



National Toxicology Program

U.S. Department of Health and Human Services

**Standard Search Strings for
Literature Database Searches:
Appendix to the Draft Handbook for
Preparing Report on Carcinogens Monographs:**

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Office of the Report on Carcinogens
Division of the National Toxicology Program
National Institute of Environmental Health Sciences
U.S. Department of Health and Human Services

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Foreword

The National Toxicology Program (NTP) is an interagency program within the Public Health Service of the Department of Health and Human Services and is headquartered at the National Institute of Environmental Health Sciences of the National Institutes of Health (NIEHS/NIH). Three agencies contribute resources to the program: NIEHS/NIH, the National Institute for Occupational Safety and Health of the Centers for Disease Control and Prevention, and the National Center for Toxicological Research of the Food and Drug Administration. Established in 1978, the NTP is charged with coordinating toxicological testing activities, strengthening the science base in toxicology, developing and validating improved testing methods, and providing information about potentially toxic substances to health regulatory and research agencies, scientific and medical communities, and the public.

The NTP prepares the Report on Carcinogens (RoC), a science-based public health document, for the Secretary, Department of Health and Human Services. The Office of the RoC is responsible for carrying out this activity within the NTP and prepares a monograph for each substance evaluated for listing in the RoC (i.e., a candidate substance). The monograph is a literature-based review document that captures the cancer hazard evaluation.

This handbook provides instructions for preparing the RoC monographs. It is based largely on approaches outlined in protocols (i.e., methods) used to prepare RoC monographs starting in 2013, although the methods have since undergone a series of revisions. These monographs, prepared according to the protocols, have been peer reviewed by panels of experts. It is anticipated that this handbook will be refined as new tools for conducting literature-based systematic reviews are developed and from knowledge learned from conducting cancer hazard evaluations on candidate substances with more diverse databases.

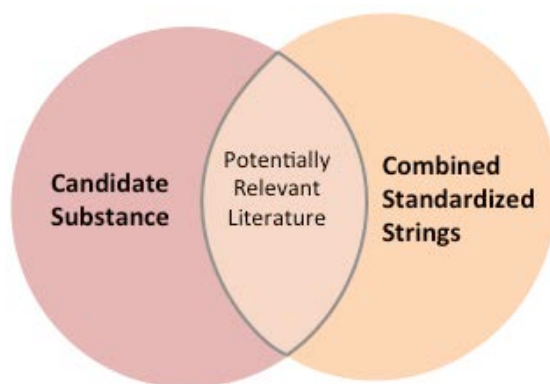
1 Introduction

The Office of the RoC (ORoC) has created a series of standardized citation database search strings for the key topic areas addressed in the cancer hazard evaluation: human cancer studies, cancer studies in experimental animals, mechanistic studies and other relevant data (such as absorption, distribution, metabolism and excretion, ADME), which complement the literature search strategy described in the Draft Handbook for Preparing Report on Carcinogen (RoC) Monographs (hereafter called RoC Handbook) (Part B, Section 1). The purpose of standardized search strings is to ensure that the searches for all candidate substances are consistent, reproducible, and transparent.

The search terms that make up the strings were collected by an information specialist and reviewed and edited by the subject matter experts of the ORoC before being structured into appropriate syntax for each database. These strings will continue to undergo testing and refinement and will be updated periodically to reflect changes that make them more effective for the purposes of the ORoC.

For each candidate substance, a unique search string is created to identify literature associated with the substance. In some cases, the literature on a candidate substance is limited and it is simpler to evaluate and categorize all the associated literature. However, in most cases the literature pool is large, and narrowing searches are used to help focus on the data more relevant for evaluating potential cancer hazards. This narrowing is accomplished by combining the candidate substance search in various ways with the standardized search strings to retrieve the intersection of potentially relevant results (see Figure 1).

Figure 1. Intersection of search strings to identify potentially relevant literature.



Searches for cancer studies in humans and experimental animals are conducted using standardized search strings for epidemiologic (human) studies and experimental animal studies in combination with cancer search strings prior to combining with the candidate substance search strings. ADME Search Strings and searches for mechanistic data (Section 2.5.2 to 2.5.5) would not normally be combined with the Cancer search, but are intersected directly with the candidate substance.

2 The Searches:

2.1 Cancer

The goal of this search is to provide a set of “narrowing” terms to focus on cancer topics as opposed to other adverse effects or health outcomes. In some cases it may be used directly against the results of the search for the candidate substance. It is generally used in combination with the human (epidemiology) or the experimental animal studies search strings.

This search string was developed primarily by removing terms from the PubMed Cancer filter to make it more focused on the topics of interest for cancer hazard literature-based evaluations captured in the RoC monographs. It still returns a broad literature set associated with cancer.

Types of terms removed from the PubMed Cancer Filter include:

- Cancer testing/screening methods
- Cancer treatment methods
- Caregivers/Medical specialty (Oncologist, Oncology, etc.)
- Journal names
- Oncogenic virus names (can be searched specifically when applicable)
- Organization names

In the PubMed search, individual tumors or cancers are searched as text words only in the Non-Medline set. Within the indexed set, the search depends upon the MeSH Neoplasms term and other MeSH terms to select the relevant literature. This limitation is not replicated in other databases.

2.1.1 Cancer Search Strings

PubMed

((("angiogenesis inducing agents"[mh] OR "myelodysplastic-myeloproliferative diseases"[mh] OR "neoplasms"[mh] OR "carcinogenicity tests"[mh] OR "carcinogens"[mh] OR (sentinel-lymph-node[tiab] NOT biopsy[tiab]) OR (ASCO[tiab] NOT fungi[tiab]) OR (WAGR[tiab] AND syndrome[tiab]) OR 5q-syndrome[tiab] OR leukostasis[tiab])) OR ((acanthoma[tiab] OR acanthomas[tiab] OR acrochordon[tiab] OR acrochordons[tiab] OR acrospiroma[tiab] OR acrospiromas[tiab] OR adamantinoma[tiab] OR adamantinomas[tiab] OR adenoacanthoma[tiab] OR adenoacanthomas[tiab] OR adenoameloblastoma[tiab] OR adenoameloblastomas[tiab] OR adenocanthoma[tiab] OR adenocanthomas[tiab] OR adenocarcinoma[tiab] OR adenocarcinomas[tiab] OR adenofibroma[tiab] OR adenofibromas[tiab] OR adenolipoma[tiab] OR adenolipomas[tiab] OR adenolymphoma[tiab] OR adenolymphomas[tiab] OR adenoma[tiab] OR adenomas[tiab] OR adenomatosis[tiab] OR adenomatous[tiab] OR adenomyoepithelioma[tiab] OR adenomyoepitheliomas[tiab] OR adenomyoma[tiab] OR adenomyomas[tiab] OR adenosarcoma[tiab] OR adenosarcomas[tiab] OR adenositis[tiab] OR aesthesioneuroblastoma[tiab] OR aesthesioneuroblastomas[tiab] OR ameloblastoma[tiab] OR ameloblastomas[tiab] OR amyloidoses[tiab] OR amyloidosis[tiab] OR anaplasia[tiab] OR androblastoma[tiab] OR androblastomas[tiab] OR angioblastoma[tiab] OR angioblastomas[tiab] OR angioendothelioma[tiab] OR angioendotheliomas[tiab] OR angioendotheliomatosis[tiab] OR angiofibroma[tiab] OR angiofibromas[tiab] OR angiofibrosarcoma[tiab]

