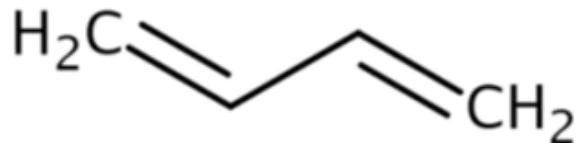

**Further Filtering Results for
Human Health Hazard Animal Toxicology and Epidemiology for
1,3-Butadiene**

Systematic Review Support Document for the Risk Evaluation

CASRN: 106-99-0



December 2025

This supplemental file contains information regarding the further filtering 'study-wide' extraction results for animal toxicology and epidemiology. Both animal toxicology and epidemiology filtered for studies with two or more exposure groups plus control or referent group. Additionally, key studies supporting dose-response analysis in existing authoritative reviews (*i.e.*, ATSDR or IRIS) were prioritized for data evaluation and extraction. Full details of the further filtering form and the filtering process are described in the [*Risk Evaluation for 1,3-Butadiene – Systematic Review Protocol*](#).

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| 1,3-Butadiene- Parent compound | | | | | | |
|--------------------------------|---|---|--|---|----------------|--|
| Animal Species | Exposure Route and Exposure Duration | LOEL | Principal Target Organs/Systems | PESS | Move to DEvEx* | Citation, HERO ID, and Reviewer |
| Mouse | Inhalation This is a reproductive/ developmental study. Short-Term (>1-30 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 500ppm (in air, water, or food) Positive for dominant lethal effect | Reproductive/Developmental, Other: Dominant lethality | This study does not report only negative outcomes. Lifestage (ex. reproductive studies, accumulation in milk) | Yes | Adler I-D et al. 1998 5663591 Reviewer: 1 and 2 |
| Mouse | Inhalation This is not a reproductive/ developmental study. Chronic (>90 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 625ppm (in air, water, or food) Increased incidence of hemangiosarcomas, malignant lymphomas, alveolar-bronchiolar adenomas and carcinomas, forestomach squamous cell papillomas and squamous cell carcinomas, mammary carcinomas (female), and ovarian tumors. Additionally, testicular atrophy, ovarian atrophy, and uterine involution. | Neurological/Behavioral, Cancer/Carcinogenesis, Cardiovascular, Thyroid, Reproductive/Developmental, Gastrointestinal, Immune/Hematological, Hepatic/Liver, Mortality, Musculoskeletal, Nutritional/Metabolic, Ocular/Sensory, Renal/Kidney, Lung/Respiratory | This study does not report only negative outcomes. | Yes | Battelle PNL, 1982 5554646 Reviewer: 1 |
| Mouse | Inhalation This is not a reproductive/ developmental study. Chronic (>90 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 625ppm (in air, water, or food) Increased incidence of hemangiosarcomas, malignant lymphomas, alveolar-bronchiolar adenomas and carcinomas, forestomach squamous cell papillomas and squamous cell carcinomas, mammary carcinomas (female), and ovarian tumors. Additionally, testicular atrophy, ovarian atrophy, and uterine involution. | Neurological/Behavioral, Cancer/Carcinogenesis, Cardiovascular, Thyroid, Reproductive/Developmental, Gastrointestinal, Immune/Hematological, Hepatic/Liver, Mortality, Musculoskeletal, Nutritional/Metabolic, Ocular/Sensory, Renal/Kidney, Lung/Respiratory, Other: clinical signs | This study does not report only negative outcomes. | Yes | Battelle PNL, 1982 5554646 Reviewer: 2 |
| Mouse | Inhalation This is a reproductive/ developmental study. Short-Term (>1-30 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 40ppm (in air, water, or food) Developmental: Decreased male fetal body weight; Maternal tox at 200 ppm | Reproductive/Developmental, Mortality, Nutritional/Metabolic, Other: Clinical signs | This study does not report only negative outcomes. Lifestage (ex. reproductive studies, accumulation in milk) | Yes | Battelle PNL, 1987 62351 Reviewer: 1 |

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1,3-Butadiene- Parent compound

| Animal Species | Exposure Route and Exposure Duration | LOEL | Principal Target Organs/Systems | PESS | Move to DEvEx* | Citation, HERO ID, and Reviewer |
|----------------|---|--|---|---|------------------|---|
| Mouse | Inhalation This is a reproductive/ developmental study. Short-Term (>1-30 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 40ppm (in air, water, or food) Developmental: Decreased male fetal body weight; Maternal tox at 200 ppm | Reproductive/Developmental, Mortality, Nutritional/Metabolic, Other: Clinical signs | This study does not report only negative outcomes. Lifestage (ex. reproductive studies, accumulation in milk), Other: Fetal Sex Differences | Yes | Battelle PNL, 1987 62351 Reviewer: 2 |
| Mouse | Inhalation This is a reproductive/ developmental study. Short-Term (>1-30 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 65ppm (in air, water, or food) Positive for dominant lethality | Reproductive/Developmental, Mortality, Nutritional/Metabolic, Other: Dominant lethality | This study does not report only negative outcomes. Lifestage (ex. reproductive studies, accumulation in milk) | Yes | BIBRA, 1996 5665017 Reviewer: 1 and 2 |
| Rat | Inhalation This is a reproductive/ developmental study. Sub-Chronic (>30-90 days) | This experiment contains 2 or more dose groups in addition to a control. | Reproductive/Developmental, Mortality, Other: Dominant lethality | This study reports only negative outcomes. Lifestage (ex. reproductive studies, accumulation in milk) | Yes | BIBRA, 1996 5674659 Reviewer: 1 |
| Rat | Inhalation This is a reproductive/ developmental study. Sub-Chronic (>30-90 days) | This experiment contains 2 or more dose groups in addition to a control. | Reproductive/Developmental, Mortality, Nutritional/Metabolic, Other: Dominant lethality | This study reports only negative outcomes. Lifestage (ex. reproductive studies, accumulation in milk) | Yes | BIBRA, 1996 5674659 Reviewer: 2 |
| Rat | Inhalation This is not a reproductive/ developmental study. Acute (less than or equal to 24 hr) | This experiment does not contain 2 or more dose groups in addition to a control. | Mortality, Nutritional/Metabolic, Lung/Respiratory, Other: Clinical signs | This study reports only negative outcomes. | Not at this time | Bio/dynamics, 1980 11273558 Reviewer: 1 and 2 |
| Mouse | Inhalation This is not a reproductive/ developmental study. Acute (less than or equal to 24 hr) | This experiment contains 2 or more dose groups in addition to a control. | Cancer/Carcinogenesis | This study reports only negative outcomes. | Yes | Bucher et al. 1993 5640580 Reviewer: 1 |
| Mouse | Inhalation This is not a reproductive/ developmental study. Acute (less than or equal to 24 hr) | This experiment contains 2 or more dose groups in addition to a control. | Cancer/Carcinogenesis, Nutritional/Metabolic | This study reports only negative outcomes. Occupational and Consumer Exposures (ex. byproduct of work) | Yes | Bucher et al. 1993 5640580 Reviewer: 2 |

