.13	1.43	0.64	5.86
Number in Group:			5	5	5	5	5	5
Mean:			196.2	1.85	1.16	1.57	0.67	5.96
Standard Deviation:			7.6	0.07	0.07	0.12	0.05	0.24
F	7	045838	205.0	1.85	1.25	1.67	0.66	6.17
F	7	045839	207.0	1.81	1.26	1.46	0.71	6.09
F	7	045840	209.0	1.85	1.21	1.95	0.66	6.19
F	7	045841	202.0	1.88	1.21	1.53	0.69	5.56
F	7	045842	202.0	1.76	1.24	1.62	0.71	6.25
Number in Group:			5	5	5	5	5	5
Mean:			205.0	1.83	1.23 ^{S+}	1.65	0.69	6.05
Standard Deviation:			3.1	0.05	0.02	0.19	0.02	0.28

Appendix 7 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Acute Inhalation Toxicity of Welding Fumes
Project 2236-101
ABSOLUTE ORGAN WEIGHTS (g)

Printed: 06-Apr-84
Study Number: 223610G

Table Includes:

Sex = All; Group = All; Weeks = All
Death = T; Subset = All

Organ Abbreviations:

LU — Lung, HT — Heart, LI — Liver
KD — Kidneys, BR — Brain

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	LU	HT	LI	KD	BR
F	1	045551	197.0	1.12	0.64	6.00	1.62	1.95
F	1	045552	191.0	1.26	0.76	6.68	1.60	1.75
F	1	045553	190.0	1.11	0.79	5.78	1.68	1.82
F	1	045554	188.0	1.23	0.68	6.03	1.42	1.67
F	1	045555	194.0	1.24	0.67	6.11	1.52	1.57
Number in Group:			5	5	5	5	5	5
Mean:			192.0	1.19	0.71	6.12	1.57	1.75
Standard Deviation:			3.5	0.07	0.07	0.34	0.10	0.15
F	2	045556	189.0	1.31	0.71	6.33	1.59	1.85
F	2	045557	191.0	1.28	0.74	6.15	1.59	1.72
F	2	045558	201.0	1.27	0.70	6.45	1.63	1.70
F	2	045560	199.0	1.36	0.68	6.45	1.49	1.80
Number in Group:			4	4	4	4	4	4
Mean:			195.0	1.30 ^{S+}	0.71	6.35	1.58	1.77
Standard Deviation:			5.9	0.04	0.02	0.14	0.06	0.07

(Continued)

Appendix 7 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes

Printed: 27-Mar-84

INDIVIDUAL ORGAN/TERMINAL BODY WEIGHT RATIOS (%) Study Number: 223610A

Table Includes:

Sex = All; Group = All; Weeks = All
Death = All; Subset = All

Organ Abbreviations:

BR — Brain, LU — Lung, KD — Kidneys
HT — Heart, LI — Liver

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	BR	LU	KD	HT	LI
M	1	047201	311.0	0.623	0.445	0.819	0.344	2.805
M	1	047202	308.0	0.630	0.411	0.764	0.300	2.830
M	1	045603	264.0	0.907	0.487	1.025	0.450	2.868
M	1	045604	260.0	0.692	0.479	0.823	0.327	2.810
M	1	045605	304.4	0.655	0.458	0.872	0.293	2.975
M	1	045606	277.3	0.702	0.437	0.857	0.330	2.832
M	1	045607	285.0	0.728	0.462	0.873	0.350	3.156
M	1	045608	315.0	0.644	0.471	0.786	0.317	2.906
M	1	045609	304.0	0.698	0.488	0.912	0.309	3.256
M	1	045610	297.0	0.682	0.461	0.931	0.338	3.018
M	1	045611	342.0	0.602	0.460	0.889	0.299	3.271
M	1	045612	313.0	0.629	0.454	0.784	0.317	2.673
Number in Group:			12	12	12	12	12	12
Mean:			298.4	0.683	0.459	0.861	0.331	2.950
Standard Deviation:			23.3	0.080	0.022	0.074	0.042	0.190
M	2	047203	301.0	0.683	0.457	0.732	0.289	3.037
M	2	047204	324.0	0.590	0.451	0.793	0.265	2.896
M	2	047205	345.0	0.594	0.508	0.784	0.319	2.902
M	2	047206	316.0	0.664	0.510	0.790	0.305	2.969
M	2	047207	317.0	0.654	0.497	0.803	0.305	2.680
Number in Group:			5	5	5	5	5	5
Mean:			320.6	0.637	0.485	0.780	0.297	2.897
Standard Deviation:			16.0	0.042	0.028	0.028	0.021	0.134
M	3	045618	282.0	0.659	0.490	0.782	0.284	2.624
M	3	045619	285.0	0.694	0.457	0.792	0.289	2.841
M	3	045620	267.0	0.697	0.416	0.898	0.326	2.651
M	3	045621	285.0	0.624	0.442	0.791	0.329	3.057
M	3	045622	290.0	0.676	0.419	0.816	0.312	2.840
Number in Group:			5	5	5	5	5	5
Mean:			281.8	0.670	0.445	0.816	0.308	2.803
Standard Deviation:			8.8	0.030	0.031	0.048	0.021	0.175
M	4	045623	253.1					
M	4	045624	223.2					
M	4	045625	253.6					
M	4	045626	236.5					
M	4	045627	228.5					
Number in Group:			5					
Mean:			239.0					
Standard Deviation:			13.9					

Appendix 7 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL ABSOLUTE ORGAN WEIGHTS (g)

Printed: 27-Mar-84

Study Number: 223610A

Table Includes:

Sex = All; Group = All; Weeks = All
Death = All; Subset = All

Organ Abbreviations:

BR — Brain, LU — Lung, KD — Kidneys
HT — Heart, LI — Liver

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	BR	LU	KD	HT	LI
M	5	045628	314.0	0.692	0.443	0.723	0.253	2.884
M	5	045629	278.0	0.694	0.442	0.784	0.308	2.714
M	5	045630	286.0	0.710	0.472	0.794	0.280	2.812
M	5	045631	333.0	0.607	0.491	0.789	0.278	2.777
M	5	045632	318.0	0.588	0.430	0.852	0.300	3.033
Number in Group:			5	5	5	5	5	5
Mean:			305.8	0.658	0.456	0.789	0.284	2.844
Standard Deviation:			23.0	0.056	0.025	0.046	0.021	0.122
M	6	045633	307.0	0.647		0.813	0.321	3.028
M	6	045634	317.0	0.679	0.496	0.790	0.293	3.122
M	6	045635	308.0	0.655	0.516	0.865	0.305	2.989
M	6	045636	301.0	0.657	0.522	0.819	0.328	2.893
M	6	045637	307.0	0.703	0.565	0.982	0.315	2.983
Number in Group:			5	5	4	5	5	5
Mean:			308.0	0.668	0.524 ^{S+}	0.854	0.312	3.003
Standard Deviation:			5.7	0.023	0.029	0.077	0.014	0.083
M	7	045638	287.0	0.673	0.492	0.847	0.305	2.955
M	7	045639	354.0	0.577	0.497	0.818	0.295	2.695
M	7	045640	337.0	0.589	0.438	0.858	0.304	2.858
M	7	045641	283.0	0.654	0.444	0.792	0.298	2.763
M	7	045642	293.0	0.675	0.493	0.712	0.306	2.829
Number in Group:			5	5	5	5	5	5
Mean:			310.8	0.634	0.473	0.805	0.302	2.820
Standard Deviation:			32.4	0.047	0.029	0.058	0.005	0.098

(Continued)

Appendix 7 (Continued)

2236-100/101

Path/Tox System Output
 Hazleton Laboratories America, Inc. Acute Inhalation Toxicity of Welding Fumes Printed: 06-Apr-84
 Department of Pathology Project 2236-101
 Vienna, Virginia ORGAN-TO-TERMINAL BODY WEIGHT RATIOS (%) Study Number: 223610G

Table Includes:

Sex = All; Group = All; Weeks = All
 Death = T; Subset = All

Organ Abbreviations:

LU — Lung, HT — Heart, LI — Liver
 KD — Kidneys, BR — Brain

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	LU	HT	LI	KD	BR
M	1	045501	288.0	0.461	0.315	2.715	0.849	0.690
M	1	045502	299.0	0.497	0.314	3.227	0.868	0.569
M	1	045503	305.0	0.448	0.296	3.140	0.886	0.627
M	1	045504	271.0	0.479	0.337	2.493	0.801	0.662
M	1	045505	271.0	0.514	0.318	3.227	0.863	0.681
Number in Group:			5	5	5	5	5	5
Mean:			286.8	0.480	0.316	2.960	0.853	0.646
Standard Deviation:			15.7	0.027	0.015	0.337	0.032	0.049
M	2	045506	320.0	0.597	0.322	3.027	0.969	0.610
M	2	045507	276.0	0.521	0.370	3.432	0.992	0.694
M	2	045508	301.0	0.582	0.311	2.858	0.773	0.660
M	2	045509	275.0	0.492	0.302	3.172	0.939	0.680
M	2	045510	276.0	0.545	0.366	3.164	0.830	0.668
Number in Group:			5	5	5	5	5	5
Mean:			289.6	0.547 ⁸⁺	0.334	3.131	0.901	0.662
Standard Deviation:			20.2	0.043	0.032	0.211	0.094	0.032

Appendix 7 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes

Printed: 27-Mar-84

INDIVIDUAL ORGAN/TERMINAL BODY WEIGHT RATIOS (%) Study Number: 223610A

Table Includes:

Sex = All; Group = All; Weeks = All
Death = All; Subset = All

Organ Abbreviations:

BR — Brain, LU — Lung, KD — Kidneys
HT — Heart, LI — Liver

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	BR	LU	KD	HT	LI
F	1	047301	195.0	0.921	0.568	0.809	0.330	3.149
F	1	047302	209.0	0.952	0.513	0.884	0.363	3.134
F	1	045803	202.0	0.896	0.521	0.930	0.358	3.426
F	1	045804	199.0	1.016	0.572	0.832	0.352	3.193
F	1	045805	205.1	0.957	0.510	0.811	0.324	3.126
F	1	045806	200.1	0.918	0.554	0.854	0.398	3.507
F	1	045807	195.0	0.905	0.505	0.784	0.341	3.041
F	1	045808	181.0	0.971	0.560	0.860	0.345	3.191
F	1	045809	189.0	1.012	0.557	0.891	0.389	3.062
F	1	045810	184.0	1.033	0.592	1.016	0.377	3.120
F	1	045811	226.0	0.804	0.529	0.805	0.346	3.376
F	1	045812	203.0	0.920	0.621	0.870	0.362	3.238
Number in Group:			12	12	12	12	12	12
Mean:			199.0	0.942	0.550	0.862	0.357	3.214
Standard Deviation:			12.0	0.063	0.036	0.064	0.022	0.147
F	2	047303	210.0	0.870	0.637	0.800	0.356	3.287
F	2	047304	215.0	0.875	0.621	0.847	0.373	2.848
F	2	047305	204.0	0.884	0.657	0.827	0.347	3.105
F	2	047306	184.0	1.008	0.682	0.850	0.330	2.840
F	2	047307	202.0	0.900	0.639	0.822	0.342	3.188
Number in Group:			5	5	5	5	5	5
Mean:			203.0	0.907	0.647 ^{S+}	0.829	0.349	3.054
Standard Deviation:			11.8	0.057	0.023	0.020	0.016	0.202
F	3	045838	192.0	0.963	0.553	0.955	0.343	3.054
F	3	045819	203.0	0.975	0.528	0.842	0.339	3.101
F	3	045820	198.0	0.933	0.564	0.886	0.326	3.415
F	3	045821	185.0	1.011	0.573	0.791	0.322	2.637
F	3	045822	196.0	0.958	0.524	0.842	0.322	3.213
Number in Group:			5	5	5	5	5	5
Mean:			194.8	0.968	0.548	0.863	0.331	3.084
Standard Deviation:			6.8	0.029	0.021	0.062	0.010	0.286