OR angiokeratoma[tiab] OR angiokeratomas[tiab] OR angiroleiomyoma[tiab] OR angiroleiomyomas[tiab] OR angioliipoma[tiab] OR angioliipomas[tiab] OR angioma[tiab] OR angiomas[tiab] OR angiomatosis[tiab] OR angiomyoliipoma[tiab] OR angiomyoliipomas[tiab] OR angiomyoma[tiab] OR angiomyomas[tiab] OR angiomyxoma[tiab] OR angiomyxomas[tiab] OR angioreticuloma[tiab] OR angioreticulomas[tiab] OR angiosarcoma[tiab] OR angiosarcomas[tiab] OR apudoma[tiab] OR apudomas[tiab] OR argentaffinoma[tiab] OR argentaffinomas[tiab] OR arrhenoblastoma[tiab] OR arrhenoblastomas[tiab] OR astroblastoma[tiab] OR astroblastomas[tiab] OR astrocytoma[tiab] OR astrocytomas[tiab] OR astroglioma[tiab] OR astrogliomas[tiab] OR baltoma[tiab] OR basiloma[tiab] OR basilomas[tiab] OR blastoma[tiab] OR blastomas[tiab] OR Buschke-Lowenstein[tiab] OR cancer[tiab] OR cancerous[tiab] OR cancers[tiab] OR carcinogen[tiab] OR carcinogenesis[tiab] OR carcinogenic[tiab] OR carcinogenicity-test*[tiab] OR carcinogens[tiab] OR carcinoid[tiab] OR carcinoma[tiab] OR carcinomas[tiab] OR carcinomatosis[tiab] OR carcinosarcoma[tiab] OR carcinosarcomas[tiab] OR cavernoma[tiab] OR cavernomas[tiab] OR cementoma[tiab] OR cementomas[tiab] OR ceruminoma[tiab] OR ceruminomas[tiab] OR chemodectoma[tiab] OR chemodectomas[tiab] OR cherubism[tiab] OR chloroma[tiab] OR chloromas[tiab] OR cholangiocarcinoma[tiab] OR cholangiocarcinomas[tiab] OR cholangiohepatoma[tiab] OR cholangioma[tiab] OR cholangiomas[tiab] OR cholangiosarcoma[tiab] OR cholesteatoma[tiab] OR cholesteatomas[tiab] OR chondroblastoma[tiab] OR chondroblastomas[tiab] OR chondroma[tiab] OR chondromas[tiab] OR chondrosarcoma[tiab] OR chondrosarcomas[tiab] OR chordoma[tiab] OR chordomas[tiab] OR chorioadenoma[tiab] OR chorioadenomas[tiab] OR chorioangioma[tiab] OR chorioangiomas[tiab] OR choriocarcinoma[tiab] OR choriocarcinomas[tiab] OR chorioepithelioma[tiab] OR chorioepitheliomas[tiab] OR chorionepithelioma[tiab] OR chorionepitheliomas[tiab] OR choristoma[tiab] OR choristomas[tiab] OR chromaffinoma[tiab] OR chromaffinomas[tiab] OR CIN[tiab] OR CLL[tiab] OR cocarcinogenesis[tiab] OR collagenoma[tiab] OR collagenomas[tiab] OR comedocarcinoma[tiab] OR comedocarcinomas[tiab] OR condyloma[tiab] OR condylomas[tiab] OR corticotropinoma[tiab] OR corticotropinomas[tiab] OR craniopharyngioma[tiab] OR craniopharyngiomas[tiab] OR cylindroma[tiab] OR cylindromas[tiab] OR cystadenocarcinoma[tiab] OR cystadenocarcinomas[tiab] OR cystadenofibroma[tiab] OR cystadenofibromas[tiab] OR cystadenoma[tiab] OR cystadenomas[tiab] OR cystoma[tiab] OR cystomas[tiab] OR cystosarcoma[tiab] OR cystosarcomas[tiab] OR dentinoma[tiab] OR dentinomas[tiab] OR dermatofibroma[tiab] OR dermatofibromas[tiab] OR dermatofibrosarcoma[tiab] OR dermatofibrosarcomas[tiab] OR dermoid[tiab] OR dictyoma[tiab] OR dysgerminoma[tiab] OR dysgerminomas[tiab] OR dyskeratoma[tiab] OR dyskeratomas[tiab] OR dysmyelopoiesis[tiab] OR ectomesenchymoma[tiab] OR ectomesenchymomas[tiab] OR elastofibroma[tiab] OR elastofibromas[tiab] OR enchondroma[tiab] OR enchondromas[tiab] OR enchondromatosis[tiab] OR endothelioma[tiab] OR endotheliomas[tiab] OR ependymblastoma[tiab] OR ependymblastomas[tiab] OR ependymoma[tiab] OR ependymomas[tiab] OR epidermoid[tiab] OR epithelioma[tiab] OR epitheliomas[tiab] OR erythroleukaemia[tiab] OR erythroleukaemias[tiab] OR erythroleukemia[tiab] OR erythroleukemias[tiab] OR erythroplakia[tiab] OR erythroplakias[tiab] OR erythroplasia[tiab] OR essential-thrombocythemia[tiab] OR esthesioneuroblastoma[tiab] OR esthesioneuroblastomas[tiab] OR esthesioneuroepithelioma[tiab] OR esthesioneuroepitheliomas[tiab] OR exostosis[tiab] OR fibroadenoma[tiab] OR fibroadenomas[tiab] OR fibroadenosarcoma[tiab] OR fibroadenosis[tiab] OR fibrochondrosarcoma[tiab] OR fibroelastoma[tiab] OR fibroelastomas[tiab] OR fibroepithelioma[tiab] OR fibroepitheliomas[tiab] OR fibrofolliculoma[tiab] OR fibrofolliculomas[tiab] OR fibroid[tiab] OR fibroids[tiab] OR fibrolipoma[tiab] OR fibrolipomas[tiab] OR fibroliposarcoma[tiab] OR fibroma[tiab] OR fibromas[tiab] OR fibromatosis[tiab] OR fibromyoma[tiab] OR fibromyomas[tiab] OR fibromyxoliipoma[tiab] OR fibromyxoma[tiab] OR fibromyxomas[tiab] OR fibroodontoma[tiab] OR fibroodontomas[tiab] OR fibrosarcoma[tiab] OR

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rhabdomyosarcoma[tiab] OR rhabdomyosarcomas[tiab] OR rhabdosarcoma[tiab] OR rhabdosarcomas[tiab] OR sarcoma[tiab] OR sarcomas[tiab] OR sarcomatosis[tiab] OR schwannoma[tiab] OR schwannomas[tiab] OR schwannomatosis[tiab] OR seminoma[tiab] OR seminomas[tiab] OR seminomatous[tiab] OR sezary-syndrome[tiab] OR somatostatinoma[tiab] OR somatostatinomas[tiab] OR somatotropinoma[tiab] OR somatotropinomas[tiab] OR spermatocytoma[tiab] OR spiradenoma[tiab] OR spiradenomas[tiab] OR spongioblastoma[tiab] OR spongioblastomas[tiab] OR steatocystoma[tiab] OR steatocystomas[tiab] OR struma-ovarii[tiab] OR subependymoma[tiab] OR subependymomas[tiab] OR syringadenoma[tiab] OR syringadenomas[tiab] OR syringocystadenoma[tiab] OR syringocystadenomas[tiab] OR syringoma[tiab] OR syringomas[tiab] OR teratocarcinoma[tiab] OR teratocarcinomas[tiab] OR teratoma[tiab] OR teratomas[tiab] OR thecoma[tiab] OR thecomas[tiab] OR thymolipoma[tiab] OR thymolipomas[tiab] OR thymoma[tiab] OR thymomas[tiab] OR trichilemmoma[tiab] OR trichilemmomas[tiab] OR trichoadenoma[tiab] OR trichoblastoma[tiab] OR trichoblastomas[tiab] OR trichodiscoma[tiab] OR trichodiscomas[tiab] OR trichoepithelioma[tiab] OR trichoepitheliomas[tiab] OR trichofolliculoma[tiab] OR trichofolliculomas[tiab] OR tricholemmoma[tiab] OR tricholemmomas[tiab] OR tumor[tiab] OR tumorigenesis[tiab] OR tumorigenic[tiab] OR tumorigenesis[tiab] OR tumorigenic[tiab] OR tumor-marker*[tiab] OR tumorigenesis[tiab] OR tumorigenic[tiab] OR tumors[tiab] OR tumour[tiab] OR tumours[tiab] OR vipoma[tiab] OR vipomas[tiab] OR waldenstrom[tiab] OR waldenstroms[tiab] OR xanthoastrocytoma[tiab] OR xanthoastrocytomas[tiab] OR xanthofibroma[tiab] OR xanthofibromas[tiab] OR xanthogranuloma[tiab] OR xanthogranulomas[tiab] OR xanthoma[tiab] OR xanthomas[tiab] OR xanthosarcoma[tiab] OR xanthosarcomas[tiab] OR oncogene-fusion[tiab] NOT medline[sb])