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1,3-Butadiene- Parent compound

| Animal Species | Exposure Route and Exposure Duration | LOEL | Principal Target Organs/Systems | PESS | Move to DEvEx* | Citation, HERO ID, and Reviewer |
|----------------|--|---|---|---|------------------|---|
| Rat | Inhalation This is not a reproductive/developmental study. Chronic (>90 days) | This experiment contains 2 or more dose groups in addition to a control. | Neurological/Behavioral, Cancer/Carcinogenesis, Thyroid, Reproductive/Developmental, Gastrointestinal, Immune/Hematological, Hepatic/Liver, Musculoskeletal, Nutritional/Metabolic, Renal/Kidney, Lung/Respiratory, Skin/Connective Tissue, Other: Endocrine | This study reports only negative outcomes. | Yes | Crouch et al. 1979 94760 Reviewer: 1 and 2 |
| Rat | Inhalation This is not a reproductive/developmental study. Short-Term (>1-30 days) | This experiment does not contain 2 or more dose groups in addition to a control. | Nutritional/Metabolic | This study reports only negative outcomes. | Not at this time | Elovaara et al. 1994 62726 Reviewer: 1 |
| Rat | Inhalation This is not a reproductive/developmental study. Short-Term (>1-30 days) | This experiment does not contain 2 or more dose groups in addition to a control. LOEL: 500ppm (in air, water, or food) increase in metabolic enzyme activity in lung and liver shown in Table 1 within Water subgroup | Hepatic/Liver, Nutritional/Metabolic, Lung/Respiratory | This study does not report only negative outcomes. Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | Not at this time | Elovaara et al. 1994 62726 Reviewer: 2 |
| Rat | Inhalation This is not a reproductive/developmental study. Chronic (>90 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 1000ppm (in air, water, or food) Carcinogenicity (increased tumor incidence at several sites, including mammary, thyroid, and uterus/vaginal in females; Leydig cells and pancreas in males; Zymbal gland in both sexes) | Neurological/Behavioral, Cancer/Carcinogenesis, Cardiovascular, Thyroid, Reproductive/Developmental, Gastrointestinal, Immune/Hematological, Hepatic/Liver, Mortality, Musculoskeletal, Nutritional/Metabolic, Ocular/Sensory, Renal/Kidney, Lung/Respiratory, Skin/Connective Tissue, Other: Endocrine organs, Serum chemistry | This study does not report only negative outcomes. Other: Sex | Yes | Hazleton Laboratories, 1981 5673742 Reviewer: 1 |

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| 1,3-Butadiene- Parent compound | | | | | | |
|--------------------------------|---|---|---|---|----------------|---|
| Animal Species | Exposure Route and Exposure Duration | LOEL | Principal Target Organs/Systems | PESS | Move to DEvEx* | Citation, HERO ID, and Reviewer |
| Rat | Inhalation This is not a reproductive/ developmental study. Chronic (>90 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 1000ppm (in air, water, or food) Carcinogenicity (increased tumor incidence at several sites, including mammary, thyroid, and uterus/vaginal in females; Leydig cells and pancreas in males; Zymbal gland in both sexes) | Neurological/Behavioral, Cancer/Carcinogenesis, Cardiovascular, Thyroid, Reproductive/Developmental, Gastrointestinal, Immune/Hematological, Hepatic/Liver, Mortality, Musculoskeletal, Nutritional/Metabolic, Ocular/Sensory, Renal/Kidney, Lung/Respiratory, Skin/Connective Tissue, Other: Endocrine organs, Serum chemistry | This study does not report only negative outcomes. Other: Sex | Yes | Hazleton Laboratories, 1981 5673742 Reviewer: 2 |
| Rat | Inhalation This is a reproductive/ developmental study. Short-Term (>1-30 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 200ppm (in air, water, or food) Foetal defects, delayed growth | Reproductive/Developmental, Nutritional/Metabolic | This study does not report only negative outcomes. Lifestage (ex. reproductive studies, accumulation in milk) | Yes | Hazleton Labs, 1981 62371 Reviewer: 1 |
| Rat | Inhalation This is a reproductive/ developmental study. Short-Term (>1-30 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 200ppm (in air, water, or food) Foetal defects, delayed growth | Reproductive/Developmental | This study does not report only negative outcomes. Lifestage (ex. reproductive studies, accumulation in milk) | Yes | Hazleton Labs, 1981 62371 Reviewer: 2 |
| Mouse | Inhalation This is not a reproductive/ developmental study. Sub-Chronic (>30-90 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 2445.4ppm (in air, water, or food) Decreased body weight in males | Neurological/Behavioral, Gastrointestinal, Immune/Hematological, Hepatic/Liver, Mortality, Nutritional/Metabolic, Renal/Kidney, Lung/Respiratory, Skin/Connective Tissue, Other: Clinical signs, Endocrine | This study does not report only negative outcomes. Sociodemographic Status (ex. home near exposure source) | Yes | IBT Labs, 1977 11273565 Reviewer: 1 |

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1,3-Butadiene- Parent compound