(Continued)

Appendix 7 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes

Printed: 27-Mar-84

INDIVIDUAL ORGAN/TERMINAL BODY WEIGHT RATIOS (%) Study Number: 223610A

Table Includes:

Sex = All; Group = All; Weeks = All
Death = All; Subset = All

Organ Abbreviations:

BR — Brain, LU — Lung, KD — Kidneys
HT — Heart, LI — Liver

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	BR	LU	KD	HT	LI
F	4	045823	173.2					
F	4	045824	162.2					
F	4	045825	122.3					
F	4	045826	148.1					
F	4	045827	177.5					
Number in Group:			5					
Mean:			156.7					
Standard Deviation:			22.3					
F	5	045828	185.0	0.954	0.621	0.790	0.342	3.068
F	5	045829	187.0	0.937	0.608	0.950	0.391	3.025
F	5	045830	204.0	0.957	0.548	0.873	0.375	3.121
F	5	045831	206.0	0.861	0.603	0.880	0.376	3.260
F	5	045832	196.0	0.897	0.689	0.847	0.352	3.229
Number in Group:			5	5	5	5	5	5
Mean:			195.6	0.921	0.614 ^{S+}	0.868	0.367	3.141
Standard Deviation:			9.6	0.041	0.051	0.058	0.020	0.101
F	6	045833	199.0	0.872	0.596	0.801	0.356	2.904
F	6	045834	208.0	0.914	0.587	0.843	0.345	3.061
F	6	045835	194.0	0.952	0.538	0.792	0.304	2.997
F	6	045836	191.0	1.009	0.638	0.814	0.353	3.132
F	6	045837	189.0	0.970	0.599	0.756	0.339	3.101
Number in Group:			5	5	5	5	5	5
Mean:			196.2	0.943	0.592	0.801	0.340	3.039
Standard Deviation:			7.6	0.053	0.036	0.032	0.021	0.091
F	7	045838	205.0	0.900	0.612	0.815	0.324	3.011
F	7	045839	207.0	0.875	0.608	0.708	0.343	2.941
F	7	045840	209.0	0.884	0.578	0.933	0.314	2.963
F	7	045841	202.0	0.930	0.600	0.759	0.342	2.750
F	7	045842	202.0	0.871	0.614	0.801	0.350	3.094
Number in Group:			5	5	5	5	5	5
Mean:			205.0	0.892	0.602 ^{S+}	0.803	0.334	2.952
Standard Deviation:			3.1	0.024	0.015	0.084	0.015	0.127

Appendix 7 (Continued)

2236-100/101

Hazleton Laboratories America, Inc. Path/Tox System Output
 Department of Pathology Acute Inhalation Toxicity of Welding Fumes Printed: 06-Apr-84
 Vienna, Virginia Project 2236-101
 ORGAN-TO-TERMINAL BODY WEIGHT RATIOS (%) Study Number: 223610G

Table Includes:

Sex = All; Group = All; Weeks = All
 Death = T; Subset = All

Organ Abbreviations:

LU — Lung, HT — Heart, LI — Liver
 KD — Kidneys, BR — Brain

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	LU	HT	LI	KD	BR
F	1	045551	197.0	0.568	0.323	3.045	0.823	0.991
F	1	045552	191.0	0.657	0.401	3.497	0.838	0.915
F	1	045553	190.0	0.582	0.415	3.043	0.883	0.956
F	1	045554	188.0	0.654	0.361	3.208	0.757	0.889
F	1	045555	194.0	0.640	0.344	3.149	0.784	0.807
Number in Group:			5	5	5	5	5	5
Mean:			192.0	0.620	0.369	3.188	0.817	0.912
Standard Deviation:			3.5	0.042	0.038	0.186	0.049	0.070
F	2	045556	189.0	0.693	0.373	3.351	0.842	0.978
F	2	045557	191.0	0.670	0.386	3.220	0.835	0.903
F	2	045558	201.0	0.632	0.348	3.210	0.812	0.845
F	2	045560	199.0	0.683	0.343	3.243	0.748	0.906
Number in Group:			4	4	4	4	4	4
Mean:			195.0	0.669 ^{S+}	0.363	3.256	0.809	0.908
Standard Deviation:			5.9	0.027	0.021	0.065	0.043	0.055

Appendix 8
Individual Lung Dry/Wet Weights and Lung Dry/Wet Weight Ratios
Toxicity Study of Welding Fumes in Rats

2236-100/101

Hazleton Laboratories America, Inc.
 Department of Pathology
 Vienna, Virginia

Path/Tox System Output
 Toxicity Study of Welding Fumes
 ABSOLUTE ORGAN WEIGHTS (g)

Printed: 27-Aug-85
 Study Number: 2236100

Table Includes:

Sex = All; Group = All; Weeks = All
 Death = All; Subset = All

Organ Abbreviations:

LU0 — Lung—Wet, LU1 — Lung—Dry, LU2 — Wet/Dry Ratio

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	LU0	LU1	LU2
M	1	047220	Missing	1.54	0.32	4.81
M	1	047221	Missing	1.51	0.31	4.87
M	1	045717	Missing	1.47	0.30	4.90
M	1	045718	Missing	1.34	0.32	4.19
M	1	045719	Missing	1.32	0.28	4.71
M	1	045720	Missing	1.83	0.32	5.72
M	1	045721	Missing	1.44	0.30	4.80
M	1	045722	Missing	1.71	0.36	4.75
M	1	045723	Missing	1.49	0.33	4.52
M	1	045724	Missing	1.40	0.30	4.67
M	1	045725	Missing	1.52	0.32	4.75
M	1	045726	Missing	1.33	0.27	4.93
Number in Group:				12	12	12
Mean:				1.49	0.31	4.80
Standard Deviation:				0.15	0.02	0.35
Minimum:				1.32	0.27	4.19
Maximum:				1.83	0.36	5.72
M	2	047215	Missing	1.66	0.36	4.61
M	2	047216	Missing	1.37	0.30	4.57
M	2	047217	Missing	1.29	0.27	4.78
M	2	047218	Missing	1.35	0.29	4.66
M	2	047219	Missing	1.37	0.29	4.72
M	2	047222	Missing	1.57	0.33	4.76
M	2	047223	Missing	1.31	0.27	4.85
M	2	047224	Missing	1.59	0.34	4.68
M	2	047225	Missing	1.60	0.33	4.85
M	2	047226	Missing	1.68	0.36	4.67
Number in Group:				10	10	10
Mean:				1.48	0.31	4.72
Standard Deviation:				0.15	0.03	0.09
Minimum:				1.29	0.27	4.57
Maximum:				1.68	0.36	4.85

Appendix 8 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
ABSOLUTE ORGAN WEIGHTS (g)

Printed: 27-Aug-85

Study Number: 2236100

Table Includes:

Sex = All; Group = All; Weeks = All
Death = All; Subset = All

Organ Abbreviations:

LU0 — Lung-Wet, LU1 — Lung-Dry, LU2 — Wet/Dry Ratio

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	LU0	LU1	LU2
M	3	045690	Missing	1.37	0.30	4.57
M	3	045691	Missing	1.34	0.29	4.62
M	3	045692	Missing	1.22	0.25	4.88
M	3	045693	Missing	1.34	0.28	4.79
M	3	045694	Missing	1.46	0.30	4.87
M	3	045732	Missing	1.37	0.31	4.42
M	3	045733	Missing	1.44	0.31	4.65
M	3	045734	Missing	1.47	0.32	4.59
M	3	045735	Missing	1.49	0.32	4.66
M	3	045736	Missing	1.32	0.31	4.26
Number in Group:				10	10	10
Mean:				1.38	0.30	4.63
Standard Deviation:				0.08	0.02	0.19
Minimum:				1.22	0.25	4.26
Maximum:				1.49	0.32	4.88
M	4	045697	Missing	1.42	0.31	4.58
M	4	045737	Missing	1.53	0.33	4.64
M	4	045739	Missing	1.53	0.33	4.64
Number in Group:				3	3	3
Mean:				1.49	0.32	4.62
Standard Deviation:				0.06	0.01	0.03
Minimum:				1.42	0.31	4.58
Maximum:				1.53	0.33	4.64
M	5	045700	Missing	1.64	0.34	4.82
M	5	045701	Missing	1.51	0.32	4.72
M	5	045702	Missing	1.69	0.33	5.12
M	5	045703	Missing	1.44	0.29	4.97
M	5	045704	Missing	1.72	0.35	4.91
M	5	045742	Missing	1.60	0.35	4.57
M	5	045743	Missing	1.80	0.37	4.86
M	5	045744	Missing	1.87	0.40	4.68
M	5	045745	Missing	1.65	0.35	4.71
M	5	045746	Missing	1.51	0.31	4.87
Number in Group:				10	10	10
Mean:				1.64	0.34	4.82
Standard Deviation:				0.13	0.03	0.16
Minimum:				1.44	0.29	4.57
Maximum:				1.87	0.40	5.12

(Continued)

Appendix 8 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
ABSOLUTE ORGAN WEIGHTS (g)

Printed: 27-Aug-85

Study Number: 2236100

Table Includes:

Sex = All; Group = All; Weeks = All
Death = All; Subset = All

Organ Abbreviations:

LU0 — Lung—Wet, LU1 — Lung—Dry, LU2 — Wet/Dry Ratio

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	LU0	LU1	LU2
M	6	045705	Missing	1.41	0.32	4.41
M	6	045706	Missing	1.32	0.28	4.71
M	6	045707	Missing	1.66	0.34	4.88
M	6	045708	Missing	1.49	0.31	4.81
M	6	045709	Missing	1.49	0.31	4.81
M	6	045747	Missing	1.56	0.33	4.73
M	6	045748	Missing	1.56	0.34	4.59
M	6	045749	Missing	1.46	0.32	4.56
M	6	045750	Missing	1.58	0.35	4.51
M	6	045751	Missing	1.45	0.39	3.72
Number in Group:				10	10	10
Mean:				1.50	0.33	4.57
Standard Deviation:				0.10	0.03	0.33
Minimum:				1.32	0.28	3.72
Maximum:				1.66	0.39	4.88
M	7	045710	Missing	1.37	0.29	4.72
M	7	045711	Missing	1.47	0.31	4.74
M	7	045712	Missing	1.61	0.33	4.88
M	7	045713	Missing	1.50	0.33	4.55
M	7	045714	Missing	1.26	0.28	4.50
M	7	045752	Missing	1.44	0.31	4.65
M	7	045753	Missing	1.47	0.30	4.90
M	7	045754	Missing	1.38	0.27	5.11
M	7	045755	Missing	1.71	0.28	6.11
M	7	045756	Missing	1.56	0.33	4.73
Number in Group:				10	10	10
Mean:				1.48	0.30	4.89
Standard Deviation:				0.13	0.02	0.46
Minimum:				1.26	0.27	4.50
Maximum:				1.71	0.33	6.11