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Web of Science

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OR cholesteatoma OR cholesteatomas OR chondroblastoma OR chondroblastomas OR chondroma OR chondromas OR chondrosarcoma OR chondrosarcomas OR chordoma OR chordomas OR chorioadenoma OR chorioadenomas OR chorioangioma OR chorioangiomas OR choriocarcinoma OR choriocarcinomas OR chorioepithelioma OR chorioepitheliomas OR chorionepithelioma OR chorionepitheliomas OR choristoma OR choristomas OR chromaffinoma OR chromaffinomas OR CLL OR cocarcinogenesis OR collagenoma OR collagenomas OR comedocarcinoma OR comedocarcinomas OR condyloma OR condylomas OR corticotropinoma OR corticotropinomas OR craniopharyngioma OR craniopharyngiomas OR cylindroma OR cylindromas OR cystadenocarcinoma OR cystadenocarcinomas OR cystadenofibroma OR cystadenofibromas OR cystadenoma OR cystadenomas OR cystoma OR cystomas OR cystosarcoma OR cystosarcomas OR dentinoma OR dentinomas OR dermatofibroma OR dermatofibromas OR dermatofibrosarcoma OR dermatofibrosarcomas OR dermoid OR dictyoma OR dysgerminoma OR dysgerminomas OR dyskeratoma OR dyskeratomas OR dysmyelopoiesis OR ectomesenchymoma OR ectomesenchymomas OR elastofibroma OR elastofibromas OR enchondroma OR enchondromas OR enchondromatosis OR endothelioma OR endotheliomas OR ependymblastoma OR ependymblastomas OR ependymoma OR ependymomas OR epidermoid OR epithelioma OR epitheliomas OR erythroleukaemia OR erythroleukaemias OR erythro leukemia OR erythro leukemias OR erythroplakia OR erythroplakias OR erythroplasia OR essential thrombocythemia OR esthesioneuroblastoma OR esthesioneuroblastomas OR esthesioneuroepithelioma OR esthesioneuroepitheliomas OR exostosis OR fibroadenoma OR fibroadenomas OR fibroadenosarcoma OR fibroadenosis OR fibrochondrosarcoma OR fibroelastoma OR fibroelastomas OR fibroepithelioma OR fibroepitheliomas OR fibrofolliculoma OR fibrofolliculomas OR fibroid OR fibroids OR fibrolipoma OR fibrolipomas OR fibroliposarcoma OR fibroma OR fibromas OR fibromatosis OR fibromyoma OR fibromyomas OR fibromyxolipoma OR fibromyxoma OR fibromyxomas OR fibroodontoma OR fibroodontomas OR fibrosarcoma OR fibrosarcomas OR fibrothecoma OR fibrothecomas OR fibroxanthoma OR fibroxanthomas OR fibroxanthosarcoma OR fibroxanthosarcomas OR ganglioblastoma OR ganglioblastomas OR gangliocytoma OR gangliocytomas OR ganglioglioma OR gangliogliomas OR ganglioneuroblastoma OR ganglioneuroblastomas OR ganglioneurofibroma OR ganglioneurofibromas OR ganglioneuroma OR ganglioneuromas OR gastrinoma OR gastrinomas OR germinoma OR germinomas OR glioblastoma OR glioblastomas OR gliofibroma OR gliofibromas OR glioma OR gliomas OR gliomatosis OR glioneuroma OR glioneuromas OR gliosarcoma OR gliosarcomas OR glomangioma OR glomangiomas OR glomangiomatosis OR glomangiomyoma OR glomangiomyomas OR glomangiosarcoma OR glomangiosarcomas OR glucagonoma OR glucagonomas OR gonadoblastoma OR gonadoblastomas OR gonocytoma OR gonocytomas OR granuloma OR granulomas OR granulomatosis OR gynaecomastia OR gynandroblastoma OR gynecomastia OR haemangioblastoma OR haemangioblastomas OR haemangioma OR haemangiomas OR haemangiopericytoma OR haemangiopericytomas OR haemangiosarcoma OR haemangiosarcomas OR hamartoma OR hamartomas OR hemangioblastoma OR hemangioblastomas OR hemangioendothelioma OR hemangioendotheliomas OR hemangioendotheliosarcoma OR hemangioendotheliosarcomas OR hemangioma OR hemangiomas OR hemangiomatosis OR hemangiopericytoma OR hemangiopericytomas OR hemangioperithelioma OR hemangiosarcoma OR hemangiosarcomas OR hepatoblastoma OR hepatoblastomas OR hepatocarcinoma OR hepatocarcinomas OR hepatocholangiocarcinoma OR hepatocholangiocarcinomas OR hepatoma OR hepatomas OR hibernoma OR hibernomas OR hidradenoma OR hidradenomas OR hidrocystoma OR hidrocystomas OR histiocytoma OR histiocytomas OR hodgkin OR hodgkins OR hydradenoma OR hydradenomas OR hypernephroma OR hypernephromas OR immunocytoma OR immunocytoma OR insulinomas OR keratoacanthoma OR keratoacanthomas OR leiomyoblastoma OR leiomyoblastomas OR leiomyofibroma

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TITLE-ABS ("acanthoma" OR "acanthomas" OR "acrochordon" OR "acrochordons" OR "acrosiroma" OR "acrosiromas" OR "adamantinoma" OR "adamantinomas" OR "adenoacanthoma" OR "adenoacanthomas" OR "adenoameloblastoma" OR "adenoameloblastomas" OR "adenocanthoma" OR "adenocanthomas" OR "adenocarcinoma" OR "adenocarcinomas" OR "adenofibroma" OR "adenofibromas" OR "adenolipoma" OR "adenolipomas" OR "adenolymphoma" OR "adenolymphomas" OR "adenoma" OR "adenomas" OR "adenomatosis" OR "adenomatous" OR "adenomyoepithelioma" OR "adenomyoepitheliomas" OR "adenomyoma" OR "adenomyomas" OR "adenosarcoma" OR "adenosarcomas" OR "adenosis" OR "aesthesioneuroblastoma" OR "aesthesioneuroblastomas" OR "ameloblastoma" OR "ameloblastomas" OR "amyloidoses" OR "amyloidosis" OR "anaplasia" OR "androblastoma" OR "androblastomas" OR "angioblastoma" OR "angioblastomas" OR "angioendothelioma" OR "angioendotheliomas" OR "angioendotheliomatosis" OR "angiofibroma" OR "angiofibromas" OR "angiofibrosarcoma" OR "angiokeratoma" OR "angiokeratomas" OR "angioleiomyoma" OR "angioleiomyomas" OR "angiolipoma" OR "angiolipomas" OR "angioma" OR "angiomas" OR "angiomatosis" OR "angiomyolipoma" OR "angiomyolipomas" OR "angiomyoma" OR "angiomyomas" OR "angiomyxoma" OR "angiomyxomas" OR "angioreticuloma" OR "angioreticulomas" OR "angiosarcoma" OR "angiosarcomas" OR "apudoma" OR "apudomas" OR "argentaffinoma" OR "argentaffinomas" OR "arrhenoblastoma" OR "arrhenoblastomas" OR "astroblastoma" OR "astroblastomas" OR "astrocytoma" OR "astrocytomas" OR "astroglioma" OR "astrogliomas" OR "baltoma" OR

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OR ("sentinel-lymph-node" AND NOT biopsy) OR (asco AND NOT fungi) OR (wagr W/3 syndrome) OR "5q-syndrome") OR KEY ("angiogenesis inducing agents" OR "myelodysplastic-myeloproliferative diseases" OR "neoplasms")

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2.2 Human Cancer Studies

The goal of the search for this monograph section (see RoC Handbook: Part D, Section 1) is to identify human studies (primarily epidemiologic) that have assessed exposure to a specific candidate substance and a cancer outcome. The Epidemiological (Human) Studies Search Strings (below) would be used in combination with the Cancer Search String (Section 2.1) to focus on the most relevant literature.

Epidemiological (Human) Studies Search Strings (below) are intended to identify an exhaustive list of epidemiologic studies in humans fitting the following types:

- Case reports and case series
- Cohort studies
- Case-control and case-referent studies
- Ecological studies
- Meta-analysis
- Workers (some epidemiological studies are defined in the title, abstract, and key words as studies of workers rather than by a specific study design)

Search terms for randomized clinical trials are not included in the strings as they are rarely used to evaluate potential hazards; however, they may be included in searches for specific candidate substances if warranted. Note, however, that the search strings provided here are not the only method by which human studies may be identified for the RoC. The mechanistic searches, mining the citations of reviews and other studies, and specially targeted searches are additional methods of identifying human/epidemiologic studies.

The focus of the search string is to collect epidemiological or clinical studies of human subjects and not necessarily other types of studies with humans. Therefore various terms that might be expected (such as age groups) are not included.

2.2.1 Epidemiological (Human) Studies Search Strings

PubMed

```
((("Epidemiologic Studies"[mh] OR "epidemiology"[sh] OR "Meta-Analysis"[pt] OR "Case Report"[pt] OR workmen*[tiab] OR Worker*[tiab] OR Seroepidemiologic-Stud*[tiab] OR retrospective-stud*[tiab] OR prospective-stud*[tiab] OR Mortality[tiab] OR longitudinal-stud*[tiab] OR follow-up stud*[tiab] OR ecological-study[tiab] OR ecological-studies[tiab] OR Cross-Sectional Stud*[tiab] OR Correlation-stud*[tiab] OR cohort*[tiab] OR case-control*[tiab] OR cancer-registr*[tiab] OR case-series[tiab] OR case-referent[tiab] OR record-link*[tiab])) OR ((metaanalysis[tiab] OR case-report[tiab] OR metaanalyses[tiab] OR meta-analysis[tiab]) NOT medline[sb]))
```

Web of Science

```
TS=("Epidemiologic Stud*" OR Meta-Analysis OR workmen* OR Worker* OR "Seroepidemiologic Stud*" OR "retrospective stud*" OR "prospective stud*" OR Mortality OR "longitudinal stud*" OR "follow-up stud*" OR "ecological study" OR "ecological studies" OR "Cross-Sectional Stud*" OR
```

"Correlation stud*" OR cohort* OR "case control*" OR "cancer registr*" OR metaanalysis OR metaanalyses OR "case report" OR "Case series" OR "Case referent" OR "record-link*")

Scopus

TITLE-ABS-KEY ("Epidemiologic Stud*" OR "Meta-Analysis" OR workmen* OR worker* OR "Seroepidemiologic Stud*" OR "retrospective stud*" OR "prospective stud*" OR mortality OR "longitudinal stud*" OR "follow-up stud*" OR "ecological study" OR "ecological studies" OR "Cross-Sectional Stud*" OR "Correlation stud*" OR cohort* OR "case control*" OR "cancer registr*" OR metaanalysis OR metaanalyses OR "meta- analyses" OR "case report" OR "Case series" OR "Case referent" OR "record-link*")

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2.3 Cancer in Experimental Animals

The goal of the literature search for this section of a RoC Monograph (see RoC Handbook: Part E, Section 1) is to identify studies that inform whether a substance causes cancer in experimental animals. The Experimental Animals Studies Search Strings (below) are used in combination with the Cancer Search Strings (Section 2.1) to focus on the most relevant literature.

Note, however, that the search strings provided here are not the only methods by which animal studies may be identified. The mechanistic searches, mining the citations of reviews and other studies, and specially targeted searches are additional methods of identifying cancer studies in experimental animals.