| Animal Species | Exposure Route and Exposure Duration | LOEL | Principal Target Organs/Systems | PESS | Move to DEvEx* | Citation, HERO ID, and Reviewer |
|----------------|--|---|--|---|------------------|--|
| Mouse | Inhalation This is not a reproductive/developmental study. Sub-Chronic (>30-90 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 2445.4ppm (in air, water, or food) Decreased body weight in males | Neurological/Behavioral, Gastrointestinal, Immune/Hematological, Hepatic/Liver, Mortality, Nutritional/Metabolic, Renal/Kidney, Lung/Respiratory, Skin/Connective Tissue, Other: Clinical signs, Endocrine | This study does not report only negative outcomes. Other: sex | Yes | IBT Labs, 1977 11273565 Reviewer: 2 |
| Mouse | Inhalation This is not a reproductive/developmental study. Chronic (>90 days) | This experiment does not contain 2 or more dose groups in addition to a control. LOEL: 1250ppm (in air, water, or food) Increased leukemia | Cancer/Carcinogenesis | This study does not report only negative outcomes. Genetics/Epigenetics (ex. genetic variants that increase susceptibility; knockout animals) | Not at this time | Irons et al. 1989 646911 Reviewer: 1 and 2 |
| Mouse | Inhalation This is not a reproductive/developmental study. Sub-Chronic (>30-90 days) | This experiment does not contain 2 or more dose groups in addition to a control. LOEL: 1250ppm (in air, water, or food) Decreased erythrocytes, total hemoglobin, hematocrit and increased mean corpuscular volume. | Immune/Hematological | This study does not report only negative outcomes. Genetics/Epigenetics (ex. genetic variants that increase susceptibility; knockout animals) | Not at this time | Irons et al. 1986 62357 Reviewer: 1 |
| Mouse | Inhalation This is not a reproductive/developmental study. Sub-Chronic (>30-90 days) | This experiment does not contain 2 or more dose groups in addition to a control. LOEL: 1250ppm (in air, water, or food) Decreased erythrocytes, total hemoglobin, hematocrit and increased mean corpuscular volume. | Immune/Hematological, Nutritional/Metabolic | This study does not report only negative outcomes. Genetics/Epigenetics (ex. genetic variants that increase susceptibility; knockout animals) | Not at this time | Irons et al. 1986 62357 Reviewer: 2 |
| Mouse | Inhalation This is not a reproductive/developmental study. Short-Term (>1-30 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 500ppm (in air, water, or food) Decreased body weight | Nutritional/Metabolic | This study does not report only negative outcomes. | Yes | Lee et al. 2005 1329207 Reviewer: 1 and 2 |
| Rat | Inhalation This is not a reproductive/developmental study. Short-Term (>1-30 days) | This experiment contains 2 or more dose groups in addition to a control. | Mortality, Nutritional/Metabolic, Other: Clinical signs | This study reports only negative outcomes. | Yes | LRRI, 2005 11273463 Reviewer: 1 and 2 |
| Mouse | Inhalation This is not a reproductive/developmental study. Short-Term (>1-30 days) | This experiment contains 2 or more dose groups in addition to a control. | Mortality, Nutritional/Metabolic, Other: Clinical signs | This study reports only negative outcomes. | Yes | LRRI, 2005 11273463 Reviewer: 1 and 2 |

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| 1,3-Butadiene- Parent compound | | | | | | |
|--------------------------------|--|--|----------------------------------|--|------------------|---|
| Animal Species | Exposure Route and Exposure Duration | LOEL | Principal Target Organs/Systems | PESS | Move to DEvEx* | Citation, HERO ID, and Reviewer |
| Rabbit | Ocular/Eye This is not a reproductive/developmental study. Acute (less than or equal to 24 hr) | This experiment does not contain 2 or more dose groups in addition to a control. | Irritation | This study reports only negative outcomes. | Not at this time | Mobil Environmental and Health Science Laboratory, 1985 11273559 Reviewer: 1 and 2 |
| Rabbit | Dermal This is not a reproductive/developmental study. Acute (less than or equal to 24 hr) | This experiment does not contain 2 or more dose groups in addition to a control. | Irritation | This study reports only negative outcomes. | Not at this time | Mobil Environmental and Health Science Laboratory, 1985 11273559 Reviewer: 1 and 2 |
| Mouse | Inhalation This is not a reproductive/developmental study. Short-Term (>1-30 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 5000ppm (in air, water, or food) Body weight lost | Mortality, Nutritional/Metabolic | This study does not report only negative outcomes. | Yes | National Institutes of Health., Department of Health and Human Services, 1984 62372 Reviewer: 1 and 2 |
| Mouse | Inhalation This is not a reproductive/developmental study. Sub-Chronic (>30-90 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 2500ppm (in air, water, or food) Body weight gain decreased | Mortality, Nutritional/Metabolic | This study does not report only negative outcomes. | Yes | National Institutes of Health., Department of Health and Human Services, 1984 62372 Reviewer: 1 and 2 |

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1,3-Butadiene- Parent compound

| Animal Species | Exposure Route and Exposure Duration | LOEL | Principal Target Organs/Systems | PESS | Move to DEvEx* | Citation, HERO ID, and Reviewer |
|----------------|---|--|--|---|------------------|---|
| Mouse | Inhalation This is not a reproductive/ developmental study. Chronic (>90 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 625ppm (in air, water, or food) Neoplasm-heart, lung, forestomach, liver, ovary, testicular and brain | Cancer/Carcinogenesis, Mortality, Nutritional/Metabolic | This study does not report only negative outcomes. | Yes | National Institutes of Health., Department of Health and Human Services, 1984 62372 Reviewer: 1 and 2 |
| Rooster | Inhalation This is not a reproductive/ developmental study. Chronic (>90 days) | This experiment does not contain 2 or more dose groups in addition to a control. LOEL: 20ppm (in air, water, or food) Increased incidence of arteriosclerotic plaques | Cardiovascular | This study does not report only negative outcomes. Lifestyle Activities (ex. exercise, smoking), Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | Not at this time | Penn et al. 1996 5663744 Reviewer: 1 and 2 |
| Rat | Inhalation This is a reproductive/ developmental study. Sub-Chronic (>30-90 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 1507ppm (in air, water, or food) Decreased body weight in F0 and F1 corresponding to reduced food consumption males and females | Neurological/Behavioral, Reproductive/Developmental, Hepatic/Liver, Mortality, Nutritional/Metabolic, Renal/Kidney, Lung/Respiratory, Other: Clinical signs, Endocrine | This study does not report only negative outcomes. Lifestage (ex. reproductive studies, accumulation in milk) | Yes | WIL Research, 2003 10367501 Reviewer: 1 |
| Rat | Inhalation This is a reproductive/ developmental study. Sub-Chronic (>30-90 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 1507ppm (in air, water, or food) Decreased body weight in F0 and F1 males and females | Neurological/Behavioral, Reproductive/Developmental, Mortality, Renal/Kidney, Lung/Respiratory, Other: Clinical signs, Endocrine | This study does not report only negative outcomes. Lifestage (ex. reproductive studies, accumulation in milk) | Yes | WIL Research, 2003 10367501 Reviewer: 2 |
| Mouse | Inhalation This is a reproductive/ developmental study. Short-Term (>1-30 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 500ppm (in air, water, or food) Decreased testis weight beginning 11 days after exposure | Reproductive/Developmental, Nutritional/Metabolic | This study does not report only negative outcomes. Lifestage (ex. reproductive studies, accumulation in milk) | Yes | Xiao et al. 1995 5546732 Reviewer: 1 |
| Mouse | Inhalation This is a reproductive/ developmental study. Short-Term (>1-30 days) | This experiment contains 2 or more dose groups in addition to a control. LOEL: 500ppm (in air, water, or food) Decreased testis weight beginning 11 days after exposure | Reproductive/Developmental, Nutritional/Metabolic, Other: genotoxicity in spermatids | This study does not report only negative outcomes. Lifestage (ex. reproductive studies, accumulation in milk) | Yes | Xiao et al. 1995 5546732 Reviewer: 2 |