Appendix 8 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
ABSOLUTE ORGAN WEIGHTS (g)

Printed: 27-Aug-85

Study Number: 2236100

Table Includes:

Sex = All; Group = All; Weeks = All
Death = All; Subset = All

Organ Abbreviations:

LU0 — Lung-Wet, LU1 — Lung-Dry, LU2 — Wet/Dry Ratio

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	LU0	LU1	LU2
F	1	047320	Missing	1.20	0.24	5.00
F	1	047321	Missing	1.32	0.27	4.89
F	1	045917	Missing	1.14	0.26	4.38
F	1	045918	Missing	1.19	0.26	4.59
F	1	045919	Missing	1.16	0.25	4.64
F	1	045920	Missing	1.17	0.24	4.88
F	1	045921	Missing	1.21	0.26	4.65
F	1	045922	Missing	1.12	0.23	4.87
F	1	045923	Missing	1.09	0.24	4.54
F	1	045924	Missing	1.16	0.25	4.64
F	1	045925	Missing	1.39	0.29	4.79
F	1	045926	Missing	1.27	0.26	4.88
Number in Group:				12	12	12
Mean:				1.20	0.25	4.73
Standard Deviation:				0.09	0.02	0.18
Minimum:				1.09	0.23	4.38
Maximum:				1.39	0.29	5.00
F	2	047315	Missing	1.15	0.24	4.79
F	2	047316	Missing	1.03	0.22	4.68
F	2	047317	Missing	1.13	0.25	4.52
F	2	047318	Missing	1.22	0.26	4.69
F	2	047319	Missing	1.15	0.25	4.60
F	2	047322	Missing	1.14	0.24	4.75
F	2	047323	Missing	1.21	0.26	4.65
F	2	047324	Missing	1.17	0.25	4.68
F	2	047325	Missing	1.18	0.25	4.72
F	2	047326	Missing	1.43	0.29	4.93
Number in Group:				10	10	10
Mean:				1.18	0.25	4.70
Standard Deviation:				0.10	0.02	0.11
Minimum:				1.03	0.22	4.52
Maximum:				1.43	0.29	4.93

(Continued)

Appendix 8 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
ABSOLUTE ORGAN WEIGHTS (g)

Printed: 27-Aug-85
Study Number: 2236100

Table Includes:

Sex = All; Group = All; Weeks = All
Death = All; Subset = All

Organ Abbreviations:

LU0 — Lung — Wet, LU1 — Lung — Dry, LU2 — Wet/Dry Ratio

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	LU0	LU1	LU2
F	3	045890	Missing	1.14	0.24	4.75
F	3	045891	Missing	1.12	0.23	4.87
F	3	045892	Missing	1.17	0.25	4.68
F	3	045893	Missing	1.14	0.24	4.75
F	3	045894	Missing	1.11	0.24	4.63
F	3	045932	Missing	1.24	0.27	4.59
F	3	045933	Missing	1.18	0.27	4.37
F	3	045934	Missing	1.06	0.24	4.42
F	3	045935	Missing	1.40	0.31	4.52
F	3	045936	Missing	1.04	0.23	4.52
Number in Group:				10	10	10
Mean:				1.16	0.25	4.61
Standard Deviation:				0.10	0.02	0.16
Minimum:				1.04	0.23	4.37
Maximum:				1.40	0.31	4.87
F	4	045897	Missing	0.97	0.23	4.22
Number in Group:						
Mean:						
Standard Deviation:						
Minimum:						
Maximum:						
F	5	045900	Missing	1.30	0.27	4.81
F	5	045901	Missing	1.28	0.26	4.92
F	5	045902	Missing	1.30	0.27	4.81
F	5	045903	Missing	1.26	0.26	4.85
F	5	045904	Missing	1.13	0.24	4.71
F	5	045942	Missing	1.25	0.26	4.81
F	5	045943	Missing	1.31	0.28	4.68
F	5	045944	Missing	1.50	0.32	4.69
F	5	045945	Missing	1.50	0.31	4.84
F	5	045946	Missing	1.31	0.28	4.68
Number in Group:				10	10	10
Mean:				1.31	0.27	4.78
Standard Deviation:				0.11	0.02	0.08
Minimum:				1.13	0.24	4.68
Maximum:				1.50	0.32	4.92

Appendix 8 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
ABSOLUTE ORGAN WEIGHTS (g)

Printed: 27-Aug-85

Study Number: 2236100

Table Includes:

Sex = All; Group = All; Weeks = All
Death = All; Subset = All

Organ Abbreviations:

LU0 — Lung-Wet, LU1 — Lung-Dry, LU2 — Wet/Dry Ratio

Sex	Dose Group	Animal Number	Terminal Body Weight (g)	LU0	LU1	LU2
F	6	045905	Missing	1.22	0.26	4.69
F	6	045906	Missing	1.09	0.22	4.95
F	6	045907	Missing	1.13	0.25	4.52
F	6	045908	Missing	1.23	0.26	4.73
F	6	045909	Missing	1.13	0.27	4.19
F	6	045947	Missing	1.42	0.29	4.90
F	6	045948	Missing	1.31	0.29	4.52
F	6	045949	Missing	1.27	0.27	4.70
F	6	045950	Missing	1.19	0.25	4.76
F	6	045951	Missing	1.23	0.27	4.56
Number in Group:				10	10	10
Mean:				1.22	0.26	4.65
Standard Deviation:				0.10	0.02	0.22
Minimum:				1.09	0.22	4.19
Maximum:				1.42	0.29	4.95
F	7	045910	Missing	1.23	0.26	4.73
F	7	045911	Missing	1.32	0.29	4.55
F	7	045912	Missing	1.23	0.26	4.73
F	7	045913	Missing	1.23	0.27	4.56
F	7	045914	Missing	1.24	0.27	4.59
F	7	045952	Missing	1.34	0.28	4.79
F	7	045953	Missing	1.50	0.31	4.84
F	7	045954	Missing	1.31	0.27	4.85
F	7	045955	Missing	1.34	0.37	3.62
F	7	045956	Missing	1.36	0.29	4.69
Number in Group:				10	10	10
Mean:				1.31	0.29	4.60
Standard Deviation:				0.08	0.03	0.36
Minimum:				1.23	0.26	3.62
Maximum:				1.50	0.37	4.85

Standard Key to Individual Histopathology Findings

Symbols Appearing Opposite "Codes"

H- = Histological Comment(s) Present for this Animal

Symbols Prefacing Neoplastic Findings

B- = Primary, Benign Neoplasm
 M- = Primary, Malignant Neoplasm
 N- = Metastatic Neoplasm
 I- = Locally Invasive Neoplasm
 X- = Other Neoplasm (See Comment)

Symbols Appearing in the Table Matrix

Distribution of Findings (n = Severity Grade):

n No Parenthesis = Not Specified
 (n Single Parenthesis = Multifocal
 (n) Double Parenthesis = Focal
]n[Inverted Brackets = Diffuse

Grades for Finding Severity or Amount:

1 = Minimal
 2 = Slight
 3 = Moderate
 4 = Moderately Severe
 5 = Severe
 + = Neoplastic Finding Present
 +n = Multiple Neoplasms of Same Type Present ('n' = Number Present)
 +aa = Metastatic or Invasive Neoplasm from Organ/Tissue Indicated by the Abbreviation 'aa', (e.g., 'LI' = Liver)
 U = Organ/Tissue Histologically Unremarkable (Tissues with Dashes Present for All Findings Also Histologically Unremarkable)
 - = Finding Not Present
 P = Finding Present
 Pn = Multiple Occurrences of Finding Present ('n' = Number Present)
 * = Tissue Missing
 A = Tissue Autolytic
 R = Tissue Recut Requested
 H = Histological Comment Present for this Tissue
 PIN = Permanent Identification Number
 HAN = Histology Accession Number
 SDS = Sex/Dose/Screen

Appendix 9 Individual Histopathology Findings Toxicity Study of Welding Fumes in Rats

2236-100/101

Hazleton Laboratories America, Inc.			Path/Tox System Output								Printed: 23-May-84		
Department of Pathology			Toxicity Study of Welding Fumes										
Vienna, Virginia			INDIVIDUAL HISTOPATHOLOGY FINDINGS								Study Number: 223610A		
SD: 11	Sex: Male	Dose-Group: 1	Group:	1	1	1	1	1	1	1	1	1	1
Table Includes:				0	0	0	0	0	0	0	0	0	0
Sex = All; Group = All; Screen = All; Weeks = All				4	4	4	4	4	4	4	4	4	4
Death = All; Find = All; Subset = All				7	7	5	5	5	5	5	5	5	5
				2	2	6	6	6	6	6	6	6	6
				0	0	0	0	0	0	0	1	1	1
Organ and Finding Description				1	2	3	4	5	6	7	8	9	0
Top of List				Codes:	T	T	T	T	T	T	T	T	T
Lung (LU)													
Alveolar Macrophages									1				
Pigmented Macrophages													
Perivascular/Peribronchial Lymphoid Hyperplasia													
Pneumonitis													
Congestion													
Perivascular Edema													
Alveolar Edema												1	
Fibrinous Pneumonia													
Hemorrhage													
Seropurulent Pneumonia													
End of List													

Hazleton Laboratories America, Inc.			Path/Tox System Output								Printed: 23-May-84		
Department of Pathology			Toxicity Study of Welding Fumes										
Vienna, Virginia			INDIVIDUAL HISTOPATHOLOGY FINDINGS								Study Number: 223610E		
SD: 12	Sex: Male	Dose-Group: 2	Group:	2	2	2	2	2					
Table Includes:				0	0	0	0	0					
Sex = All; Group = All; Screen = All; Weeks = All				4	4	4	4	4					
Death = All; Find = All; Subset = All				7	7	7	7	7					
				2	2	2	2	2					
				0	0	0	0	0					
Organ and Finding Description				3	4	5	6	7					
Top of List				Codes:	T	T	T	T	T				
Lung (LU)													
Alveolar Macrophages					2		2						
Pigmented Macrophages					1	(1							
Perivascular/Peribronchial Lymphoid Hyperplasia													
Pneumonitis													
Congestion													
Perivascular Edema													
Alveolar Edema													
Fibrinous Pneumonia													
Hemorrhage													
Seropurulent Pneumonia													
End of List													

(Continued)