The terms for the Experimental Animals Search Strings were selected to focus on experimental studies with the following characteristics:

- In vivo
- Non-human mammalian subjects

2.3.1 Experimental Animals Studies Search Strings

PubMed

("Animals, Genetically Modified"[mh] OR "Animals, Inbred Strains"[mh] OR "Chimera"[mh] OR "Animals, Laboratory"[mh]) OR (animal-stud*[tiab] OR wood-mouse[tiab] OR murinae[tiab] OR muridae[tiab] OR cricetinae[tiab] OR rodentia[tiab] OR rodent[tiab] OR rodents[tiab] OR ferrets[tiab] OR ferret[tiab] OR polecat*[tiab] OR mustela-putorius[tiab] OR cavia[tiab] OR callithrix[tiab] OR marmoset*[tiab] OR chinchilla*[tiab] OR jird[tiab] OR jirds[tiab] OR merione[tiab] OR meriones[tiab] OR cats[tiab] OR cat[tiab] OR felis[tiab] OR canis[tiab] OR sheep[tiab] OR sheeps[tiab] OR goats[tiab] OR goat[tiab] OR capra[tiab] OR saguinus[tiab] OR tamarin*[tiab] OR leontopithecus[tiab] OR ape[tiab] OR apes[tiab] OR pan-paniscus[tiab] OR bonobo*[tiab] OR pan-troglodytes[tiab] OR gibbon*[tiab] OR siamang*[tiab] OR nomascus[tiab] OR symphalangus[tiab] OR chimpanzee*[tiab] OR orangutan*[tiab] OR horse[tiab] OR horses[tiab] OR equus[tiab] OR cow[tiab] OR cows[tiab] OR chicken[tiab] OR chickens[tiab] OR wistar[tiab] OR balb[tiab] OR C57[tiab] OR C57bl[tiab] OR quail[tiab] OR long-evans[tiab] OR guppy[tiab] OR medaka[tiab] OR zebrafish[tiab] OR flying-fox[tiab] OR Fruit-bat[tiab] OR non-human-primate*[tiab] OR capuchin*[tiab] OR rhesus[tiab] OR macaque*[tiab] OR cattle[tiab] OR bovine[tiab] OR pigs[tiab] OR pig[tiab] OR swine[tiab] OR swines[tiab] OR piglet*[tiab] OR Sprague-Dawley[tiab] OR vervet*[tiab]) OR ((mice[tiab] OR mouse[tiab] OR murine[tiab] OR rats[tiab] OR rat[tiab] OR hamster[tiab] OR hamsters[tiab] OR guinea-pig*[tiab] OR gerbil*[tiab] OR rabbits[tiab] OR rabbit[tiab] OR dogs[tiab] OR dog[tiab] OR monkey[tiab] OR monkeys[tiab] OR pongo-pygmaeus[tiab] OR sow[tiab] OR sows[tiab] OR boar[tiab] OR boars[tiab]) NOT medline[sb])

Web of Science

TS=("mice" OR "mouse" OR "rats" OR "rat" OR "hamster" OR "hamsters" OR "guinea pig*" OR "gerbil*" OR "rabbits" OR "rabbit" OR "dogs" OR "dog" OR "monkey" OR "monkeys" OR "pongo pygmaeus" OR "sow" OR "sows" OR "boar" OR "boars" OR "animal-stud*" OR "murine" OR "wood-

mouse" OR "murinae" OR "muridae" OR "cricetinae" OR "rodentia" OR "rodent" OR "rodents" OR "ferrets" OR "ferret" OR "polecat*" OR "mustela putorius" OR "cavia" OR "callithrix" OR "marmoset*" OR "chinchilla*" OR "jird" OR "jirds" OR "merione" OR "meriones" OR "cats" OR "cat" OR "felis" OR "canis" OR "sheep" OR "sheeps" OR "goats" OR "goat" OR "capra" OR "saguinus" OR "tamarin*" OR "leontopithecus" OR "ape" OR "apes" OR "pan-paniscus" OR "bonobo*" OR "pan troglodytes" OR "gibbon*" OR "siamang*" OR "nomascus" OR "symphalangus" OR "chimpanzee*" OR "orangutan*" OR "horse" OR "horses" OR "equus" OR "cow" OR "cows" OR "chicken" OR "chickens" OR "wistar" OR "balb" OR "C57" OR "C57bl" OR "quail" OR "long-evans" OR "guppy" OR "medaka" OR "zebrafish" OR "flying fox" OR "Fruit bat" OR "non-human-primate*" OR "capuchin*" OR "rhesus" OR "macaque*" OR "cattle" OR "bovine" OR "pigs" OR "pig" OR "swine" OR "swines" OR "piglet*" OR "Sprague-Dawley" OR "vervet*" OR "chimera")

Scopus

KEY ("Animals, Genetically Modified" OR "Animals, Inbred Strains" OR "Chimera" OR "Animals, Laboratory") OR TITLE-ABS ("mice" OR "mouse" OR "rats" OR "rat" OR "hamster" OR "hamsters" OR "guinea pig*" OR "gerbil*" OR "rabbits" OR "rabbit" OR "dogs" OR "dog" OR "monkey" OR "monkeys" OR "pongo pygmaeus" OR "sow" OR "sows" OR "boar" OR "boars" OR "animal-stud*" OR "murine" OR "wood-mouse" OR "murinae" OR "muridae" OR "cricetinae" OR "rodentia" OR "rodent" OR "rodents" OR "ferrets" OR "ferret" OR "polecat*" OR "mustela putorius" OR "cavia" OR "callithrix" OR "marmoset*" OR "chinchilla*" OR "jird" OR "jirds" OR "merione" OR "meriones" OR "cats" OR "cat" OR "felis" OR "canis" OR "sheep" OR "sheeps" OR "goats" OR "goat" OR "capra" OR "saguinus" OR "tamarin*" OR "leontopithecus" OR "ape" OR "apes" OR "pan-paniscus" OR "bonobo*" OR "pan troglodytes" OR "gibbon*" OR "siamang*" OR "nomascus" OR "symphalangus" OR "chimpanzee*" OR "orangutan*" OR "horse" OR "horses" OR "equus" OR "cow" OR "cows" OR "chicken" OR "chickens" OR "wistar" OR "balb" OR "C57" OR "C57bl" OR "quail" OR "long-evans" OR "guppy" OR "medaka" OR "zebrafish" OR "flying fox" OR "Fruit bat" OR "non-human-primate*" OR "capuchin*" OR "rhesus" OR "macaque*" OR "cattle" OR "bovine" OR "pigs" OR "pig" OR "swine" OR "swines" OR "piglet*" OR "Sprague-Dawley" OR "vervet*")

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2.5 Other Relevant Data

The goal of the literature search for this monograph section (see RoC Handbook: Part F, Section 1) is to ensure that the selected biological processes are adequately explored to provide clarification and support to an understanding of the carcinogenic effects of the candidate substance, and biological plausibility for the effects observed in humans or experimental animals.

Four search strings pertain to the Other Relevant Data section: ADME, Characteristics of Carcinogens, Genotoxicity, and Other Mechanistic Terms.

2.5.1 ADME Search Strings

The goal of the ADME search is to provide supporting literature for use within the Disposition and Toxicokinetics section of the monograph (see RoC Handbook: Part F, Section 3). The intent of these sections is to ensure that the processes are adequately understood to provide clarification and support to understanding the carcinogenic effects of the candidate substance.

PubMed

((Volume-of-Distribution[tiab] OR Toxicokinetics[mh] OR tissue-distribut*[tiab] OR Renal Elimination[mh] OR protein-bound[tiab] OR protein-bind*[tiab] OR plasma-protein[tiab] OR Pharmacokinetics[mh] OR Metabolism[mh] OR kinetic[tiab] OR Intestinal Elimination[mh] OR Hepatobiliary Elimination[mh] OR Hepatobiliary[tiab] OR enterohepatic[tiab] OR entero-hepatic[tiab] OR Distribution-volume[tiab] OR cellular-clearance[tiab] OR cell-clearance[tiab] OR Biotransformation[tiab] OR bioavailability[tiab] OR ADME[tiab] OR absorptive[tiab] OR (Skin[tiab] AND absorption[tiab]) OR (Oral[tiab] AND absorption[tiab]) OR (Injection[tiab] AND absorption[tiab]) OR (Gavage[tiab] AND absorption[tiab]) OR (Dietary[tiab] AND absorption[tiab]) OR (Dermal[tiab] AND absorption[tiab])) OR ((urine[tiab] OR Urination[tiab] OR toxicokinetic*[tiab] OR Pharmacokinetic*[tiab] OR Metabolite*[tiab] OR metabolism[tiab] OR Metabolic* [tiab] OR feces[tiab] OR fecal[tiab] OR excretion[tiab] OR defecation[tiab] OR biliary[tiab] OR Bile[tiab]) NOT Medline[sb]))

Web of Science

TS=(Hepatobiliary OR enterohepatic OR "entero hepatic" OR bioavailability OR absorptive OR (Skin AND absorption) OR (Oral AND absorption) OR (Injection AND absorption) OR (Gavage AND absorption) OR (Dietary AND absorption) OR (Dermal AND absorption) OR "Volume of Distribution" OR "tissue distribut*" OR "protein bound" OR "protein bind*" OR "plasma-protein" OR "Distribution volume" OR urine OR Urination OR feces OR fecal OR excretion OR defecation OR biliary OR Bile OR "Renal Elimination" OR "Intestinal Elimination" OR "Hepatobiliary Elimination" OR "cellular clearance" OR "cell clearance" OR toxicokinetic* OR Pharmacokinetic* OR kinetic OR ADME OR Metabolite* OR metabolism OR Metabolic* OR Biotransformation)