* Data Quality Evaluation and Extraction

| 1,3-Butadiene- Parent compound | | | | | |
|---|--|---|--|----------------|-------------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DExEx* | Citation, HERO ID, and Reviewer |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study does not assess occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Measured concentration or dose Reported Exposure Levels: Other The study does not assess the association between exposure to the chemical of interest and a health outcome for other reason. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological | Geography/site-specific (ex. downstream of release sites) | No | Barregard et al. 2009 5621149 |
| Other Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study assesses occupational exposure. | Quantitative measurement type(s): Duration of exposure, Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Job-Exposure Matrix (JEM) or similar, Biomarker of exposure with quantitative data Reported Exposure Levels: Other The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. This study contains limited useful dose-response data as the exposure to 1,3-BTD through a cumulative exposure rank month along with other exposure substances modeled (styrene, acrylonitrile). This is an observational epidemiology study | Non-Cancer: Hepatic/liver | Occupational, Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | No | Cave et al. 2011 1008952 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Job-Exposure Matrix (JEM) or similar Reported Exposure Levels: An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This study contains useful dose-response data with lagged exposure reported. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological, Mortality | Lifestage: Older adults (>=65 years) Occupational | Yes | Cheng et al. 2007 646899 |

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| 1,3-Butadiene- Parent compound | | | | | |
|--|---|---|--|-----------------|---------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DDevEx* | Citation, HERO ID, and Reviewer |
| Inhalation, Dermal/Skin, Ocular/Eye Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study assesses occupational exposure. | Quantitative measurement type(s): None - no quantitative measurement Quantitative method(s): Reported Exposure Levels: The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. No This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological | Occupational | No | Cole et al. 1993 51368 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study does not assess occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Modeled concentration or dose Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome. A continuous measure of exposure but didn't use this measurement in any model or analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Neurological/behavioral, Childhood cancer (before birth through age 18) | Lifestage: Infants (birth through <12 months), Children (age 1 year through <11 years) | Yes | Danysh et al. 2015 3011004 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Acute inhalation (24 hours or less), Short-term inhalation (>24 hours and <=28 days) This study does not assess occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Measured concentration or dose Reported Exposure Levels: An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. Table 4 contains potentially useful dose-response data This is an observational epidemiology study | Non-Cancer: Lung/respiratory | Lifestage: Children (age 1 year through <11 years), Adolescents (age 11 years through <21 years) Pre-existing Disease (ex. altered metabolism, behaviors, treatments related to condition), Geography/site-specific (ex. downstream of release sites), Sociodemographic status (ex. home near exposure source), Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | Yes | Delfino et al. 2003 50460 |

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| 1,3-Butadiene- Parent compound | | | | | |
|---|--|---|--|----------------|---------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DEvEx* | Citation, HERO ID, and Reviewer |
| Dermal/Skin, Other Dermal/Skin (wipe sampling, questionnaire assessing dermal exposure, patch testing (intentional dosing), dermal chamber studies, shower studies, skin permeability coefficient, skin exposure biomarkers, etc.) This study assesses occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Measured concentration or dose, Modeled concentration or dose, Job-Exposure Matrix (JEM) or similar Reported Exposure Levels: An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. "Both BD ppm-years and STY ppm-years displayed a consistent dose-response pattern in single exposure models, but for each chemical this pattern was weakened in analyses that controlled for the other agent. Further adjustment for DMDTC did not substantially alter the data for BD (also adjusted for STY), but did have a marked impact on the RRs for STY (also adjusted for BD), changing its association with leukemia from positive to inverse, without dose-response." This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological, Mortality | Occupational, Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | Yes | Delzell et al. 2001 737524 |
| Inhalation, Dermal/Skin, Ocular/Eye, Other Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study assesses occupational exposure. | Quantitative measurement type(s): Duration of exposure Quantitative method(s): Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Neurological/behavioral, Cancer of the Reproductive System, Gastrointestinal, Immune/hematological, Hepatic/liver, Mortality, Nutritional/metabolic, Renal/kidney, Lung/respiratory Non-Cancer: Neurological/behavioral, Cardiovascular, Thyroid, Reproductive/developmental, Gastrointestinal, Immune/hematological, Mortality, Nutritional/metabolic, Renal/kidney, Lung/respiratory, Other | Lifestage: Older adults (>=65 years) Occupational | Yes | Delzell et al. 2006 737525 |
| Inhalation, Dermal/Skin, Ocular/Eye Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study assesses occupational exposure. | Quantitative measurement type(s): Duration of exposure Quantitative method(s): Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Neurological/behavioral, Cancer of the Reproductive System, Gastrointestinal, Immune/hematological, Hepatic/liver, Mortality, Musculoskeletal, Renal/kidney, Lung/respiratory, Skin & connective tissue Non-Cancer: Neurological/behavioral, Cardiovascular, Reproductive/developmental, Gastrointestinal, Immune/hematological, Mortality, Nutritional/metabolic, Renal/kidney, Lung/respiratory, Other | Occupational | Yes | Delzell et al. 51390 |