Appendix 9 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes

Printed: 23-May-84

INDIVIDUAL HISTOPATHOLOGY FINDINGS

Study Number: 223610A

SD: 13 to 15 Sex: Male	Group:	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5
Dose-Group: 3 to 5		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Table Includes:		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Sex = All; Group = 3, 4, 5; Screen = All;		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Weeks = All Death = All; Find = All;		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Subset = All		1	1	2	2	2	2	2	2	2	2	2	2	3	3	3
Organ and Finding Description		8	9	0	1	2	3	4	5	6	7	8	9	0	1	2
Top of List	Codes:	T	T	T	T	T	D	D	DH	D	DH	T	T	T	T	T
Lung (LU)									H		H					
Alveolar Macrophages		—	—	—	—	—	—	—	—	—	—	—	—	—	2	2
Pigmented Macrophages		2	2	1	1	2	—	—	—	1	2	1	(1	1	(1	2
Perivascular/Peribronchial																
Lymphoid Hyperplasia		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Pneumonitis		—	—	—	—	—	—	—	]1[	—	]1[	—	—	—	—	—
Congestion		—	—	—	—	—	P	P	P	P	—	—	—	—	—	—
Perivascular Edema		—	—	—	—	—	4	3	3	2	2	—	—	—	—	—
Alveolar Edema		—	—	—	—	—	1	2	2	3	—	—	—	—	—	—
Fibrinous Pneumonia		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hemorrhage		—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
Seropurulent Pneumonia		—	—	—	—	—	—	(4	—	(3	—	—	—	—	—	—
End of List																

PIN	HAN	SDS	ABR	Tissue	Special Histopathological Comment
045625	255977	141	LU	Lung	Pneumonitis Consisted of Slight Acute Diffuse Neutrophil Exudation into Alveoli
045627	255979	141	LU	Lung	Pneumonitis Consisted of Minimal Diffuse Exudation of Neutrophils and a Few Macrophages into Alveoli

Appendix 9 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL HISTOPATHOLOGY FINDINGS

Printed: 23-May-84

Study Number: 223610A

SD: 16 to 17	Sex: Male	Dose-Group: 6 to 7	Group:	6	6	6	6	6	7	7	7	7	7
Table Includes:				0	0	0	0	0	0	0	0	0	0
Sex = All; Group = 6, 7; Screen = All; Weeks = All				4	4	4	4	4	4	4	4	4	4
Death = All; Find = All; Subset = All				5	5	5	5	5	5	5	5	5	5
				6	6	6	6	6	6	6	6	6	6
				3	3	3	3	3	3	3	4	4	4
Organ and Finding Description				3	4	5	6	7	8	9	0	1	2
Top of List				Codes:	T	T	T	T	T	T	T	T	T
Lung (LU)													
Alveolar Macrophages					—	—	—	—	—	—	—	1	—
Pigmented Macrophages					2	2	2	2	3	2	2	2	2
Perivascular/Peribronchial Lymphoid Hyperplasia					—	—	—	—	—	—	—	—	—
Pneumonitis					—	—	—	—	—	—	—	—	—
Congestion					—	—	—	—	—	—	—	—	—
Perivascular Edema					—	—	(1	—	(1	—	—	—	—
Alveolar Edema					—	—	—	—	—	—	—	—	—
Fibrinous Pneumonia					—	—	—	—	—	—	—	—	—
Hemorrhage					—	—	—	—	—	—	—	—	—
Seropurulent Pneumonia					—	—	—	—	—	—	—	—	—
End of List													

Hazleton Laboratories America, Inc.				Path/Tox System Output					Printed: 09-Feb-84				
Department of Pathology				Acute Inhalation Toxicity of Welding Fumes									
Vienna, Virginia				Project 2236-101					Study Number: 223610G				
				INDIVIDUAL HISTOPATHOLOGY FINDINGS									
SD: 11	Sex: Male	Dose-Group: 1	Group:	1	1	1	1	1	1	1	1	1	1
Table Includes:				0	0	0	0	0	0	0	0	0	0
Sex = All; Group = All; Screen = All; Weeks = All				4	4	4	4	4	4	4	4	4	4
Death = All; Find = All; Subset = All				5	5	5	5	5	5	5	5	5	5
				5	5	5	5	5	5	5	5	5	5
Organ and Finding Description				0	0	0	0	0	0	0	0	0	0
				1	2	3	4	5	5	5	5	5	5
Top of List				Codes:	TH	T	T	T	T	T	T	T	T
Lung (LU)													
Perivascular/Peribronchial Lymphoid Hyperplasia					1	1	—	1	1	1	1	1	1
Pigmented Macrophages					—	—	—	—	—	—	—	—	—
Perivascular Edema					—	—	—	—	—	—	—	—	—
Congestion					—	—	—	—	—	—	—	—	—
Pneumonitis					—	—	—	—	—	—	—	—	—
End of List													

(Continued)

Appendix 9 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.		Path/Tox System Output				Printed: 09-Feb-84			
Department of Pathology		Acute Inhalation Toxicity of Welding Fumes							
Vienna, Virginia		Project 2236-101							
		INDIVIDUAL HISTOPATHOLOGY FINDINGS				Study Number: 223610G			
SD: 12	Sex: Male	Dose-Group: 2	Group:	2	2	2	2	2	
				0	0	0	0	0	
Table Includes:				4	4	4	4	4	
Sex = All; Group = All; Screen = All; Weeks = All				5	5	5	5	5	
Death = All; Find = All; Subset = All				5	5	5	5	5	
				0	0	0	0	1	
Organ and Finding Description				6	7	8	9	0	
Top of List		Codes:	T	T	T	T	T	T	
Lung (LU)									
Perivascular/Peribronchial Lymphoid Hyperplasia			1	1	1	—	—	—	
Pigmented Macrophages			1	—	1	2	1	—	
Perivascular Edema			—	—	—	—	—	—	
Congestion			—	—	—	—	—	—	
Pneumonitis			—	—	—	—	—	—	
End of List									

Hazleton Laboratories America, Inc.				Path/Tox System Output								Printed: 23-May-84			
Department of Pathology				Toxicity Study of Welding Fumes											
Vienna, Virginia				INDIVIDUAL HISTOPATHOLOGY FINDINGS								Study Number: 223610A			
SD: 21	Sex: Female	Dose-Group: 1	Group:	1	1	1	1	1	1	1	1	1	1	1	1
				0	0	0	0	0	0	0	0	0	0	0	0
Table Includes:				4	4	4	4	4	4	4	4	4	4	4	4
Sex = All; Group = All; Screen = All; Weeks = All				7	7	5	5	5	5	5	5	5	5	5	5
Death = All; Find = All; Subset = All				3	3	8	8	8	8	8	8	8	8	8	8
				0	0	0	0	0	0	0	0	0	1	1	1
Organ and Finding Description				1	2	3	4	5	6	7	8	9	0	1	2
Top of List				Codes:	T	T	T	T	T	T	T	T	T	T	T
Lung (LU)															
Alveolar Macrophages					—	—	—	—	—	(2)	(2)	—	—	—	—
Pigmented Macrophages					—	—	—	—	—	—	—	—	—	—	—
Perivascular/Peribronchial Lymphoid Hyperplasia					—	—	1	—	—	—	—	—	—	—	—
Pneumonitis					—	—	—	—	—	—	—	—	—	—	—
Congestion					—	—	—	—	—	—	—	—	—	—	—
Perivascular Edema					—	—	—	—	—	—	—	—	—	—	—
Alveolar Edema					—	—	—	—	—	—	—	—	—	—	—
Fibrinous Pneumonia					—	—	—	—	—	—	—	—	—	—	—
Hemorrhage					—	—	—	—	—	—	—	—	—	—	—
Seropurulent Pneumonia					—	—	—	—	—	—	—	—	—	—	—
End of List															

Appendix 9 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL HISTOPATHOLOGY FINDINGS

Printed: 23-May-84

Study Number: 223610E

SD: 22 Sex: Female Dose-Group: 2 Group:	2	2	2	2	2
Table Includes:	0	0	0	0	0
Sex = All; Group = All; Screen = All; Weeks = All	4	4	4	4	4
Death = All; Find = All; Subset = All	7	7	7	7	7
	3	3	3	3	3
	0	0	0	0	0
Organ and Finding Description	3	4	5	6	7
Top of List	Codes:	T	T	T	T
Lung (LU)					
Alveolar Macrophages	—	1	(1	—	—
Pigmented Macrophages	—	1	—	—	—
Perivascular/Peribronchial Lymphoid Hyperplasia	—	—	—	—	—
Pneumonitis	—	—	—	—	—
Congestion	—	—	—	—	—
Perivascular Edema	—	—	—	—	—
Alveolar Edema	—	—	—	—	—
Fibrinous Pneumonia	—	—	—	—	—
Hemorrhage	—	—	—	—	—
Seropurulent Pneumonia	—	—	—	—	—
End of List					

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL HISTOPATHOLOGY FINDINGS

Printed: 23-May-84

Study Number: 223610A

SD: 23 to 25 Sex: Female Dose-Group: 3 to 5 Group:	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5
Table Includes:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sex = All; Group = 3, 4, 5; Screen = All;	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Weeks = All Death = All; Find = All;	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Subset = All	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Organ and Finding Description	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3
	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2
Top of List	Codes:	TH	T	T	T	T	DH	D	DH	DH	DH	T	T	T	T
Lung (LU)		H					H		H	H	H				
Alveolar Macrophages	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Pigmented Macrophages	2	2	2	2	1	—	2	1	—	—	1	1	—	1	1
Perivascular/Peribronchial Lymphoid Hyperplasia	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Pneumonitis	(1)	—	—	—	—	(2)	]2[	—	(1	2	—	—	—	—	—
Congestion	—	—	—	—	—	P	P	P	P	P	—	—	—	—	—
Perivascular Edema	—	—	—	—	—	(2	(2	3	3	3	—	—	—	—	—
Alveolar Edema	—	—	—	—	—	(2	(3	3	1	1	—	—	—	—	—
Fibrinous Pneumonia	—	—	—	—	—	—	—	(3	—	—	—	—	—	—	—
Hemorrhage	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Seropurulent Pneumonia	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
End of List															

(Continued)

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PIN	HAN	SDS	ABR	Tissue	Special Histopathological Comment
045818	256012	231	LU	Lung	Acute Pneumonitis in a Localized Area
045823	256017	241	LU	Lung	Pneumonitis Consisted of a Localized Area of Acute Neutrophil Exudation
045825	256019	241	LU	Lung	Acute Fibrinous Pneumonia Involved the Bronchi, but was Primarily an Alveolar Lesion
045826	256020	241	LU	Lung	Pneumonitis Consisted of Acute Neutrophil Exudation with a Small Macrophage Population
045827	256021	241	LU	Lung	Pneumonitis Consisted of a Multifocal Acute Exudation of Neutrophils

Appendix 9 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.
Department of Pathology
Vienna, Virginia

Path/Tox System Output
Toxicity Study of Welding Fumes
INDIVIDUAL HISTOPATHOLOGY FINDINGS

Printed: 23-May-84

Study Number: 223610A

SD: 26 to 27	Sex: Female	Dose-Group: 6 to 7	Group:	6	6	6	6	6	7	7	7	7	7
Table Includes:				0	0	0	0	0	0	0	0	0	0
Sex = All; Group = 6, 7; Screen = All; Weeks = All				4	4	4	4	4	4	4	4	4	4
Death = All; Find = All; Subset = All				5	5	5	5	5	5	5	5	5	5
				8	8	8	8	8	8	8	8	8	8
				3	3	3	3	3	3	4	4	4	4
Organ and Finding Description				3	4	5	6	7	8	9	0	1	2
Top of List				Codes:	T	T	T	T	T	T	T	T	T
Lung (LU)													
Alveolar Macrophages					—	—	—	—	—	—	—	—	—
Pigmented Macrophages					3	1	2	1	2	2	3	2	2
Perivascular/Peribronchial Lymphoid Hyperplasia					—	—	—	—	—	—	—	—	—
Pneumonitis					—	—	—	—	—	—	—	—	—
Congestion					—	—	—	—	—	—	—	—	—
Perivascular Edema					—	—	—	—	—	—	—	—	—
Alveolar Edema					—	—	—	—	—	—	—	—	—
Fibrinous Pneumonia					—	—	—	—	—	—	—	—	—
Hemorrhage					—	—	—	—	—	—	—	—	—
Seropurulent Pneumonia					—	—	—	—	—	—	—	—	—
End of List													