Scopus

TITLE_ABS(Hepatobiliary OR enterohepatic OR "entero hepatic" OR bioavailability OR absorptive OR (Skin AND absorption) OR (Oral AND absorption) OR (Injection AND absorption) OR (Gavage AND absorption) OR (Dietary AND absorption) OR (Dermal AND absorption) OR "Volume of Distribution" OR "tissue distribut*" OR "protein bound" OR "protein bind*" OR "plasma-protein" OR "Distribution volume" OR urine OR Urination OR feces OR fecal OR excretion OR defecation OR biliary OR Bile OR "Renal Elimination" OR "Intestinal Elimination" OR "Hepatobiliary Elimination" OR "cellular clearance" OR "cell clearance" OR toxicokinetic* OR Pharmacokinetic* OR kinetic OR ADME OR Metabolite* OR metabolism OR Metabolic* OR Biotransformation)

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2.5.2 Characteristics of Carcinogens Search Strings

This search is a combination of ten searches, each targeting a characteristic of carcinogens as defined in Smith *et al.*, 2015 ([Environmental Health Perspectives DOI:10.1289/ehp.1509912](https://doi.org/10.1289/ehp.1509912)). It is intended to locate literature relevant to the Mechanistic and Genotoxicity sections of a monograph (see RoC Handbook: Part F, Section 1). This search is not generally used in conjunction with the Cancer Search Strings.

Ten Characteristics of Carcinogens:

- (1) act as an electrophile either directly or after metabolic activation
- (2) be genotoxic
- (3) alter DNA repair or cause genomic instability
- (4) induce epigenetic alterations
- (5) induce oxidative stress
- (6) induce chronic inflammation
- (7) be an immunomodulator
- (8) modulate receptor-mediated effects
- (9) cause immortalization
- (10) alter cell proliferation, cell death, or nutrient supply

PubMed

((adduct-formation[tiab] OR "DNA Adducts"[mh] OR DNA-Adduct*[tiab] OR electrophile[tiab] OR electrophilic[tiab] OR dna-alkylating-agent*[tiab] OR "Comet Assay"[mh] OR "Germ-line-mutation"[mh] OR "Mutagenesis"[mh] OR "Mutagenicity tests"[mh] OR "Sister-chromatid exchange"[mh] OR "Mutation"[mh] OR Ames-Assay[tiab] OR Ames-test[tiab] OR Bacterial-Reverse-Mutation-Assay[tiab] OR Clastogen*[tiab] OR DNA-Repair*[tiab] OR Genetic-toxicology[tiab] OR hyperploid[tiab] OR micronucleus-test[tiab] OR tetraploid[tiab] OR Chromosome-aberrations[tiab] OR DNA damage[tiab] OR Mutation[tiab] OR chromosome-translocations[tiab] OR DNA protein crosslinks[tiab] OR DNA-damag*[tiab] OR DNA-inhibit*[tiab] OR Micronuclei[tiab] OR Micronucleus[tiab] OR Mutagens[tiab] OR Strand-break*[tiab] OR Unscheduled-DNA-synthes*[tiab] OR chromosomal-aberration[tiab] OR chromosome-aberration[tiab] OR chromosomal-aberrations[tiab] OR chromosomal-abnormalit*[tiab] OR chromosome-abnormalit*[tiab] OR genotoxic[tiab] OR "SOS Response (Genetics)"[mh] OR "Polyploidy"[mh] OR "Genomic Instability"[mh] OR "DNA Repair"[mh] OR "Aneuploidy"[mh] OR (DNA[tiab] AND Crosslink[tiab]) OR microsatellite-instability[tiab] OR chromosomal-instability[tiab] OR binucleation[tiab] OR binucleated[tiab] OR "ubiquitination"[mh] OR "Gene Expression Regulation"[mh] OR "epigenomics"[mh] OR "DNA methylation"[mh] OR "gene silencing"[mh] OR "histone deacetylases"[mh] OR "RNA Interference"[mh] OR "microRNAs"[mh] OR "RNA, Small Interfering"[mh] OR CpG-island-Methylator[tiab] OR CpG-island-Methylation[tiab] OR epigenotype[tiab] OR epimutation*[tiab] OR methylation-associated-silencing[tiab] OR histone-tail-modifications[tiab] OR histone-tail-modification[tiab] OR chromatin-organization[tiab] OR histone-modification[tiab] OR epigenetic*[tiab] OR epigenomic*[tiab] OR rna-interference[tiab] OR gene-activation[tiab] OR proteasome[tiab] OR "Free Radicals"[mh] OR "Reactive Oxygen Species"[mh] OR

"Oxidative stress"[mh] OR "Electron Transport"[mh] OR Oxidative-damage*[tiab] OR reactive-nitrogen-species[tiab] OR superoxide-radical*[tiab] OR hydroxyl-radical[tiab] OR glutathione-deplet*[tiab] OR "C-reactive protein"[mh] OR "eosinophils"[mh] OR (fibrinogen[tiab] AND Inflammation[tiab]) OR chronic-inflammation[tiab] OR chronically-inflamed[tiab] OR infiltrating-leukocyt*[tiab] OR inflammatory-leukocyte[tiab] OR inflammatory-leukocytes[tiab] OR leukocyte-infiltrat*[tiab] OR pro-inflammatory[tiab] OR proinflammatory[tiab] OR macrophage-recruitment[tiab] OR "Cytotoxicity, Immunologic"[mh] OR "Immunologic Factors"[mh] OR "Immunomodulation"[mh] OR "B-Cell Activation Factor Receptor"[mh] OR Antigenic Modulation[mh] OR "B-Cell Activating Factor"[mh] OR Immunologic Factors[pa] OR b-cell-activation[tiab] OR immune surveillance[tiab] OR immune-suppress*[tiab] OR immunostimulant[tiab] OR immune-activation[tiab] OR immunodeficien*[tiab] OR somatic-hypermutation[tiab] OR immune-activation[tiab] OR immune-system-activation[tiab] OR Chronic-antigenic-stimulation[tiab] OR immunosuppress*[tiab] OR "Receptors, Aryl Hydrocarbon"[mh] OR "Transcriptional Activation"[mh] OR Aryl-hydrocarbon-receptor*[tiab] OR receptor-mediati*[tiab] OR transcription-factor*[tiab] OR transcriptional-activat*[tiab] OR Xenobiotic-sensor*[tiab] OR xenosensor*[tiab] OR Ah-receptor*[tiab] OR alternative-lengthening-of-telomere*[tiab] OR cellular-Immortalization[tiab] OR p53-inactivat*[tiab] OR p53-inhibit*[tiab] OR p53-delet*[tiab] OR pRb-inactivat*[tiab] OR pRb-inhibit*[tiab] OR pRb-delet*[tiab] OR Rb/p16INK4a inactiv*[tiab] OR retinoblastoma-protein[tiab] OR senescent[tiab] OR senescence[tiab] OR "Angiogenesis Modulating Agents"[mh] OR "Angiogenesis Inducing Agents"[pa] OR "Angiogenesis Inducing Agents"[mh] OR "Neovascularization, Pathologic"[mh] OR "Cell Hypoxia"[mh] OR angiogenic[tiab] OR cellular-energetics[tiab] OR hypoxic-cell*[tiab] OR cell-hypoxia[tiab] OR cellular-hypoxia[tiab] OR "Apoptosis"[mh] OR "Cytotoxicity, Immunologic"[mh] OR "Caspases"[mh] OR "autophagy"[mh] OR "necrosis" [mh] OR "Autolysis"[mh] OR survivin[tiab] OR Cytotoxin[tiab] OR Caspases[tiab] OR "Cell Proliferation"[mh] OR "homeostasis"[mh] OR "Cyclin-Dependent Kinases"[mh] OR "Cyclin-Dependent Kinase Inhibitor Proteins"[mh] OR "mitogens"[mh] OR "Mitogens"[pa] OR cell-cycle-control*[tiab] OR mitotic-checkpoint*[tiab] OR hepatocellular-proliferation[tiab] OR Cytogenesis[tiab] OR Cytogenic[tiab] OR cellular-replication*[tiab] OR hyperplasia[tiab] OR Neoplasia[tiab] OR mitogenesis[tiab])) OR ((Comet-assay[tiab] OR Mutagenic[tiab] OR Mutagenicity[tiab] OR mutations[tiab] OR chromosomal-aberration-test[tiab] OR Sister-chromatid-exchange[tiab] OR SOS-response[tiab] OR Polyploid*[tiab] OR Genomic-Instability[tiab] OR DNA-Repair*[tiab] OR Aneuploid*[tiab] OR gene-silencer[tiab] OR gene-silencing[tiab] OR deacetylation[tiab] OR DNA-methylation[tiab] OR histone-deacetylase*[tiab] OR ubiquitination[tiab] OR gene-expression[tiab] OR microRNA*[tiab] OR miRNA*[tiab] OR non-coding-RNA*[tiab] OR SiRNA*[tiab] OR small-inhibitory-RNA*[tiab] OR Small-interfering-RNA*[tiab] OR electron-transport-chain*[tiab] OR reactive-oxygen-species[tiab] OR Oxidative-stress*[tiab] OR free-radical*[tiab] OR C-reactive-protein*[tiab] OR eosinophil*[tiab] OR autoimmunity[tiab] OR Immunomodulation[tiab] OR Immune-modulation[tiab] OR cellular-homeostasis[tiab] OR Cell-Proliferat*[tiab] OR Cellular-Proliferat*[tiab] OR cyclin-dependent-kinase*[tiab] OR cyclin-dependent-kinase-inhibit*[tiab] OR mitogens[tiab] OR mitogen[tiab] OR Apoptosis[tiab] OR autophagy[tiab] OR necrosis [tiab] OR autolysis[tiab] OR angiogenesis[tiab]) NOT medline[sb])