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| 1,3-Butadiene- Parent compound | | | | | |
|---|---|---|---|----------------|---------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DEvEx* | Citation, HERO ID, and Reviewer |
| Other Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study assesses occupational exposure. | <p>Quantitative measurement type(s): None - no quantitative measurement</p> <p>Quantitative method(s):</p> <p>Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome</p> <p>The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. "The lack of a dose-response effect was confirmed when the cumulative exposure score, i.e. the estimate that includes exposure class, the length of time in the job, and calendar time of exposure, was used in the Cox regression analysis. No association was found between the estimate of BD exposure and any LHC category. Again, these results are consistent with those for the varied exposure group in that the risk does not increase with increasing duration of exposure. These results from the Cox regression analysis are presumed to use a more accurate representation of the overall dose received by the cohort, and this method avoids the problems associated with using an external comparison group." This is an observational epidemiology study</p> | <p>Cancer/ Carcinogenesis: Neurological/behavioral, Cancer of the Reproductive System, Gastrointestinal, Immune/hematological, Mortality, Renal/kidney, Lung/respiratory, Skin & connective tissue, Other: "All cancers"</p> <p>Non-Cancer: Cardiovascular, Hepatic/liver, Mortality, Nutritional/metabolic, Lung/respiratory, Other: "All external causes"</p> | Occupational | No | Divine et al. 2001 2959633 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study does not assess occupational exposure. | <p>Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest</p> <p>Quantitative method(s): Measured concentration or dose</p> <p>Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome</p> <p>The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest.</p> <p>Assesses tertiles of exposure in relation to breast cancer</p> <p>This is an observational epidemiology study</p> | Cancer/ Carcinogenesis: Cancer of the Reproductive System | <p>Studies focusing on reproductive parameters,</p> <p>Pre-existing Disease (ex. altered metabolism, behaviors, treatments related to condition),</p> <p>Lifestyle Activities (ex. exercise, smoking),</p> <p>Geography/site-specific (ex. downstream of release sites),</p> <p>Sociodemographic status (ex. home near exposure source),</p> <p>Aggregate Exposures (ex. multiple air exposure sources)</p> | Yes | Ellis et al. 2025 12381562 |

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| 1,3-Butadiene- Parent compound | | | | | |
|---|---|---|--|----------------|---------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DEvEx* | Citation, HERO ID, and Reviewer |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Job-Exposure Matrix (JEM) or similar Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological, Mortality | Lifestage: Older adults (>=65 years) Occupational | Yes | Graff et al. 2009 2950774 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.), Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Duration of exposure, Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Job-Exposure Matrix (JEM) or similar Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological, Mortality | Occupational, Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | Yes | Graff et al. 2005 737523 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study does not assess occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Measured concentration or dose Reported Exposure Levels: An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. Reported useful dose-response data in Table 2 and 3. This is an observational epidemiology study | Cancer/ Carcinogenesis: Cancer of the Reproductive System, Childhood cancer (before birth through age 18) | Lifestage: Pregnant people (parent) or embryo/fetus (developmental) (conception through birth). Children (age 1 year through <11 years) Studies focusing on reproductive parameters, Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | Yes | Hall et al. 2019 5641117 |

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| 1,3-Butadiene- Parent compound | | | | | |
|--|--|--|---|-----------------|---------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DDevEx* | Citation, HERO ID, and Reviewer |
| Inhalation, Dermal/Skin, Ocular/Eye Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study assesses occupational exposure. | Quantitative measurement type(s): Duration of exposure Quantitative method(s): Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Other: Breast cancer | Occupational | No | Hansen, J. 2000 94367 |
| Inhalation, Dermal/Skin, Ocular/Eye Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.), Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Concentration or dose per time period (ex: mg/day, mg/kg/day, ml/hour, ml/year, TWA, etc.), Biomarker of exposure with quantitative data Reported Exposure Levels: Other The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. Analysis between exposed vs unexposed. No useful dose-response data. This is an observational epidemiology study | Cancer/ Carcinogenesis: Other: Genotoxicity Non-Cancer: Immune/hematological | Occupational, Genetics/Epigenetics (ex. genetic variants that increase susceptibility, knockout | No | Hayes et al. 2001 5552863 |

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| 1,3-Butadiene- Parent compound | | | | | |
|--|--|---|---|-----------------|---------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DDevEx* | Citation, HERO ID, and Reviewer |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.), Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) Acute inhalation (24 hours or less) This study assesses occupational exposure. | Quantitative measurement type(s): Duration of exposure, Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Job-Exposure Matrix (JEM) or similar, Concentration or dose per time period (ex: mg/day, mg/kg/day, ml/hour, ml/year, TWA, etc.), Biomarker of exposure with quantitative data Reported Exposure Levels: A continuous measure of exposure but didn't use this measurement in any model or analyses of the association between the chemical of interest and a health outcome, An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. the only dose-response data is a correlation table, most analyses are just exposed vs unexposed This is an observational epidemiology study | Non-Cancer: Immune/hematological | Occupational, Genetics/Epigenetics (ex. genetic variants that increase susceptibility, knockout | Yes | Hayes et al. 2000 5586518 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study does not assess occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Measured concentration or dose, Modeled concentration or dose Reported Exposure Levels: An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Cancer of the Reproductive System | Lifestage: Older adults (>=65 years) Studies focusing on reproductive parameters, Lifestyle Activities (ex. exercise, smoking), Geography/site-specific (ex. downstream of release sites), Sociodemographic status (ex. home near exposure source), Aggregate Exposures (ex. multiple air exposure sources), Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | Yes | Heck et al. 2024 11438289 |

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| 1,3-Butadiene- Parent compound | | | | | |
|---|---|--|--|----------------|---------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DEvEx* | Citation, HERO ID, and Reviewer |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study does not assess occupational exposure. | Quantitative measurement type(s): Duration of exposure, Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Measured concentration or dose, Modeled concentration or dose, Concentration or dose per time period (ex: mg/day, mg/kg/day, ml/hour, ml/year, TWA, etc.) Reported Exposure Levels: An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Childhood cancer (before birth through age 18), Immune/hematological | Lifestage: Pregnant people (parent) or embryo/fetus (developmental) (conception through birth), Infants (birth through <12 months), Children (age 1 year through <11 years) Sociodemographic status (ex. home near exposure source), Aggregate Exposures (ex. multiple air exposure sources), Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | Yes | Heck et al. 2014 2345720 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study does not assess occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Measured concentration or dose Reported Exposure Levels: An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Childhood cancer (before birth through age 18), Ocular/sensory | Lifestage: Pregnant people (parent) or embryo/fetus (developmental) (conception through birth), Infants (birth through <12 months), Children (age 1 year through <11 years) Aggregate Exposures (ex. multiple air exposure sources) | Yes | Heck et al. 2013 2369182 |
| Other Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study assesses occupational exposure. | Quantitative measurement type(s): None - no quantitative measurement Quantitative method(s): Reported Exposure Levels: Other The study does not assess the association between exposure to the chemical of interest and a health outcome for other reason. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. Contains no dose-response data. This is an observational epidemiology study | Cancer/ Carcinogenesis: Neurological/behavioral, Thyroid, Cancer of the Reproductive System, Gastrointestinal, Immune/hematological, Hepatic/liver, Mortality, Ocular/sensory, Renal/kidney, Lung/respiratory, Skin & connective tissue Non-Cancer: Neurological/behavioral, Cardiovascular, Gastrointestinal, Immune/hematological, Hepatic/liver, Mortality, Lung/respiratory | Occupational | No | IISRP, 1982 5372807 |