Appendix 9 (Continued)

2236-100/101

Hazleton Laboratories America, Inc.		Path/Tox System Output		Acute Inhalation Toxicity of Welding Fumes		Printed: 09-Feb-84	
Department of Pathology				Project 2236-101			
Vienna, Virginia		INDIVIDUAL HISTOPATHOLOGY FINDINGS		Study Number: 223610G			
SD: 21	Sex: Female	Dose-Group: 1	Group:	1	1	1	1
Table Includes:				0	0	0	0
Sex = All; Group = All; Screen = All; Weeks = All				4	4	4	4
Death = All; Find = All; Subset = All				5	5	5	5
				5	5	5	5
				5	5	5	5
Organ and Finding Description				1	2	3	4
							5
Top of List				T	T	T	T
Lung (LU)							
Perivascular/Peribronchial Lymphoid Hyperplasia				—	1	—	1
Pigmented Macrophages				—	—	—	—
Perivascular Edema				—	—	—	—
Congestion				—	—	—	—
Pneumonitis				—	—	—	—
End of List							

Hazleton Laboratories America, Inc.		Path/Tox System Output		Acute Inhalation Toxicity of Welding Fumes		Printed: 09-Feb-84	
Department of Pathology				Project 2236-101			
Vienna, Virginia		INDIVIDUAL HISTOPATHOLOGY FINDINGS		Study Number: 223610G			
SD: 22	Sex: Female	Dose-Group: 2	Group:	2	2	2	2
Table Includes:				0	0	0	0
Sex = All; Group = All; Screen = All; Weeks = All				4	4	4	4
Death = All; Find = All; Subset = All				5	5	5	5
				5	5	5	5
				5	5	5	6
Organ and Finding Description				6	7	8	9
							0
Top of List				T	T	T	DH
Lung (LU)							H
Perivascular/Peribronchial Lymphoid Hyperplasia				—	—	1	2
Pigmented Macrophages				1	1	1	2
Perivascular Edema				—	—	(2)	(3
Congestion				—	—	—	P
Pneumonitis				—	—	—	13[
End of List							

PIN	HAN	SDS	ABR	Tissue	Special Histopathological Comment
045559	258034	221	LU	Lung	Acute Pneumonitis

Key to Appendices 10-12

NR = No Result
 NC = No Culture
 TE = Technical Error
 ND = No Data
 TT = Too Turbid to Read

$$\text{Mean Viability Index} = \frac{\text{Mean \% Viable Experimental Cells}}{\text{Mean \% Viable Control Cells}}$$

Appendix 10A					2236-100/101
Body Weights of Animals, Cell Recovery and Percentage Macrophages in RAM Preparations Toxicity Study of Welding Fumes in Rats Control					
Fume	Animal Number	Sex	Body Weight (g)	Cell Recovery ($\times 10^6$)	% Macrophages
E70S-3	No Tag	M	247.5	1.17	94.5
	45646	M	258.7	1.49	95.9
E7018	45649	M	280.5	3.36	90.9
	45650	M	283.0	5.72	93.1
E6010	45651	M	276.5	4.36	98.6
	45652	M	268.7	4.56	96.3
E70T-1	45653	M	290.4	a	a
	45654	M	266.0	a	a
E5356	47208	M	299.6	3.12	91.2
	47209	M	300.5	3.12	96.3
Mean $\pm$ S.D.			277.14 $\pm$ 17.275		
E70S-3	45845	F	187.9	1.08	95.4
	45846	F	183.0	0.51	95.9
E7018	45849	F	197.3	4.3	91.2
	45850	F	201.1	4.4	87.9
E6010	45851	F	169.0	2.66	100
	45852	F	184.7	2.84	93.7
E70T-1	45853	F	204.5	a	a
	45854	F	190.5	a	a
E5356	47308	F	194.8	2.64	100
	47309	F	200.8	3.88	100
Mean $\pm$ S.D.			191.36 $\pm$ 10.701		

a. Bloody prep.

Appendix 10B
Body Weights of Animals, Cell Recovery and
Percentage Macrophages in RAM Preparations
Toxicity Study of Welding Fumes in Rats
Fume E70S-3

2236-100/101

Animal Number	Sex	Body Weight (g)	Cell Recovery ($\times 10^6$)	% Macrophages
45660	M	254.6	1.26	100
45661	M	253.8	1.56	100
45662	M	253.7	1.05	92.7
45663	M	259.8	0.51	100
45664	M	231.3	1.05	98.2
Mean $\pm$ S.D.		250.64 $\pm$ 11.101		
45860	F	185.0	0.71	87.9
45861	F	175.0	0.91	97.0
45862	F	184.3	1.32	88.1
45863	F	187.2	1.04	96.6
45864	F	182.5	0.96	73.4
Mean $\pm$ S.D.		182.80 $\pm$ 4.674		

Appendix 10C
Body Weights of Animals, Cell Recovery and
Percentage Macrophages in RAM Preparations
Toxicity Study of Welding Fumes in Rats
Fume E308-16

2236-100/101

Animal Number	Sex	Body Weight (g)	Cell Recovery ($\times 10^6$)	% Macrophages
45516	M	249.0	a	
45517	M	239.8	a	
45518	M	258.9	a	
45519	M	246.7	a	
45520	M	254.1	a	
Mean $\pm$ S.D.		249.70 $\pm$ 7.272		
45566	F	184.9	a	
45567	F	189.8	a	
45568	F	177.4	a	
45569	F	188.0	a	
45570	F	180.8	a	
Mean $\pm$ S.D.		184.18 $\pm$ 5.101		

a. Bloody prep.

2236-100/101

Appendix 10D
Body Weights of Animals, Cell Recovery and
Percentage Macrophages in RAM Preparations
Toxicity Study of Welding Fumes in Rats
Fume E7018

Animal Number	Sex	Body Weight (g)	Cell Recovery ($\times 10^6$)	% Macrophages ^b
45670	M	257.0	a	91
45671	M	273.2	a	100
45672	M	278.8	0	93
45674	M	266.9	0.4	7
No Tag	M	279.2	0.25	100
Mean $\pm$ S.D.		271.02 $\pm$ 9.297		
45870	F	184.6	0.08	10
45871	F	185.7	0.10	20
45872	F	178.0	0.20	91
45873	F	193.0	0.24	44
45874	F	182.5	0.34	2
Mean $\pm$ S.D.		184.76 $\pm$ 5.468		

a. Bloody prep.

b. All macrophages appeared dead.

2236-100/101

Appendix 10E
Body Weights of Animals, Cell Recovery and
Percentage Macrophages in RAM Preparations
Toxicity Study of Welding Fumes in Rats
Fume E6010

Animal Number	Sex	Body Weight (g)	Cell Recovery ($\times 10^6$)	% Macrophages
45675	M	270.9	0.80	18.9
45676	M	254.2	a	ND
45677	M	250.9	1.08	30
45679	M	264.0	0.68	0
No Tag	M	251.7	a	ND
Mean $\pm$ S.D.		258.34 $\pm$ 8.752		
45875	F	169.4	0.44	ND
45876	F	164.5	0.20	ND
45877	F	172.3	a	ND
45878	F	173.1	0.56	32.1
45879	F	184.7	0.08	ND
Mean $\pm$ S.D.		172.80 $\pm$ 7.457		

a. Bloody prep.

Appendix 10F
Body Weights of Animals, Cell Recovery and
Percentage Macrophages in RAM Preparations
Toxicity Study of Welding Fumes in Rats
Fume E70T-1

2236-100/101

Animal Number	Sex	Body Weight (g)	Cell Recovery ($\times 10^6$)	% Macrophages
45680	M	261.0	0.52	76.8
45681	M	261.6	1.50	91.5
45682	M	260.7	0.96	92.6
45683	M	272.1	1.38	82.4
45684	M	266.1	1.86	82.3
Mean $\pm$ S.D.		264.30 $\pm$ 4.879		
45880	F	189.7	0.60	89.7
45881	F	180.7	2.2	91.4
45882	F	197.9	a	a
45883	F	202.2	1.52	82.8
45884	F	195.7	1.64	85
Mean $\pm$ S.D.		193.24 $\pm$ 8.334		

a. Bloody prep.

Appendix 10G
Body Weights of Animals, Cell Recovery and
Percentage Macrophages in RAM Preparations
Toxicity Study of Welding Fumes in Rats
Fume E5356

2236-100/101

Animal Number	Sex	Body Weight (g)	Cell Recovery ($\times 10^6$)	% Macrophages
47210	M	290.8	1.32	98.1
47211	M	285.3	a	ND
47212	M	309.1	1.00	97.1
47213	M	294.1	1.56	96.2
47214	M	302.0	b	ND
Mean $\pm$ S.D.		296.26 $\pm$ 9.386		
47310	F	200.2	2.56	100
47311	F	199.7	1.32	82.4
47313	F	179.9	0.88	100
47314	F	195.8	1.48	100
No Tag	F	186.7	1.56	94.3
Mean $\pm$ S.D.		192.46 $\pm$ 8.866		

a. Bloody prep.

b. Too few cells.

Appendix 11A
Viability Determinations in RAM Cultures
Toxicity Study of Welding Fumes in Rats
Controls

2236-100/101

Fume	Animal Number	Sex	Relative No. of Live Cells	% Viable	% Phagocytosis
E70S-3	No Tag	M	132	94.3	66.7
	45646	M	73.3	90.6	73.7
E7018	45649	M	137.7	92.9	38.4
	45650	M	98.7	95.3	55.2
E6010	45651	M	105	95.2	51.1
	45652	M	82.7	93.6	63.5
E70T-1	45653	M	a	a	a
	45654	M	a	a	a
E5356	47208	M	72.7	96.9	60.3
	47209	M	97.7	95.8	45.8
E70S-3	45845	F	128	93.9	57.5
	45846	F	13	13.5	69
E7018	45849	F	13.3	94.3	42.2
	45850	F	114.7	85.3 ^a	44.5
E6010	45851	F	83	90.7	59.2
	45852	F	152	95.6	80.3
E70T-1	45853	F	a	a	a
	45854	F	a	a	a
E5356	47308	F	133.5	94.7	83.3
	47309	F	129.3	94.9	52.0

a. Bloody prep.