Web of Science

TS=("DNA Adducts" OR "Sister-chromatid exchange" OR "SOS Response Genetics" OR "Gene Expression Regulation" OR angiogenesis OR "adduct formation" OR "DNA Adduct*" OR electrophile OR electrophilic OR "dna alkylating agent*" OR "metabolic activation" OR "Germ line mutation*" OR mutagenesis OR "Mutagenicity test*" OR mutation OR "Ames Assay" OR "Ames test" OR "Bacterial

Reverse Mutation Assay*" OR clastogen* OR "DNA Repair*" OR "Genetic toxicology" OR hyperploid OR "micronucleus test*" OR tetraploid OR "Chromosome aberration*" OR "chromosome translocation*" OR "DNA damag*" OR "DNA inhibit*" OR micronuclei OR micronucleus OR mutagens OR "Strand break*" OR "Unscheduled DNA synthes*" OR "chromosomal aberration" OR "chromosome aberration" OR "chromosomal aberrations" OR "chromosomal abnormalit*" OR "chromosome abnormalit*" OR genotoxic OR "Comet assay" OR mutagenic OR mutagenicity OR mutations OR "chromosomal aberration test*" OR "Sister chromatid exchange" OR "microsatellite instability" OR "chromosomal instability" OR binucleation OR binucleated OR "SOS response" OR polyploid* OR "Genomic Instability" OR "DNA Repair*" OR aneuploid* OR "Transcriptional Activation" OR epigenotype OR epimutation* OR "methylation associated silencing" OR "gene silencers" OR "chromatin organization" OR "histone modification*" OR epigenetic* OR epigenomic* OR "rna interference" OR "gene activation" OR proteasome OR "gene silencer" OR "gene silencing" OR deacetylation OR "DNA methylation" OR "histone deacetylase*" OR ubiquitination OR "gene-expression" OR microrna* OR mirna* OR "non-coding-RNA*" OR sirna* OR "small-inhibitory-RNA*" OR "Small-interfering-RNA*" OR "hydroxyl radicals" OR "Oxidative damage*" OR "reactive nitrogen species" OR "superoxide radical*" OR "hydroxyl radical" OR "glutathione depletion" OR "electron transport chain*" OR "reactive oxygen species" OR "Oxidative stress*" OR "free radical*" OR "chronic inflammation" OR "chronically inflamed" OR "infiltrating leukocyt*" OR "inflammatory leukocyte" OR "inflammatory leukocytes" OR "leukocyte infiltrat*" OR "pro-inflammatory" OR "proinflammatory" OR "C-reactive protein*" OR eosinophil* OR "B-Cell Activation Factor Receptor" OR "Antigenic Modulation" OR "B-Cell Activating Factor" OR autoimmunity OR "Immunologic Factors" OR "b-cell activation" OR "immune surveillance" OR immunostimulant OR immunodeficien* OR "somatic hypermutation" OR "Chronic antigenic stimulation" OR immunosuppress* OR autoimmunity OR immunomodulation OR "Immune modulation" OR "Aryl-hydrocarbon receptor*" OR "receptor mediat*" OR "transcription factor*" OR "transcriptional activat*" OR "Xenobiotic sensor*" OR xenosensor* OR "Ah-receptor*" OR "alternative lengthening of telomeres" OR "cellular immortalization" OR "p53 inactivation" OR "p53 inhibition" OR "p53 deletion" OR "pRb inactivation" OR "pRb inhibition" OR "pRb deletion" OR "Rb/p16INK4a inactiv*" OR "retinoblastoma protein" OR senescent OR senescence OR "cell-cycle control*" OR "mitotic-checkpoint*" OR "hepatocellular proliferation" OR "immunologic cytotox*" OR "pathologic neovascularization" OR cytogenesis OR cytogenic OR "cellular replication*" OR hyperplasia OR neoplasia OR mitogenesis OR "cellular homeostasis" OR "Cell Proliferat*" OR "Cellular Proliferat*" OR "cyclin dependent kinase*" OR mitogens OR mitogen OR angiogenic OR "cellular energetics" OR "hypoxic cell*" OR "cell hypoxia" OR "cellular hypoxia" OR survivin OR cytotoxin OR caspases OR apoptosis OR autophagy OR necrosis OR autolysis OR "CpG island Methylator" OR "CpG island Methylation" OR "histone-tail modification*" OR "macrophage recruitment" OR "immune-suppress*" OR "immune activation") OR TS=(dna AND crosslink) OR TS=(fibrinogen AND inflammation)

Scopus

(TITLE-ABS-KEY ("DNA Adducts" OR "Sister-chromatid exchange" OR "SOS Response Genetics" OR "Gene Expression Regulation" OR angiogenesis) OR TITLE-ABS ("adduct formation" OR "DNA Adduct*" OR electrophile OR electrophilic OR "dna alkylating agent*" OR "metabolic activation" OR "Germ line mutation*" OR mutagenesis OR "Mutagenicity test*" OR mutation OR "Ames Assay" OR "Ames test" OR "Bacterial Reverse Mutation Assay*" OR clastogen* OR "DNA Repair*" OR "Genetic toxicology" OR hyperploid OR "micronucleus test*" OR tetraploid OR "Chromosome aberration*" OR "chromosome translocation*" OR ("DNA protein" W/2 crosslink*) OR "DNA damag*" OR "DNA inhibit*" OR micronuclei OR micronucleus OR mutagens OR "Strand break*" OR "Unscheduled DNA

synthes*" OR "chromosomal aberration" OR "chromosome aberration" OR "chromosomal aberrations"
OR "chromosomal abnormalit*" OR "chromosome abnormalit*" OR genotoxic OR "Comet assay" OR
mutagenic OR mutagenicity OR mutations OR "chromosomal aberration test*" OR "Sister chromatid
exchange" OR "microsatellite instability" OR "chromosomal instability" OR binucleation OR binucleated
OR "SOS response" OR polyploid* OR "Genomic Instability" OR "DNA Repair*" OR aneuploid* OR
"Transcriptional Activation" OR epigenotype OR epimutation* OR "methylation associated silencing"
OR "gene silencers" OR "chromatin organization" OR "histone modification*" OR epigenetic* OR
epigenomic* OR "rna interference" OR "gene activation" OR proteasome OR "gene silencer" OR "gene
silencing" OR deacetylation OR "DNA methylation" OR "histone deacetylase*" OR ubiquitination OR
"gene-expression" OR microrna* OR mirna* OR "non-coding-RNA*" OR sirna* OR "small-inhibitory-
RNA*" OR "Small-interfering-RNA*" OR "hydroxyl radicals" OR "Oxidative damage*" OR "reactive
nitrogen species" OR "superoxide radical*" OR "hydroxyl radical" OR "glutathione depletion" OR
"electron transport chain*" OR "reactive oxygen species" OR "Oxidative stress*" OR "free radical*" OR
"chronic inflammation" OR "chronically inflamed" OR "infiltrating leukocyt*" OR "inflammatory
leukocyte" OR "inflammatory leukocytes" OR "leukocyte infiltrat*" OR "pro-inflammatory" OR
"proinflammatory" OR "C-reactive protein*" OR eosinophil* OR "B-Cell Activation Factor Receptor"
OR "Antigenic Modulation" OR "B-Cell Activating Factor" OR autoimmunity OR "Immunologic
Factors" OR "b-cell activation" OR "immune surveillance" OR immunostimulant OR immunodeficien*
OR "somatic hypermutation" OR "Chronic antigenic stimulation" OR immunosuppress* OR
autoimmunity OR immunomodulation OR "Immune modulation" OR "Aryl-hydrocarbon receptor*" OR
"receptor mediat*" OR "transcription factor*" OR "transcriptional activat*" OR "Xenobiotic sensor*" OR
xenosensor* OR "Ah-receptor*" OR "alternative lengthening of telomeres" OR "cellular
Immortalization" OR "p53 inactivation" OR "p53 inhibition" OR "p53 deletion" OR "pRb inactivation"
OR "pRb inhibition" OR "pRb deletion" OR "Rb/p16INK4a inactiv*" OR "retinoblastoma protein" OR
senescent OR senescence OR "cell-cycle control*" OR "mitotic-checkpoint*" OR "hepatocellular
proliferation" OR "immunologic cytotox*" OR "pathologic neovascularization" OR cytogenesis OR
cytogenic OR "cellular replication*" OR hyperplasia OR neoplasia OR mitogenesis OR "cellular
homeostasis" OR "Cell Proliferat*" OR "Cellular Proliferat*" OR "cyclin dependent kinase*" OR
mitogens OR mitogen OR angiogenic OR "cellular energetics" OR "hypoxic cell*" OR "cell hypoxia" OR
"cellular hypoxia" OR survivin OR cytotoxin OR caspases OR apoptosis OR autophagy OR necrosis OR
autolysis OR "CpG island Methylator" OR "CpG island Methylation" OR "histone-tail modification*"
OR "macrophage recruitment" OR "immune-suppress*" OR "immune activation" OR (dna W/3 crosslink
) OR (fibrinogen W/3 inflammation)))

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2.5.4 Genotoxicity Search Strings

As part of the Mechanistic and Other Relevant Data section of the document (see RoC Handbook: Part F, Section 1), the goal of the Genotoxicity section is to ensure that the genetic effects of the candidate substance are adequately explored to provide clarification and support to understanding the carcinogenic effects of the candidate substance.