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| 1,3-Butadiene- Parent compound | | | | | |
|---|--|---|--------------|-----------------|---|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DDevEx* | Citation, HERO ID, and Reviewer |
| Inhalation, Dermal/Skin Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Modeled concentration or dose, Job-Exposure Matrix (JEM) or similar, Concentration or dose per time period (ex: mg/day, mg/kg/day, ml/hour, ml/year, TWA, etc.) Reported Exposure Levels: An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. Information on multiple models' leukemia relative rate is provided by 1,3-BTD ppm- person years ranges (20, 0-38.7, 38.7-123.6, 123.6-287.3,287.3-641.9, 641.9+) additional associations and adjustments are shown. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological, Mortality | Occupational | Yes | IISRP, 2000 5664525 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): None - no quantitative measurement Quantitative method(s): Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome, An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Neurological/behavioral, Thyroid, Cancer of the Reproductive System, Gastrointestinal, Immune/hematological, Hepatic/liver, Mortality, Musculoskeletal, Nutritional/metabolic, Ocular/sensory, Renal/kidney, Lung/respiratory, Skin & connective tissue | Occupational | No | IISRP, 1986 5672830 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Biomarker of exposure with only binary data (detected/undetected) Quantitative method(s): Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological | Occupational | No | Johns Hopkins University, 1988 5665273 |

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| 1,3-Butadiene- Parent compound | | | | | |
|--|--|--|---|-----------------|---|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DDevEx* | Citation, HERO ID, and Reviewer |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Duration of exposure Quantitative method(s): Reported Exposure Levels: An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological | Occupational | No | Johns Hopkins University, 1988 5673747 |
| Other Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study assesses occupational exposure. | Quantitative measurement type(s): Duration of exposure Quantitative method(s): Reported Exposure Levels: An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Neurological/behavioral, Cardiovascular, Thyroid, Cancer of the Reproductive System, Gastrointestinal, Immune/hematological, Hepatic/liver, Mortality, Musculoskeletal, Nutritional/metabolic, Ocular/sensory, Renal/kidney, Lung/respiratory, Skin & connective tissue, Other: "all cancers" Non-Cancer: Neurological/behavioral, Cardiovascular, Reproductive/developmental, Gastrointestinal, Immune/hematological, Hepatic/liver, Mortality, Nutritional/metabolic, Renal/kidney, Lung/respiratory, Irritation, Sensitization, Other: "All external causes, all accidents, motor vehicle accidents, suicides" | Occupational, Sociodemographic status (ex. home near exposure source) | No | Johns Hopkins University, 1992 5790933 |
| Inhalation Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study does not assess occupational exposure. | Quantitative measurement type(s): None - no quantitative measurement Quantitative method(s): Reported Exposure Levels: Other: classified by levels of outcome instead of exposure The study does not assess the association between exposure to the chemical of interest and a health outcome for other reason. No analysis based on measured exposure levels; patients are classified by severity of symptoms and the only analysis compares clinical parameters across different levels of symptomatic severity. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. No, no real exposure vs. outcome statistical analysis This is an observational epidemiology study | Non-Cancer: Neurological/behavioral | Geography/site-specific (ex. downstream of release sites) | No | Khalil et al. 2007 5617530 |

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| 1,3-Butadiene- Parent compound | | | | | |
|---|---|--|--|----------------|---------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DEvEx* | Citation, HERO ID, and Reviewer |
| Inhalation, Other Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study does not assess occupational exposure. | Quantitative measurement type(s): None - no quantitative measurement Quantitative method(s): Reported Exposure Levels: Other The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. This study explores a boundary crossing technique as being "useful for examining simultaneous exposures to several hazard types", however, no quantitative dose data was available in the study. Distance from bus stations, railway stations, railways, roads, canals, estuaries, and other rivers were the main measurement of exposure, 1,3-BTD is mentioned as a prominent carcinogen found at these sites but no quantitative measures on exposure levels are taken. "Stimulated proliferation of an existing malignant clone by a viral or other infection offers a reasonable pathogenetic model for a tumour of the immune system; and this could explain the many reported occurrences of close-set space-time onset clusters." This is an observational epidemiology study | Cancer/ Carcinogenesis: Childhood cancer (before birth through age 18), Immune/hematological, Mortality, Other: "other 'solid' tumours" Non-Cancer: Mortality | Lifestage: Pregnant people (parent) or embryo/fetus (developmental) (conception through birth), Infants (birth through <12 months), Children (age 1 year through <11 years), Adolescents (age 11 years through <21 years) Geography/site-specific (ex. downstream of release sites), Sociodemographic status (ex. home near exposure source), Aggregate Exposures (ex. multiple air exposure sources), Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | No | Knox, E. G. 2006 1938083 |
| Inhalation Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study does not assess occupational exposure. | Quantitative measurement type(s): None - no quantitative measurement Quantitative method(s): Reported Exposure Levels: Other The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. Exposure levels were based on distance to nearest emission hotspot. This is an observational epidemiology study | Cancer/ Carcinogenesis: Childhood cancer (before birth through age 18), Mortality | Lifestage: Infants (birth through <12 months), Children (age 1 year through <11 years) Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | No | Knox, E. G. 2005 88410 |

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| 1,3-Butadiene- Parent compound | | | | | |
|---|---|---|--|-----------------|---------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DDevEx* | Citation, HERO ID, and Reviewer |
| Inhalation, Dermal/Skin, Drinking water, Other Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study does not assess occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Other (please specify), County-level annual toxic releases in pounds Reported Exposure Levels: An exposure-response model using a continuous measure (or estimate) of exposure, Other: includes a dichotomous variable (zero release; nonzero release) The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. Range of exposure to 1,3 BTD is not specified. This is an observational epidemiology study | Cancer/ Carcinogenesis: Lung/respiratory | Geography/site-specific (ex. downstream of release sites), Sociodemographic status (ex. home near exposure source) | Yes | Luo, et al. 2011 1021648 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study does not assess occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Measured concentration or dose, Modeled concentration or dose Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Cancer of the Reproductive System | Lifestage: Older adults (>=65 years) Studies focusing on reproductive parameters, Geography/site-specific (ex. downstream of release sites), Aggregate Exposures (ex. multiple air exposure sources), Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | Yes | Niehoff et al. 2019 5440630 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Duration of exposure, Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Job-Exposure Matrix (JEM) or similar Reported Exposure Levels: A continuous measure of exposure but didn't use this measurement in any model or analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological, Mortality | Occupational | No | NIOSH, 1994 5790851 |