Appendix 11B
Viability Determinations in RAM Cultures
Toxicity Study of Welding Fumes in Rats
Fume E70S-3

2236-100/101

Animal Number	Sex	Relative No. of Live Cells	% Viable	% Phagocytosis
45660	M	84	94.4	7.2
45661	M	83	97.6	5
45662	M	133	95.7	16.5
45663	M	132	85.2	9.8
45664	M	112	95.2	3.0
45860	F	151	88.8	3.7
45861	F	160	87.0	2.4
45862	F	58	77.9	11.3
45863	F	124	86.5	7.5
45864	F	147	92.5	18.6

Appendix 11C
Viability Determinations in RAM Cultures
Toxicity Study of Welding Fumes in Rats
Fume E308-16

2236-100/101

All Cell Samples Discarded Due to Bloody Preparations

Appendix 11D
Viability Determinations in RAM Cultures
Toxicity Study of Welding Fumes in Rats
Fume E7018

2236-100/101

Animal Number	Sex	Relative No. of Live Cells	% Viable	% Phagocytosis
45670	M	a	a	a
45671	M	a	a	a
45672	M	b	b	b
45674	M	b	b	b
No Tag	M	b	b	b
45870	F	b	b	b
45871	F	b	b	b
45872	F	b	b	b
45873	F	b	b	b
45874	F	b	b	b

a. Bloody prep.

b. Too few cells.

Appendix 11E
Viability Determinations in RAM Cultures
Toxicity Study of Welding Fumes in Rats
Fume E6010

2236-100/101

Animal Number	Sex	Relative No. of Live Cells	% Viable	% Phagocytosis
45675	M	106	98.1	0.05
45676	M	a	a	a
45677	M	119	97.5	33.2
45679	M	81	93.1	1.5
No Tag	M	a	a	a
45875	F	b	b	b
45876	F	b	b	b
45877	F	a	a	a
45878	F	66	93.0	10.9
45879	F	b	b	b

a. Bloody prep.

b. Too few cells.

Appendix 11F
Viability Determinations in RAM Cultures
Toxicity Study of Welding Fumes in Rats
Fume E70T-1

2236-100/101

Animal Number	Sex	Relative No. of Live Cells	% Viable	% Phagocytosis
45680	M	89	89.0	0.6
45681	M	104	92.0	1.5
45682	M	79	89.8	b
45683	M	121	95.3	0
45684	M	107	94.3	0
45880	F	60	95.2	1
45881	F	86.5	84.8	0
45882	F	a	a	a
45883	F	155	92.8	
45884	F	137	95.8	3.7

a. Bloody prep.

Appendix 11G
Viability Determinations in RAM Cultures
Toxicity Study of Welding Fumes in Rats
Fume E5356

2236-100/101

Animal Number	Sex	Relative No. of Live Cells	% Viable	% Phagocytosis
47210	M	180	100	67
47211	M	a	a	a
47212	M	176	97.8	63.6
47213	M	149	95.5	67.3
47214	M	b	b	b
47310	F	77	96.4	82.5
47311	F	81.5	96.0	88.7
47313	F	142	92.8	39.6
47314	F	109	89.3	84.2
No Tag	F	78	97.5	29.3

a. Bloody prep.

b. Too few cells.

Appendix 12A
Cellular Enzyme Analysis of RAM Cultures
Toxicity Study of Welding Fumes in Rats
Controls

2236-100/101

Fume	Animal Number	Sex	ATP (g/ml $\times 10^{-8}$)	AP $\mu\text{g/ml}$	Lysozyme $\mu\text{g/ml}$
E70S-3	No Tag	M	11.5, 12.3, 16.1	6.7, 4.0, 5.7	90, 90, 107
	45646	M	10.0, 7.3, 11.8	1.9, 2.4, 3.2	35, 107
E7018	45649	M	12.0, 7.4, 10.6	2.2, 1.8, 1.8	0, 30, 0
	45650	M	16.0, 11.3, 10.7	2.2, 2.2, 2.2	0, 0, 0
E6010	45651	M	53.6, 30.3, 41.5	2.4, 2.5, 2.4	50, 50
	45652	M	40.6, 33.7, 54.7	2.5, 1.7, 1.8	72.5, 25
E70T-1	45653	M	a	a	a
	45654	M	a	a	a
E5356	47208	M	25.3, 28.8, 19.4	3.4, 3.0, 3.0	14, 2.5, 5.0
	47209	M	25.3, 20.2, 21.6	4.8, 4.6, 4.7	23, 10, 17
E70S-3	45845	F	14.5, 15.3, 16.5	5.3, 6.2, 4.7	17.5, 52.5, 72.5
	45846	F	TE	17.5	3.7
E7018	45849	F	16.0, 13.9, 14.3	1.8, 1.6, 2.0	15, 30, 30
	45850	F	15.7, 16.7, 28.6	1.6, 1.6, 1.8	30, 30, 30
E6010	45851	F	20.3, 30.2	2.0, 2.1	72.5, 0
	45852	F	42.4, 15.2	3.9, 3.2	0
E70T-01	45853	F	a	a	a
	45854	F	a	a	a
E5356	47308	F	22.4, 18.5	6.4, 5.5	10, 7.5
	47309	F	25.5, 18.2, 20.6	7.2, 7.8, 6.9	17, 10, 5

a. Bloody prep.

Appendix 12B
Cellular Enzyme Analysis of RAM Cultures
Toxicity Study of Welding Fumes in Rats
E70S-3

2236-100/101

Animal Number	Sex	ATP (g/ml $\times 10^{-8}$)	AP $\mu\text{g/ml}$	Lysozyme $\mu\text{g/ml}$
45660	M	15.0, 15.6, 12.3	3.5, 5.8, 6.1	72.5, 17.5, 35
45661	M	8.3, 9.4	4.7, 7.8	35, 52.5
45662	M	20.6, 17.5, 12.5	8.5, 12.9, 9.2	35, 90, 90
45663	M	5.7	25.4	267.5
45664	M	19.5, 11.0, 14.8	11.5, 7.8, 8.9	35, 0, 0
45860	F	11.8	13.1	52.5
45861	F	16.6	11.6	17.5
45862	F	9.1, 11.0	4.5, 4.4	72.5, 17.5
45863	F	11.7, 9.5, 6.7	9.8, 7.9, 10.5	35, 0
45864	F	17.5	11.3	a

a. Discarded — poor viability.

Appendix 12C
Cellular Enzyme Analysis of RAM Cultures
Toxicity Study of Welding Fumes in Rats
E308-16

2236-100/101

All Cell Samples Discarded Due to Bloody Preparations

Appendix 12D
Cellular Enzyme Analysis of RAM Cultures
Toxicity Study of Welding Fumes in Rats
Fume E7018

2236-100/101

Animal Number	Sex	ATP (g/ml $\times 10^{-8}$)	AP μ g/ml	Lysozyme μ g/ml
45670	M	b	b	b
45671	M	b	b	b
45672	M	b	b	b
45674	M	b	b	b
No Tag	M	b	b	b
45870	F	a	a	a
45871	F	a	a	a
45872	F	c	c	c
45873	F	b	b	b
45874	F	b	b	b

- a. Bloody prep.
b. Too few cells.
c. Discarded — poor viability.

Appendix 12E
Cellular Enzyme Analysis of RAM Cultures
Toxicity Study of Welding Fumes in Rats
Fume E6010

2236-100/101

Animal Number	Sex	ATP (g/ml $\times 10^{-8}$)	AP μ g/ml	Lysozyme μ g/ml
45675	M	18.3	b	b
45676	M	a	a	a
45677	M	12.2	b	b
45679	M	9.5	b	b
No Tag	M	a	a	a
45875	F	b	b	b
45876	F	b	b	b
45877	F	a	a	a
45878	F	11.0	b	b
45879	F	b	b	b

- a. Bloody prep.
b. Too few cells.

Appendix 12F
Cellular Enzyme Analysis of RAM Cultures
Toxicity Study of Welding Fumes in Rats
Fume E70T-1

2236-100/101

Animal Number	Sex	ATP (g/ml $\times 10^{-8}$)	AP $\mu\text{g/ml}$	Lysozyme $\mu\text{g/ml}$
45680	M	6.3	TT	TT
45681	M	7.2	TT	TT
45682	M	2.7	TT	TT
45683	M	7.4	TT	TT
45684	M	7.7	TT	TT
45880	F	9.7	TT	TT
45881	F	10.6	TT	TT
45882	F	a	a	a
45883	F	8.2	TT	TT
45884	F	8.4	TT	TT

a. Bloody prep.

Appendix 12G
Cellular Enzyme Analysis of RAM Cultures
Toxicity Study of Welding Fumes in Rats
Fume E5356

2236-100/101

Animal Number	Sex	ATP (g/ml $\times 10^{-8}$)	AP $\mu\text{g/ml}$	Lysozyme $\mu\text{g/ml}$
47210	M	13.3	b	b
47211	M	a	a	a
47212	M	14.0	b	b
47213	M	15.7	b	b
47214	M	b	b	b
47310	F	10.4, 10.6	5.1, 5.3	7.5, 5.0
47311	F	15.2	b	b
47313	F	12.2	b	b
47314	F	11.5	b	b
No Tag	F	11.1	b	b

a. Bloody prep.

b. Too few cells.

Appendix 13
Individual Animal Data
***In Vivo* Bone Marrow Chromosome Study with Welding Fumes**
Toxicity Study of Welding Fumes in Rats

2236-100/101

Animal Number	Number of Cells Analyzed	Number of Aberrant Cells	Number of Total Aberrations	Chromatid Gaps ^a	Chromosome Gaps ^a	Chromatid Breaks	Chromosome Breaks	Exchanges	Greater than 10 Aberrations	Mean Modal Numbers	Mitotic Index
GROUP C — FUME E356 — 2236-100											
47215M	50	0	0	0	0	0	0	0	0	41.90	3.6
47216M	50	0	0	0	0	0	0	0	0	41.30	4.0
47217M	50	0	0	0	0	0	0	0	0	41.84	4.4
47218M	50	0	0	0	0	0	0	0	0	41.30	1.2
47219M	50	0	0	0	0	0	0	0	0	41.70	2.8
47315F	50	1	1	0	0	1	0	0	0	41.24	2.4
47316F	50	0	0	0	0	0	0	0	0	41.58	1.8
47317F	50	0	0	0	0	0	0	0	0	41.00	0.4
47318F	50	1	1	1	0	1	0	0	0	41.96	4.8
47319F	50	0	0	1	0	0	0	0	0	41.16	3.4
Total	500	2	2	2	0	2	0	0	0	—	—
GROUP C — FUME E70S-3 — 2236-100											
45690M	50	0	0	0	0	0	0	0	0	41.82	0.8
45691M	50	0	0	0	0	0	0	0	0	41.56	1.2
45692M	0	—	—	—	—	—	—	—	—	—	0
45693M	50	0	0	0	0	0	0	0	0	41.72	0.8
45694M	50	0	0	0	0	0	0	0	0	41.70	0.6
45890F	50	0	0	3	0	0	0	0	0	41.86	1.0
45891F	50	0	0	0	0	0	0	0	0	41.68	1.4
45892F	50	0	1	1	0	0	0	0	0	41.74	2.0
45893F	50	0	0	1	0	0	0	0	0	41.64	0.8
45894F	50	0	0	0	0	0	0	0	0	41.72	1.0
Total	450	0	0	5	0	0	0	0	0	—	—

a. Chromatid and chromosome gaps are not counted as aberrations.