This search is not generally used in conjunction with the Cancer Search Strings.

This search is not needed when the Characteristics of Carcinogens Search Strings are used, as that search incorporates all the relevant terms.

PubMed

((("Comet Assay"[mh] OR "Germ-line-mutation"[mh] OR "Mutagenesis"[mh] OR "Mutagenicity tests"[mh] OR "Sister-chromatid exchange"[mh] OR "Mutation"[mh] OR Ames-Assay[tiab] OR Ames-test[tiab] OR Bacterial-Reverse-Mutation-Assay[tiab] OR Clastogen*[tiab] OR DNA-Repair*[tiab] OR Genetic-toxicology[tiab] OR hyperploid[tiab] OR micronucleus-test[tiab] OR tetraploid[tiab] OR Chromosome-aberrations[tiab] OR DNA-damage[tiab] OR Mutation[tiab] OR chromosome-translocations[tiab] OR DNA-protein-crosslink*[tiab] OR DNA-damag*[tiab] OR DNA-inhibit*[tiab] OR Micronuclei[tiab] OR Micronucleus[tiab] OR Mutagens[tiab] OR Strand-break*[tiab] OR Unscheduled-DNA-synthes*[tiab] OR chromosomal-aberration[tiab] OR chromosome-aberration[tiab] OR chromosomal-aberrations[tiab] OR chromosomal-abnormalit*[tiab] OR chromosome-abnormalit*[tiab] OR genotoxic[tiab] OR "SOS Response (Genetics)"[mh] OR "Polyploidy"[mh] OR "Genomic Instability"[mh] OR "DNA Repair"[mh] OR "Aneuploidy"[mh] OR (DNA[tiab] AND Crosslink[tiab]) OR microsatellite-instability[tiab] OR chromosomal-instability[tiab] OR binucleation[tiab] OR binucleated[tiab])) OR ((Comet-assay[tiab] OR Mutagenic[tiab] OR Mutagenicity[tiab] OR mutations[tiab] OR chromosomal-aberration-test[tiab] OR Sister-chromatid-exchange[tiab] OR SOS-response[tiab] OR Polyploid*[tiab] OR Genomic-Instability[tiab] OR DNA-Repair*[tiab] OR Aneuploid*[tiab]) NOT Medline[sb])

Web of Science

TS=("Comet Assay" OR "Germ-line-mutation" OR "Mutagenesis" OR "Mutagenicity" OR Mutation* OR Mutagenic OR "Sister chromatid exchange" OR "Ames Assay" OR "Ames test" OR "Bacterial Reverse Mutation Assay" OR Clastogen* OR "DNA Repair*" OR "Genetic toxicology" OR hyperploid OR "micronucleus test" OR tetraploid OR "Chromosome aberrations" OR "DNA damage" OR "chromosome translocations" OR "DNA protein crosslink*" OR "DNA damag*" OR "DNA inhibit*" OR Micronuclei OR Micronucleus OR Mutagens OR "Strand break*" OR "Unscheduled DNA synthes*" OR "chromosomal aberration" OR "chromosome aberration" OR "chromosomal aberrations" OR "chromosomal abnormalit*" OR "chromosome abnormalit*" OR "chromosomal instability" OR genotoxic OR "SOS Response" OR "Polyploidy" OR Polyploid* OR Aneuploid* OR "Aneuploidy" OR "Genomic Instability" OR (DNA AND Crosslink) OR "microsatellite instability" OR binucleation OR binucleated)

Scopus

TITLE-ABS-KEY("Comet Assay" OR "Germ-line-mutation" OR "Mutagenesis" OR "Mutagenicity" OR Mutation* OR Mutagenic OR "Sister chromatid exchange" OR "Ames Assay" OR "Ames test" OR "Bacterial Reverse Mutation Assay" OR Clastogen* OR "DNA Repair*" OR "Genetic toxicology" OR hyperploid OR "micronucleus test" OR tetraploid OR "Chromosome aberrations" OR "DNA damage" OR

"chromosome translocations" OR "DNA protein crosslink*" OR "DNA damag*" OR "DNA inhibit*" OR
Micronuclei OR Micronucleus OR Mutagens OR "Strand break*" OR "Unscheduled DNA synthes*" OR
"chromosomal aberration" OR "chromosome aberration" OR "chromosomal aberrations" OR
"chromosomal abnormalit*" OR "chromosome abnormalit*" OR "chromosomal instability" OR genotoxic
OR "SOS Response" OR "Polyploidy" OR Polyploid* OR Aneuploid* OR "Aneuploidy" OR "Genomic
Instability" OR "microsatellite instability" OR binucleation OR binucleated) OR (TITLE-ABS-
KEY(DNA AND Crosslink))

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2.5.5 Other Mechanistic Terms Search Strings

This search is a limited set of terms designed to supplement the Characteristics of Carcinogens Search Strings and uses terms not included in that search. It will generally be used to gain an initial grasp of the best-understood mechanistic information associated with the candidate substance. This search is not generally used in conjunction with the Cancer Search Strings.

Some additional information about the mechanism of action for a material can be collected from general data sources, mining the citations of reviews and other studies, and specially targeted searches.

PubMed

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((("etiology"[sh] OR "Causality"[mh] OR "tumor markers, biological"[mh] OR "oncogene fusion"[mh] OR "tumor necrosis factors"[mh] OR adverse-outcome-pathway*[tiab] OR biological-marker[tiab] OR biological-markers[tiab] OR biomarkers[tiab] OR biomarker[tiab] OR Biotransformation[tiab] OR etiology[tiab] OR Key Event*[tiab] OR Mechanism-of-action[tiab] OR Mechanisms-of-action[tiab] OR Mode-of-action[tiab] OR modes-of-action[tiab] OR Molecular-Initiating-Event*[tiab] OR neoplastic-cell-transform*[tiab] OR Phosphorylation[tiab] OR Toxicity-Pathway*[tiab] OR toxicokinetic*[tiab] OR toxic-pathway*[tiab]) AND (Cancer[sb])) OR (tumor-inhibit*[tiab] OR tumor-promot*[tiab] OR tumour-inhibit*[tiab] OR tumour-promot*[tiab] OR Oncogenes[tiab] OR Oncogenesis[tiab] OR Oncogenic[tiab] OR pathogenesis[tiab]))
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Web of Science

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((TS=(Cancer* OR Neopla* OR Tumor* OR Tumour*)) AND (TS=("adverse outcome pathway*" OR "biological marker" OR "biological markers" OR "biomarkers" OR "biomarker" OR "tumor marker" OR "tumor markers" OR "oncogene fusion" OR "Biotransformation" OR "etiology" OR "Key Event*" OR "Mechanism of action" OR "Mechanisms of action" OR "Mode of action" OR "modes of action" OR "Molecular Initiating Event*" OR "neoplastic cell transform*" OR "Phosphorylation" OR "Toxicity Pathway*" OR "toxicokinetic*" OR "toxic pathway*"))) OR (TS=("tumor-inhibit*" OR "tumor-promot*" OR "tumour-inhibit*" OR "tumour-promot*" OR "tumor necrosis factor*" OR Oncogenes OR Oncogenesis OR Oncogenic OR pathogenesis))
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Scopus

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(( TITLE-ABS-KEY ( cancer* OR neopla* OR tumor* OR tumour* ) AND TITLE-ABS-KEY ( "adverse outcome pathway*" OR "biological marker" OR "biological markers" OR "biomarkers" OR "biomarker" OR "tumor marker" OR "tumor markers" OR "oncogene fusion" OR "Biotransformation" OR "etiology" OR "Key Event*" OR "Mechanism of action" OR "Mechanisms of action" OR "Mode of action" OR "modes of action" OR "Molecular Initiating Event*" OR "neoplastic cell transform*" OR "Phosphorylation" OR "Toxicity Pathway*" OR "toxicokinetic*" OR "toxic pathway*" ) ) OR TITLE-ABS-KEY ( "tumor-inhibit*" OR "tumor-promot*" OR "tumour-inhibit*" OR "tumour-promot*" OR "tumor necrosis factor*" OR oncogenes OR oncogenesis OR oncogenic OR pathogenesis ) )
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2.6.1 General Toxicity Search Strings

Much of the general toxicity information needed for the RoC is collected by checking a standard list of authoritative sources for reviews, reports, and data about the candidate substance and its adverse effects (see RoC Handbook: Part B, Section 3). This citation database search will be used in special cases where additional general toxicity information is needed.

This search is not generally used in conjunction with the Cancer Search Strings.