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| 1,3-Butadiene- Parent compound | | | | | |
|--|---|---|--|-----------------|-------------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DDevEx* | Citation, HERO ID, and Reviewer |
| Inhalation, Dermal/Skin Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study assesses occupational exposure. | Quantitative measurement type(s): None - no quantitative measurement Quantitative method(s): Reported Exposure Levels: Other The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. No useful dose-response data. This is an observational epidemiology study | Cancer/ Carcinogenesis: Renal/kidney | Occupational | No | Parent et al. 2000 632551 |
| Other Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study does not assess occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Biomarker of exposure with quantitative data Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Non-Cancer: Ocular/sensory | Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | Yes | Pudrith et al. 2019 5660361 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Measured concentration or dose, Job-Exposure Matrix (JEM) or similar Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome. An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological, Mortality | Lifestage: Older adults (>=65 years) Occupational | Yes | Sathiakumar et al. 2021 10192219 |

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| 1,3-Butadiene- Parent compound | | | | | |
|---|---|--|--|-----------------|------------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DDevEx* | Citation, HERO ID, and Reviewer |
| Inhalation, Dermal/Skin Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Measured concentration or dose, Job-Exposure Matrix (JEM) or similar Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome, An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Gastrointestinal, Mortality, Nutritional/metabolic, Renal/kidney, Lung/respiratory Non-Cancer: Lung/respiratory | Lifestage: Older adults (>=65 years) Occupational | Yes | Sathiakumar et al. 2021 9038746 |
| Other Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study assesses occupational exposure. | Quantitative measurement type(s): Duration of exposure, Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Job-Exposure Matrix (JEM) or similar Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome, An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Mortality, Lung/respiratory | Lifestyle Activities (ex. exercise, smoking), Occupational, Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | Yes | Sathiakumar et al. 2009 1600222 |

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| 1,3-Butadiene- Parent compound | | | | | |
|---|---|--|--|-----------------|---------------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DDevEx* | Citation, HERO ID, and Reviewer |
| Inhalation, Dermal/Skin, Ocular/Eye Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study assesses occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Job-Exposure Matrix (JEM) or similar Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome, An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological, Mortality | Occupational | Yes | Sathiakumar et al. 2015 4659248 |
| Inhalation, Dermal/Skin, Ocular/Eye, Other Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study assesses occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Job-Exposure Matrix (JEM) or similar Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. Useful for dose-response: exposure concentrations extrapolated from JEM, at least three levels of exposure. This is an observational epidemiology study | Cancer/ Carcinogenesis: Neurological/behavioral, Cancer of the Reproductive System, Gastrointestinal, Immune/hematological, Hepatic/liver, Mortality, Nutritional/metabolic, Renal/kidney, Lung/respiratory Non-Cancer: Neurological/behavioral, Cardiovascular, Thyroid, Reproductive/developmental, Gastrointestinal, Immune/hematological, Mortality, Nutritional/metabolic, Renal/kidney, Lung/respiratory, Other | Lifestage: Older adults (>=65 years) Studies focusing on reproductive parameters, Occupational, Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | Yes | Sathiakumar et al. 2009 1330953 |

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| 1,3-Butadiene- Parent compound | | | | | |
|---|---|--|--|----------------|------------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DEvEx* | Citation, HERO ID, and Reviewer |
| Inhalation, Dermal/Skin, Ocular/Eye, Other Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.), Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Duration of exposure, Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Job-Exposure Matrix (JEM) or similar Reported Exposure Levels: An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Neurological/behavioral, Cancer of the Reproductive System, Gastrointestinal, Immune/hematological, Hepatic/liver, Mortality, Renal/kidney, Lung/respiratory Non-Cancer: Neurological/behavioral, Cardiovascular, Thyroid, Reproductive/developmental, Gastrointestinal, Immune/hematological, Mortality, Nutritional/metabolic, Renal/kidney, Lung/respiratory | Lifestage: Older adults (>=65 years) Studies focusing on reproductive parameters, Occupational, Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | Yes | Sathiakumar et al. 2019 6592911 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Modeled concentration or dose, Job-Exposure Matrix (JEM) or similar, Concentration or dose per time period (ex: mg/day, mg/kg/day, ml/hour, ml/year, TWA, etc.) Reported Exposure Levels: An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological, Mortality | Occupational | Yes | Sielken, 2007 6544022 |

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| 1,3-Butadiene- Parent compound | | | | | |
|--|--|---|--|----------------|---------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DEvEx* | Citation, HERO ID, and Reviewer |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Duration of exposure, Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Measured concentration or dose Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. The study contains useful dose-response data, 1,3-BTD cumulative inhalation exposure is reported in ppm-years and detailed analysis is performed, and exposure response modeling is broken down in detail. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological, Mortality | Lifestage: Older adults (>=65 years) Occupational | Yes | Sielken et al. 2013 1798799 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Duration of exposure, Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Modeled concentration or dose, Job-Exposure Matrix (JEM) or similar Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological, Mortality | Occupational | Yes | Sielken et al. 2011 1940484 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Measured concentration or dose, Modeled concentration or dose Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological, Mortality | Occupational, Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | Yes | Sielken et al. 2001 1942871 |

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| 1,3-Butadiene- Parent compound | | | | | |
|---|---|--|--|----------------|------------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DEvEx* | Citation, HERO ID, and Reviewer |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study does not assess occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Measured concentration or dose Reported Exposure Levels: A continuous measure of exposure but didn't use this measurement in any model or analyses of the association between the chemical of interest and a health outcome The study does not assess the association between exposure to the chemical of interest and a health outcome for other reason. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. The analysis only compares cancer incidence rates across counties, there's no direct statistical test of association between 1,3-BTD exposure and cancer incidence. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological | Lifestyle Activities (ex. exercise, smoking), Geography/site-specific (ex. downstream of release sites), Sociodemographic status (ex. home near exposure source), Nutrition (ex. contaminated food source), Genetics/Epigenetics (ex. genetic variants that increase susceptibility, knockout, Aggregate Exposures (ex. multiple air exposure sources) | No | Simpson et al. 2013 2225126 |
| Other Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study assesses occupational exposure. | Quantitative measurement type(s): None - no quantitative measurement Quantitative method(s): Reported Exposure Levels: The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Mortality, Skin & connective tissue | Occupational, Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | No | Sobel et al. 1987 1357737 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study does not assess occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Modeled concentration or dose Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome, A continuous measure of exposure but didn't use this measurement in any model or analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Childhood cancer (before birth through age 18), Immune/hematological | Lifestage: Pregnant people (parent) or embryo/fetus (developmental) (conception through birth), Infants (birth through <12 months), Children (age 1 year through <11 years) Lifestyle Activities (ex. exercise, smoking), Sociodemographic status (ex. home near exposure source), Aggregate Exposures (ex. multiple air exposure sources), Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | Yes | Symanski et al. 2016 3358047 |