Appendix 13 (Continued)

2236-100/101

Animal Number	Number of Cells Analyzed	Number of Aberrant Cells	Number of Total Aberrations	Chromatid Gaps ^a	Chromosome Gaps ^a	Chromatid Breaks	Chromosome Breaks	Exchanges	Greater than 10 Aberrations	Mean Modal Numbers	Mitotic Index
GROUP C — FUME E70T-1 — 2236-100											
45710M	50	0	0	3	0	0	0	0	0	41.30	0.6
45711M	50	0	0	0	0	0	0	0	0	41.40	3.6
45712M	50	0	0	0	0	0	0	0	0	41.36	3.2
45713M	50	1	1	1	0	1	0	0	0	41.48	4.8
45714M	50	0	0	0	0	0	0	0	0	41.50	3.2
45910F	50	0	0	0	0	0	0	0	0	41.30	3.4
45911F	50	0	0	0	0	0	0	0	0	41.36	2.0
45912F	50	0	0	1	0	0	0	0	0	41.42	3.2
45913F	50	0	0	0	0	0	0	0	0	41.26	4.4
45914F	50	0	0	0	0	0	0	0	0	41.38	4.2
Total	500	1	1	5	0	1	0	0	0	—	—

GROUP C — FUME E6010 — 2236-100											
45705M	50	0	0	0	0	0	0	0	0	41.66	1.0
45706M	50	2	2	0	0	2	0	0	0	41.52	0.2
45707M	50	1	1	0	0	1	0	0	0	41.82	0.8
45708M	50	0	0	0	0	0	0	0	0	41.58	6.0
45709M	50	0	0	0	0	0	0	0	0	41.68	0.2
45905F	34	0	0	0	0	0	0	0	0	41.53	0.8
45906F	50	0	0	0	0	0	0	0	0	41.68	4.0
45907F	50	0	0	0	0	0	0	0	0	41.52	2.0
45908F	50	1	1	0	0	1	0	0	0	41.68	3.0
45909F	50	0	0	0	0	0	0	0	0	41.58	5.0
Total	484	4	4	0	0	4	0	0	0	—	—

a. Chromatid and chromosome gaps are not counted as aberrations.

(Continued)

Appendix 13 (Continued)

2236-100/101

Animal Number	Number of Cells Analyzed	Number of Aberrant Cells	Number of Total Aberrations	Chromatid Gaps ^a	Chromosome Gaps ^a	Chromatid Breaks	Chromosome Breaks	Exchanges	Greater than 10 Aberrations	Mean Modal Numbers	Mitotic Index
GROUP C — FUME E7018 — 2236-100											
45700M	50	2	2	1	0	2	0	0	0	41.78	3.4
45701M	50	2	2	1	0	2	0	0	0	41.82	4.2
45702M	50	0	0	1	0	0	0	0	0	41.76	2.0
45703M	50	0	0	1	0	0	0	0	0	41.82	2.0
45704M	50	1	1	0	0	1	0	0	0	41.84	1.6
45900F	50	0	0	1	0	0	0	0	0	41.80	2.6
45901F	50	1	1	2	0	1	0	0	0	41.78	1.4
45902F	50	1	1	3	0	1	0	0	0	41.86	1.4
45903F	50	0	0	0	0	0	0	0	0	41.80	1.6
45904F	50	1	1	0	0	1	0	0	0	41.82	0.4
Total	500	8	8	10	0	8	0	0	0	—	—
GROUP C — FUME E308-16 — 2236-101											
45521M	50	0	0	0	0	0	0	0	0	41.60	4.0
45522M	50	1	1	0	0	1	0	0	0	41.66	4.0
45523M	50	1	1	0	0	1	0	0	0	41.56	4.0
45524M	50	1	1	0	0	1	0	0	0	41.70	5.0
45525M	50	1	1	0	0	1	0	0	0	41.62	4.0
45571F	50	0	0	0	0	0	0	0	0	41.60	4.0
45572F	50	0	0	0	0	0	0	0	0	41.58	5.0
45573F	50	0	0	0	0	0	0	0	0	41.56	3.0
45574F	50	2	2	0	0	2	0	0	0	41.68	6.0
45575F	50	0	0	0	0	0	0	0	0	—	—
Total	450	5	5	0	0	5	0	0	0	—	—

a. Chromatid and chromosome gaps are not counted as aberrations.

Appendix 13 (Continued) 2236-100/101

Animal Number	Number of Cells Analyzed	Number of Aberrant Cells	Number of Total Aberrations	Chromatid Gaps ^a	Chromosome Gaps ^a	Chromatid Breaks	Chromosome Breaks	Exchanges	Greater than 10 Aberrations	Mean Modal Numbers	Mitotic Index
GROUP D — FUME E5356 — 2236-100											
47222M	50	0	0	1	0	0	0	0	0	41.42	3.8
47223M	50	0	0	1	0	0	0	0	0	41.86	4.2
47224M	50	0	0	0	0	0	0	0	0	41.28	3.2
47225M	50	0	0	2	0	0	0	0	0	41.32	4.6
47226M	50	0	0	1	0	0	0	0	0	41.32	1.8
47322F	50	0	0	0	0	0	0	0	0	41.86	5.6
47323F	50	0	0	1	0	0	0	0	0	41.34	4.6
47324F	50	0	0	1	0	0	0	0	0	41.64	2.2
47325F	50	0	0	2	0	0	0	0	0	41.20	0.6
47326F	50	0	0	0	0	0	0	0	0	41.74	5.2
Total	500	0	0	9	0	0	0	0	0	—	—
GROUP D — FUME E70S-3 — 2236-100											
45732M	50	0	0	3	0	0	0	0	0	41.40	1.0
45733M	50	0	0	0	0	0	0	0	0	41.86	1.4
45734M	50	0	0	0	0	0	0	0	0	41.72	0.6
45735M	50	0	0	2	0	0	0	0	0	41.88	1.6
45736M	50	0	0	0	0	0	0	0	0	41.82	1.6
45932F	0	—	—	—	—	—	—	—	—	—	0.2
45933F	50	0	0	0	0	0	0	0	0	41.76	1.4
45934F	50	0	0	1	0	0	0	0	0	41.84	3.0
45935F	50	1	1	0	0	1	0	0	0	41.58	2.0
45936F	50	0	0	0	0	0	0	0	0	41.72	0.4
Total	450	1	1	6	0	1	0	0	0	—	—

a. Chromatid and chromosome gaps are not counted as aberrations.

(Continued)

Appendix 13 (Continued) 2236-100/101

Animal Number	Number of Cells Analyzed	Number of Aberrant Cells	Number of Total Aberrations	Chromatid Gaps ^a	Chromosome Gaps ^a	Chromatid Breaks	Chromosome Breaks	Exchanges	Greater than 10 Aberrations	Mean Modal Numbers	Mitotic Index
GROUP D — FUME E70T-1 — 2236-100											
45752M	50	0	0	0	0	0	0	0	0	41.36	2.8
45753M	50	0	0	2	0	0	0	0	0	41.56	3.8
45754M	50	0	0	1	0	0	0	0	0	41.40	5.0
45755M	50	0	0	1	0	0	0	0	0	41.46	2.2
45756M	50	1	1	3	0	1	0	0	0	41.50	4.0
45952F	50	0	0	1	0	0	0	0	0	41.40	4.2
45953F	50	0	0	0	0	0	0	0	0	41.34	5.4
45954F	50	0	0	0	0	0	0	0	0	41.44	1.6
45955F	50	0	0	1	0	0	0	0	0	41.50	3.8
45956F	50	0	0	0	0	0	0	0	0	41.48	4.6
Total	500	1	1	9	0	1	0	0	0	—	—
GROUP D — FUME E6010 — 2236-100											
45747M	25	0	0	0	0	0	0	0	0	41.48	0.2
45748M	50	0	0	0	0	0	0	0	0	41.80	0.6
45749M	0	—	—	—	—	—	—	—	—	—	0
45750M	50	1	1	1	0	1	0	0	0	41.50	1.0
45751M	50	0	0	0	0	0	0	0	0	41.70	0.6
45947F	50	0	0	0	0	0	0	0	0	41.56	3.0
45948F	50	0	0	0	0	0	0	0	0	41.64	4.0
45949F	50	0	0	0	0	0	0	0	0	41.80	1.2
45950F	50	1	1	0	0	1	0	0	0	41.50	0.4
45951F	50	1	1	1	0	1	0	0	0	41.72	0.2
Total	425	3	3	2	0	3	0	0	0	—	—

a. Chromatid and chromosome gaps are not counted as aberrations.

Appendix 13 (Continued)

2236-100/101

Animal Number	Number of Cells Analyzed	Number of Aberrant Cells	Number of Total Aberrations	Chromatid Gaps ^a	Chromosome Gaps ^a	Chromatid Breaks	Chromosome Breaks	Exchanges	Greater than 10 Aberrations	Mean Modal Numbers	Mitotic Index
GROUP D — FUME E7018 — 2236-100											
45742M	50	0	0	0	0	0	0	0	0	41.44	0.4
45743M	50	0	0	0	0	0	0	0	0	41.66	0.6
45744M	50	0	0	1	0	0	0	0	0	41.44	0.4
45745M	0	—	—	—	—	—	—	—	—	—	0
45746M	0	—	—	—	—	—	—	—	—	—	0
45942F	0	—	—	—	—	—	—	—	—	—	0
45943F	50	0	0	0	0	0	0	0	0	41.24	0.2
45944F	0	—	—	—	—	—	—	—	—	—	1.0
45945F	50	0	0	0	0	0	0	0	0	41.62	0.6
45946F	50	0	0	0	0	0	0	0	0	41.54	0.8
Total	300	0	0	1	0	0	0	0	0	—	—

GROUP D — FUME E308-16 — 2236-101											
45531M	50	1	1	0	0	1	0	0	0	41.62	5.0
45532M	50	3	3	1	0	3	0	0	0	41.62	5.0
45533M	50	0	0	0	0	0	0	0	0	41.58	2.0
45534M	50	0	0	0	0	0	0	0	0	41.62	5.0
45535M	50	0	0	0	0	0	0	0	0	41.56	3.0
45581F	50	0	0	0	0	0	0	0	0	41.62	4.0
45582F	50	0	0	0	0	0	0	0	0	41.62	4.0
45583F	50	0	0	0	0	0	0	0	0	41.60	3.0
45584F	50	0	0	0	0	0	0	0	0	41.64	1.0
45585F	50	0	0	0	0	0	0	0	0	41.66	0.2
Total	500	4	4	1	0	4	0	0	0	—	—

a. Chromatid and chromosome gaps are not counted as aberrations.