PubMed

"abnormalities, drug-induced"[MH] OR "adverse drug reaction reporting systems"[MH] OR "Akathisia, Drug-Induced"[MH] OR Amino Acids, Peptides, and Proteins/ae[MH] OR Animal Diseases/CI[MH] OR "biohazard release"[MH] OR Biological Factors/ae[MH] OR Biomedical and Dental Materials/ae[MH] OR "burns, chemical"[MH] OR Carbohydrates/ae[MH] OR "Cardiotoxicity"[MH] OR Cardiovascular Diseases/CI[MH] OR Chemical Actions and Uses/ae[MH] OR "chemical hazard release"[MH] OR "chemical terrorism"[MH] OR "Chemically-Induced Disorders"[MH] OR Complex Mixtures/ae[MH] OR Congenital, Hereditary, and Neonatal Diseases and Abnormalities/CI[MH] OR Digestive System Diseases/CI[MH] OR Disorders of Environmental Origin/CI[MH] OR Endocrine System Diseases/CI[MH] OR Environment and Public Health/ae[MH] OR "Environmental Health"[MH] OR "environmental illness"[MH] OR "environmental monitoring"[MH] OR "environmental pollutants"[MH] OR "environmental pollution"[MH] OR Enzymes and Coenzymes/ae[MH] OR Eye Diseases/CI[MH] OR Female Urogenital Diseases and Pregnancy Complications/CI[MH] OR food and beverages/ae[MH] OR "forensic toxicology"[MH] OR Genetic Phenomena/de[MH] OR Hemic and Lymphatic Diseases/CI[MH] OR Heterocyclic Compounds/ae[MH] OR Hormones, Hormone Substitutes, and Hormone Antagonists/ae[MH] OR household products/ae[MH] OR Immune System Diseases/CI[MH] OR "Inactivation, Metabolic"[MH] OR Inorganic Chemicals/ae[MH] OR Integumentary System Physiological Phenomena/de[MH] OR Lipids/ae[MH] OR Macromolecular Substances/ae[MH] OR Male Urogenital Diseases/CI[MH] OR manufactured materials/ae[MH] OR "Material Safety Data Sheets"[MH] OR mental disorders/ci[MH] OR Musculoskeletal Diseases/CI[MH] OR Nervous System Diseases/CI[MH] OR "noxae"[MH] OR Nucleic Acids, Nucleotides, and Nucleosides/ae[MH] OR Nutritional and Metabolic Diseases/CI[MH] OR "occupational diseases"[MH] OR Ocular Physiological Phenomena/de[MH] OR Organic Chemicals/ae[MH] OR Otorhinolaryngologic Diseases/CI[MH] OR Pathological Conditions, Signs and Symptoms /CI[MH] OR "persian gulf syndrome"[MH] OR pesticides/to[MH] OR Pharmaceutical Preparations/ae[MH] OR Phytochemicals/ae[MH] OR plants, medicinal/ae[MH] OR "plants, toxic"[MH] OR "poisoning"[MH] OR Polycyclic Compounds/ae[MH] OR Reproductive and Urinary Physiological Phenomena/de[MH] OR Respiratory Tract Diseases/CI[MH] OR "Safety-Based Drug Withdrawals"[MH] OR Skin and Connective Tissue Diseases/CI[MH] OR Stomatognathic Diseases/CI[MH] OR "substance-related disorders"[MH] OR "Teratogenesis"[MH] OR "Toxic Actions"[MH] OR "toxicity tests"[MH] OR "psychoses, substance-induced"[MH] OR "Toxicokinetics"[MH] OR "toxicology"[MH] OR cardiotox*[tiab] OR "chemical hazard release"[tiab] OR "hazardous substances"[tiab] OR hepatotox*[tiab] OR immunotox*[tiab] OR LC50[tiab] OR mutagen*[tiab] OR nanostructures[tiab] OR nephrotox*[tiab] OR neurotox*[tiab] OR poison*[tiab] OR terata*[tiab] OR terato*[tiab] OR toxic*[tiab] OR toxif*[tiab] OR toxig*[tiab]

Web of Science

TS=("drug-induced abnormalities" OR "adverse drug reaction reporting systems" OR "Drug-Induced Akathisia" OR "Animal Diseases" OR "biohazard release" OR "Biological Factors" OR "Biomedical and Dental Materials" OR "chemical burns" OR "Carbohydrates" OR "Cardiotoxicity" OR "Cardiovascular Diseases" OR "Chemical Actions and Uses" OR "chemical hazard release" OR "chemical terrorism" OR "Chemically-Induced Disorders" OR "Complex Mixtures" OR "Digestive System Diseases" OR "Disorders of Environmental Origin" OR "Endocrine System Diseases" OR "Environment and Public Health" OR "Environmental Health" OR "environmental illness" OR "environmental monitoring" OR "environmental pollutants" OR "environmental pollution" OR "Enzymes and Coenzymes" OR "Eye Diseases" OR "Female Urogenital Diseases and Pregnancy Complications" OR "food and beverages" OR "forensic toxicology" OR "Genetic Phenomena" OR "Hemic and Lymphatic Diseases" OR "Heterocyclic Compounds" OR "household products" OR "Immune System Diseases" OR "Metabolic Inactivation" OR "Inorganic Chemicals" OR "Integumentary System Physiological Phenomena" OR "Lipids" OR "Macromolecular Substances" OR "Male Urogenital Diseases" OR "manufactured materials" OR "Material Safety Data Sheets" OR "mental disorders" OR "Musculoskeletal Diseases" OR "Nervous System Diseases" OR "noxae" OR "Nutritional and Metabolic Diseases" OR "occupational diseases" OR "Ocular Physiological Phenomena" OR "Organic Chemicals" OR "Otorhinolaryngologic Diseases" OR "Pathological Conditions" OR "persian gulf syndrome" OR "pesticides" OR "Pharmaceutical Preparations" OR "Phytochemicals" OR "medicinal plants" OR "toxic plants" OR "poisoning" OR "Polycyclic Compounds" OR "Reproductive and Urinary Physiological Phenomena" OR "Respiratory Tract Diseases" OR "Safety-Based Drug Withdrawals" OR "Skin and Connective Tissue Diseases" OR "Stomatognathic Diseases" OR "substance-related disorders" OR "Teratogenesis" OR "Toxic Actions" OR "toxicity tests" OR "substance-induced psychoses" OR "Toxicokinetics" OR "toxicology" OR "chemical hazard release" OR "hazardous substances" OR hepatotox* OR immunotox* OR LC50 OR mutagen* OR nanostructures OR nephrotox* OR neurotox* OR poison* OR terata* OR terato* OR toxic* OR toxif* OR toxig* OR toxig*)

Scopus

TITLE-ABS-KEY ("drug-induced abnormalities" OR "adverse drug reaction reporting systems" OR "Drug-Induced Akathisia" OR "Animal Diseases" OR "biohazard release" OR "Biological Factors" OR "Biomedical and Dental Materials" OR "chemical burns" OR "Carbohydrates" OR "Cardiotoxicity" OR "Cardiovascular Diseases" OR "Chemical Actions and Uses" OR "chemical hazard release" OR "chemical terrorism" OR "Chemically-Induced Disorders" OR "Complex Mixtures" OR "Digestive System Diseases" OR "Disorders of Environmental Origin" OR "Endocrine System Diseases" OR "Environment and Public Health" OR "Environmental Health" OR "environmental illness" OR "environmental monitoring" OR "environmental pollutants" OR "environmental pollution" OR "Enzymes and Coenzymes" OR "Eye Diseases" OR "Female Urogenital Diseases and Pregnancy Complications" OR "food and beverages" OR "forensic toxicology" OR "Genetic Phenomena" OR "Hemic and Lymphatic Diseases" OR "Heterocyclic Compounds" OR "household products" OR "Immune System Diseases" OR "Metabolic Inactivation" OR "Inorganic Chemicals" OR "Integumentary System Physiological Phenomena" OR "Lipids" OR "Macromolecular Substances" OR "Male Urogenital Diseases" OR "manufactured materials" OR "Material Safety Data Sheets" OR "mental disorders" OR "Musculoskeletal Diseases" OR "Nervous System Diseases" OR "noxae" OR "Nutritional and Metabolic Diseases" OR "occupational diseases" OR "Ocular Physiological Phenomena" OR "Organic Chemicals" OR "Otorhinolaryngologic

Diseases" OR "Pathological Conditions" OR "persian gulf syndrome" OR "pesticides" OR "Pharmaceutical Preparations" OR "Phytochemicals" OR "medicinal plants" OR "toxic plants" OR "poisoning" OR "Polycyclic Compounds" OR "Reproductive and Urinary Physiological Phenomena" OR "Respiratory Tract Diseases" OR "Safety-Based Drug Withdrawals" OR "Skin and Connective Tissue Diseases" OR "Stomatognathic Diseases" OR "substance-related disorders" OR "Teratogenesis" OR "Toxic Actions" OR "toxicity tests" OR "substance-induced psychoses" OR "Toxicokinetics" OR "toxicology" OR "chemical hazard release" OR "hazardous substances" OR hepatotox* OR immunotox* OR lc50 OR mutagen* OR nanostructures OR nephrotox* OR neurotox* OR poison* OR terata* OR terato* OR toxic* OR toxif* OR toxig* OR toxig*)

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