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| 1,3-Butadiene- Parent compound | | | | | |
|---|---|---|--------------|-----------------|---------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DDevEx* | Citation, HERO ID, and Reviewer |
| Inhalation, Dermal/Skin Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Measured concentration or dose, Job-Exposure Matrix (JEM) or similar Reported Exposure Levels: A continuous measure of exposure but didn't use this measurement in any model or analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. analysis is only exposed vs. unexposed; study published by company producing the chemical This is an observational epidemiology study | Non-Cancer: Immune/hematological | Occupational | No | Tsai et al. 2005 2988431 |
| Other Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study assesses occupational exposure. | Quantitative measurement type(s): None - no quantitative measurement Quantitative method(s): Reported Exposure Levels: Other The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological, Mortality, Musculoskeletal, Other Non-Cancer: Neurological/behavioral, Cardiovascular, Reproductive/developmental, Gastrointestinal, Immune/hematological, Mortality, Musculoskeletal, Renal/kidney, Lung/respiratory, Skin & connective tissue | Occupational | No | Tsai et al. 2001 2959630 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Duration of exposure, Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Job-Exposure Matrix (JEM) or similar, Concentration or dose per time period (ex: mg/day, mg/kg/day, ml/hour, ml/year, TWA, etc.) Reported Exposure Levels: An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Neurological/behavioral, Cancer of the Reproductive System, Gastrointestinal, Immune/hematological, Mortality, Renal/kidney, Lung/respiratory, Skin & connective tissue, Other: Benign neoplasms Non-Cancer: Neurological/behavioral, Cardiovascular, Gastrointestinal, Immune/hematological, Mortality, Nutritional/metabolic, Renal/kidney, Lung/respiratory | Occupational | Yes | UAB, 1995 5665016 |

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| 1,3-Butadiene- Parent compound | | | | | |
|---|--|--|---|----------------|---------------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DEvEx* | Citation, HERO ID, and Reviewer |
| Other Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study assesses occupational exposure. | Quantitative measurement type(s): Duration of exposure, Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Job-Exposure Matrix (JEM) or similar Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Neurological/behavioral, Cancer of the Reproductive System, Gastrointestinal, Immune/hematological, Hepatic/liver, Mortality, Nutritional/metabolic, Renal/kidney, Lung/respiratory, Other: "all cancer" Non-Cancer: Neurological/behavioral, Cardiovascular, Gastrointestinal, Immune/hematological, Mortality, Renal/kidney, Lung/respiratory, Other: Benign neoplasms, External causes, Other known, Unknown | Lifestyle Activities (ex. exercise, smoking), Occupational, Sociodemographic status (ex. home near exposure source), Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | Yes | UAB, 2007 6544020 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study assesses occupational exposure. | Quantitative measurement type(s): Biomarker of exposure with only binary data (detected/undetected), Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Concentration or dose per time period (ex: mg/day, mg/kg/day, ml/hour, ml/year, TWA, etc.) Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological, Mortality, Renal/kidney | Occupational | Yes | Valdez-Flores et al. 2022 11531254 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study does not assess occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Measured concentration or dose Reported Exposure Levels: An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Non-Cancer: Neurological/behavioral, Reproductive/developmental | Lifestage: Pregnant people (parent) or embryo/fetus (developmental) (conception through birth). Children (age 1 year through <11 years) Aggregate Exposures (ex. multiple air exposure sources) | Yes | von Ehrenstein et al. 2014 2453135 |

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| 1,3-Butadiene- Parent compound | | | | | |
|---|--|---|---|----------------|---------------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DEvEx* | Citation, HERO ID, and Reviewer |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study does not assess occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Modeled concentration or dose Reported Exposure Levels: An exposure-response model using a continuous measure (or estimate) of exposure The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Neurological/behavioral, Childhood cancer (before birth through age 18) | Lifestage: Pregnant people (parent) or embryo/fetus (developmental) (conception through birth), Infants (birth through <12 months), Children (age 1 year through <11 years) Geography/site-specific (ex. downstream of release sites), Sociodemographic status (ex. home near exposure source), Aggregate Exposures (ex. multiple air exposure sources), Other Chemical and Non-chemical stressors (ex. exposure to other substances that affect same organ as test chemical) | Yes | Von Ehrenstein et al. 2016 5684085 |
| Other Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) This study assesses occupational exposure. | Quantitative measurement type(s): Duration of exposure Quantitative method(s): Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study does not report a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological | Occupational, Sociodemographic status (ex. home near exposure source) | No | West et al. 1995 1268080 |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.) Chronic inhalation (more than 28 days) This study does not assess occupational exposure. | Quantitative measurement type(s): Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Modeled concentration or dose Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Immune/hematological | Lifestage: Children (age 1 year through <11 years), Adolescents (age 11 years through <21 years) Geography/site-specific (ex. downstream of release sites) | Yes | Whitworth et al. 2008 622776 |

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| 1,3-Butadiene- Parent compound | | | | | |
|---|---|--|--|-----------------|---------------------------------|
| Exposure | Measured Exposure | Principal Target Organs/Systems | PESS | Move to DDevEx* | Citation, HERO ID, and Reviewer |
| Inhalation Inhalation (air sampling, personal air monitoring, area air monitoring, inhalation chamber studies, shower studies, questionnaire assessing inhalation exposure, lung tissue exposure biomarkers, etc.), Other (duration, non-route-specific biomarker (matrices such as blood, urine, etc.) etc.) Chronic inhalation (more than 28 days) This study does not assess occupational exposure. | Quantitative measurement type(s): Duration of exposure, Quantitative measurement or estimate of concentration or dose of the chemical of interest Quantitative method(s): Biomarker of exposure with quantitative data Reported Exposure Levels: Three or more levels of exposure (i.e., referent group + 2 or more groups), which were used in the analyses of the association between the chemical of interest and a health outcome, A continuous measure of exposure but didn't use this measurement in any model or analyses of the association between the chemical of interest and a health outcome The study assesses the association between exposure to the chemical of interest and a health outcome. The study reports a quantitative measurement or estimate of concentration or dose of the chemical of interest. This is an observational epidemiology study | Cancer/ Carcinogenesis: Lung/respiratory | Lifestyle Activities (ex. exercise, smoking) | Yes | Yuan et al. 2012 1508766 |

* Data Quality Evaluation and Extraction