(Continued)

Appendix 13 (Continued)

2236-100/101

Animal Number	Number of Cells Analyzed	Number of Aberrant Cells	Number of Total Aberrations	GROUP CCD — MALES — 2236-100							Greater than 10 Aberrations	Mean Modal Numbers	Mitotic Index
				Chromatid Gaps ^a	Chromosome Gaps ^a	Chromatid Breaks	Chromosome Breaks	Exchanges	Chromosome Breaks	Exchanges			
47220M	50	3	5	4	0	4	0	1	0	0	0	41.34	3.6
47221M	50	0	0	0	0	0	0	0	0	0	0	41.46	5.6
45717M	50	0	0	0	0	0	0	0	0	0	0	41.82	1.0
45718M	50	0	0	0	0	0	0	0	0	0	0	41.78	0.6
45725M	50	0	0	1	0	0	0	0	0	0	0	41.50	2.2
45726M	50	1	1	0	0	1	0	0	0	0	0	41.32	4.8
45723M	50	0	0	0	0	0	0	0	0	0	0	41.62	0.2
45724M	50	0	0	0	0	0	0	0	0	0	0	41.64	4.0
45721M	50	0	0	0	0	0	0	0	0	0	0	41.34	0.2
47722M	0	—	—	—	—	—	—	—	—	—	—	—	0.2
Total	450	4	6	5	0	5	0	1	0	0	0	—	—
GROUP CCD — FEMALES — 2236-100													
47320F	50	0	0	2	0	0	0	0	0	0	0	41.18	3.4
47321F	50	0	0	0	0	0	0	0	0	0	0	41.76	5.6
45917F	50	0	0	0	0	0	0	0	0	0	0	41.82	1.8
45918F	50	0	0	0	0	0	0	0	0	0	0	41.60	7.0
45925F	50	0	0	1	0	0	0	0	0	0	0	41.42	2.8
45926F	50	0	0	2	0	0	0	0	0	0	0	41.38	2.0
45923F	50	0	0	0	0	0	0	0	0	0	0	41.52	4.0
45924F	38	0	0	0	0	0	0	0	0	0	0	41.50	0.2
47921F	0	—	—	—	—	—	—	—	—	—	—	—	0
45922F	50	0	0	0	0	0	0	0	0	0	0	41.46	0.6
Females	438	0	0	5	0	0	0	0	0	0	0	—	—
Males	450	4	6	5	0	5	0	1	0	0	0	—	—
Total	888	4	6	10	0	5	0	1	0	0	0	—	—

a. Chromatid and chromosome gaps are not counted as aberrations.

Appendix 13 (Continued)

2236-100/101

Animal Number	Number of Cells Analyzed	Number of Aberrant Cells	Number of Total Aberrations	Chromatid Gaps ^a	Chromosome Gaps ^a	Chromatid Breaks	Chromosome Breaks	Exchanges	Greater than 10 Aberrations	Mean Modal Numbers	Mitotic Index
GROUP CCD — FUME E08-16 ONLY — 2236-101											
45526M	50	0	0	0	0	0	0	0	0	41.66	2.0
45527M	50	0	0	0	0	0	0	0	0	41.56	3.0
45528M	50	1	1	0	0	1	0	0	0	41.58	4.0
45529M	50	0	0	0	0	0	0	0	0	41.70	4.0
45530M	50	0	0	0	0	0	0	0	0	41.60	4.0
45576F	50	0	0	0	0	0	0	0	0	41.62	2.0
45577F	0	—	—	—	—	—	—	—	—	—	0
45578F	50	0	0	0	0	0	0	0	0	41.60	4.0
45579F	50	0	0	0	0	0	0	0	0	41.66	4.0
45580F	50	0	0	0	0	0	0	0	0	41.54	3.0
Total	450	1	1	0	0	1	0	0	0	—	—

a. Chromatid and chromosome gaps are not counted as aberrations.

Appendix 14A
Temperature and Humidity Data
Toxicity Study of Welding Fumes in Rats
Fume E308-16 Range Finding

2236-100/101

Reading	Temperature (°F)							Humidity (%)						
	Hours							Hours						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
0.25 mg/L														
1	65	69	72	74	75	75	75	25	27	26	25	25	25	25
2	66	70	73	74	75	75	75	26	26	26	25	25	25	25
3	67	71	73	74	75	75		27	26	25	25	26	25	
4	68	72	74	74	75	75		27	27	26	25	25	25	
0.45 mg/L														
1	67	71	75	76	75	76	76	37	38	37	37	37	40	42
2	68	72	75	76	75	77	76	39	38	36	37	38	40	43
3	70	74	75	75	76	77		40	37	36	37	40	40	
4	71	75	75	75	76	77		38	37	36	37	40	41	

Appendix 14B
Hourly Test Atmospheric Concentrations
Toxicity Study of Welding Fumes in Rats
Fume E308-16 Range Finding

2236-100/101

Dosage Level	Exposure Hour						Mean	S.D.
	1	2	3	4	5	6		
% Oxygen								
0.25 mg/L	19.8	19.8	19.8	19.8	19.8	19.8	19.8	0.0
0.45 mg/L	19.8	19.8	19.89	19.8	19.7	19.7	19.8	0.05
ppm Nitrogen Oxide (NO + NO ₂)								
0.25 mg/L	5.0	10.0	8.0	7.5	7.5	8.0	7.7	1.60
0.45 mg/L	7.5	10	7.5	6.0	10	6.0	7.8	1.81
ppm Nitrogen Oxide (NO ₂)								
0.25 mg/L	0	0	0	0	0	0	0	0.0
0.45 mg/L	0	0	0	0	0	0	0	0.0
ppm Carbon Monoxide								
0.25 mg/L	61	60 ^a	35.4	27.5	39.5	44	44.6	13.49
0.45 mg/L	55 ^a	25	18	18.0	18	35		

a. Mean of two measurements taken within that hour exposure.

Appendix 14C
Gravimetric Concentrations (mg/L)
Toxicity Study of Welding Fumes in Rats
Fume E308-16 Range Finding

2236-100/101

Sample												Mean	S.D.
1	2	3	4	5	6	7	8	9	10	11	12		
<u>0.25 mg/L</u>													
0.161	0.217	0.353	0.181	0.299	0.209	0.265	0.103	0.423	0.239			0.245	0.0943
<u>0.45 mg/L</u>													
0.438	0.251	0.656	0.183	0.332	0.383	0.185	0.411	0.208	0.267	0.249	0.263	0.319	0.1364

Appendix 14D
Summary of Clinical Observations
Toxicity Study of Welding Fumes in Rats
Postexposure Period — Fume E308-16 Range Finding

2236-100/101

Observations	Exposure Off/ Removal from Chamber	Day Postexposure													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
MALES															
0.25 mg/L															
Number of animals observed	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Appeared normal	0	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Wart-like lesion on head	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Fur stained slightly brown	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.45 mg/L															
Number of animals observed	10	10	10	10	10	8	8	8	8	8	8	8	8	8	8
Appeared normal	0	9	10	10	8	7	7	7	7	7	7	7	7	7	7
Fur stained slightly brown	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wheezing	9	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Dyspnea	1	0	0	0	2	1	1	1	1	1	1	0	0	0	0
Bloody crust on the mouth	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Bloody crust on the nose	0	0	0	0	1	0	1	1	1	1	1	1	1	0	0
FEMALES															
0.25 mg/L															
Number of animals observed	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Appeared normal	0	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Fur stained slightly brown	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.45 mg/L															
Number of animals observed	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Appeared normal	0	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Fur stained slightly brown	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wheezing	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(Continued)

Appendix 14D (Continued)

2236-100/101

Observations	Time During Exposure (Hour)											
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
MALES AND FEMALES												
0.25 mg/L												
Number of animals observed	20	20	20	20	20	20	20	20	20	20	20	20
Appeared normal	19	19	19	19	19	19	19	19	19	19	19	19
Wart-like lesion on head	1	1	1	1	1	1	1	1	1	1	1	1
0.45 mg/L												
Number of animals observed	20	20	20	20	20	20	20	20	20	20	20	20
Appeared normal	20	20	b	b	b	b	b	b	b	b	b	b
Polypnea	0	0	a	a	a	a	a	a	a	0	0	0
Dyspnea	0	0	0	0	0	0	0	a	a	a	a	a

NOTE: Due to poor visibility in the chamber during exposure, the exact number of animals exhibiting clinical signs could not be determined at certain intervals. The following approximations were made at these intervals and are indicated in the table as follows:

- a. Indicates several of the animals that were visible showed the designated clinical sign.
- b. Indicates that remaining animals that were visible appeared normal.

Appendix 14E
Mean Body Weights and Standard Deviations (grams)
Toxicity Study of Welding Fumes in Rats
Fume E308-16 Range Finding

2236-100/101

Group		Pre-Exposure	Day Postexposure				Found Dead
		Day 1	Day 1	Day 7	Day 13	Day 14	
MALES							
0.25 mg/L	Mean	286.3	286.6	305.2	347.4	318.0	—
	S.D.	10.46	10.21	10.94	16.84	15.56	—
	Mean	287.3	266.7	274.3	301.6	276.3	208.3
	S.D.	9.30	8.90	29.58	50.91	45.21	23.62
FEMALES							
0.45 mg/L	Mean	195.9	184.1	203.1	216.4	193.9	—
	S.D.	5.78	6.23	6.92	8.40	7.69	—
	Mean	190.0	178.5	193.2	205.4	183.6	—
	S.D.	7.47	7.09	10.64	8.66	8.53	—

Appendix 14F
Individual Body Weights with Means and Standard Deviations (grams)
Toxicity Study of Welding Fumes in Rats
Fume E308-16 Range Finding — 0.25 mg/L

2236-100/101

Animal Number	Pre-Exposure	Day Postexposure				Found Dead
	Day 1	Day 1	Day 7	Day 13	Day 14	
MALES						
47701	295	281	318	368	339	
47702	286	270	312	360	329	
47703	293	276	312	363	335	
47704	283	266	302	343	315	
47705	302	280	311	364	331	
47706	275	256	295	339	311	
47707	269	254	292	318	295	
47708	276	256	289	328	297	
47709	290	271	301	338	307	
47710	294	276	320	353	321	
Mean	286.3	268.6	305.2	347.4	318.0	
S.D.	10.46	10.21	10.94	16.84	15.56	
FEMALES						
47711	204	189	208	224	201	
47712	195	186	207	218	197	
47713	195	181	205	216	195	
47714	186	176	200	207	187	
47715	197	185	202	215	192	
47716	192	179	197	216	190	
47717	201	190	204	216	197	
47718	194	184	202	217	192	
47719	191	176	190	202	180	
47720	204	195	216	233	208	
Mean	195.9	184.1	203.1	216.4	193.9	
S.D.	5.78	6.23	6.92	8.40	7.69	

(Continued)

Appendix 14F (Continued)
Fume E308-16 Range Finding — 0.45 mg/L

2236-100/101

Animal Number	Pre-Exposure	Day Postexposure				Found Dead
	Day 1	Day 1	Day 7	Day 13	Day 14	
MALES						
47721	291	267	297	308	283	—
47722	272	253	—	—	—	191.6
47723	281	265	210	177	166	—
47724	295	276	265	320	289	—
47725	287	267	276	322	295	—
47726	287	261	280	320	288	—
47727	286	266	286	319	297	—
47728	286	264	—	—	—	225
47729	307	286	309	334	307	—
47730	281	262	271	313	285	—
Mean	287.3	266.7	274.3	301.6	276.3	208.3
S.D.	9.30	8.90	29.58	50.91	45.21	23.62
FEMALES						
47731	189	178	194	205	184	—
47732	194	181	196	204	183	—
47733	184	174	195	208	189	—
47734	179	166	176	191	168	—
47735	193	181	197	213	192	—
47736	200	187	202	212	188	—
47737	198	186	200	209	189	—
47738	181	170	172	191	170	—
47739	185	176	196	204	181	—
47740	197	186	204	217	192	—
Mean	190.0	178.5	193.2	205.4	183.6	—
S.D.	7.47	7.09	10.64	8.66	8.53	—

Appendix 15

References

Toxicity Study of Welding Fumes in Rats

Subgroup A — Statistical Analysis

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