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Polynuclear Aromatic Compounds, Part 1, Chemical, Environmental and Experimental Data

Summary of Data Reported and Evaluation

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2- and 3-Methylfluoranthenes
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Perylene
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Last updated: 17 April 1998

ANTHANTHRENE

VOL.: 32 (1983) (p. 95)

CAS No.: 191-26-4

Chem. Abstr. Name: Dibenzo(*def,mno*)chrysene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Anthanthrene was tested for carcinogenicity by skin application in mice in four studies. In one study, relatively high doses of anthanthrene in acetone produced skin tumours; in the other studies, no increased incidence of tumours was observed. It was also tested in the mouse-skin initiation-promotion assay in three studies. In two of the studies for initiating activity, anthanthrene gave negative results; in one, the results were inconclusive.

An experiment involving subcutaneous injection of anthanthrene to mice was inadequate. In a study using direct injection into the pulmonary tissue of rats, anthanthrene produced pulmonary squamous-cell carcinomas in a dose-related fashion.

No data on the teratogenicity of this compound were available.

Anthanthrene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system.

There is *inadequate evidence* that anthanthrene is active in short-term tests.

5.2 Human data

Anthanthrene is present as a minor component of the total content of polynuclear aromatic compounds of the environment. Human exposure to anthanthrene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated with combustion products.

5.3 Evaluation

There is *limited evidence* that anthanthrene is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 57: **Group 3**)

Synonyms

- Anthanthren
- Dibenzo(*cd,jk*)pyrene

ANTHRACENE

VOL.: 32 (1983) (p. 105)

CAS No.: 120-12-7

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Anthracene was tested for carcinogenicity in mice by skin application in several studies, and in the mouse-skin initiation-promotion assay in two studies. The results were not indicative of a carcinogenic effect or of initiating activity.

It was tested in rats by oral, subcutaneous, intraperitoneal and intrapulmonary administration, and in rabbits by implantation into the brain or eyes. The studies involving oral or intrapulmonary administration produced no evidence of carcinogenicity. The studies in rats by subcutaneous or intraperitoneal administration and in rabbits by implantation into the brain or eyes were inadequate for evaluation.

When anthracene was administered by skin application to mice together with exposure to ultraviolet radiation, contradictory results were obtained.

No data on the teratogenicity of this compound were available.

Anthracene was negative in an assay for differential survival using DNA repair-proficient/-deficient strains of *Bacillus subtilis*. It did not induce mutations in bacteria or yeast nor unscheduled DNA synthesis or mutations in cultured mammalian cells. No cytogenetic effect in mammalian cells was observed *in vitro* or *in vivo*, and assays for morphological transformation were negative.

There is no evidence that anthracene is active in short-term tests.

5.2 Human data

Anthracene is present as a major component of the total content of polynuclear aromatic compounds in the environment and has been produced in commercial quantities. Human exposure to anthracene occurs primarily through the smoking of tobacco, inhalation of polluted air and ingestion of food or water contaminated by combustion effluents.

No relevant case report or epidemiological study on exposure to anthracene alone was available to the Working Group.

5.3 Evaluation

The available data provide no evidence that anthracene is carcinogenic to experimental animals.

Subsequent evaluation: Suppl. 7 (1987) (p. 57: **Group 3**)

Synonyms

- Anthracin
- Green oil

- Paranaphthalene
- Tetra Olive N2G

Last updated: 17 April 1998

BENZ[*a*]ACRIDINE

VOL.: 32 (1983) (p. 123)

CAS No.: 225-11-6

Chem. Abstr. Name: Benz(*a*)acridine

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Benz[*a*]acridine was inadequately tested for carcinogenicity in one experiment by skin application to mice. No data on the teratogenicity of this compound were available.

The single report of the mutagenicity of benz[*a*]acridine in *Salmonella typhimurium* was inconclusive.

There is *inadequate evidence* that benz[*a*]acridine is active in short-term tests.

5.2 Human data

Benz[*a*]acridine is present as a minor component of the total content of polynuclear aromatic compounds in the environment. Human exposure to benz[*a*]acridine occurs primarily through inhalation of polluted air and by ingestion of food and water contaminated with combustion products.

5.3 Evaluation

The available data are *inadequate* to permit the evaluation of the carcinogenicity of benz[*a*]acridine in experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 58: **Group 3**)

Synonyms

- 7-Azabenz(*a*)anthracene
- 1,2-Benzacridine

BENZ[*c*]ACRIDINE

VOL.: 32 (1983) (p. 129)

CAS No.: 225-51-4

Chem. Abstr. Name: Benz(*c*)acridine

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Benz[*c*]acridine was tested for carcinogenicity in one experiment in mice by skin application and produced a low incidence of skin tumours. It was also tested in the mouse-skin initiation-promotion assay and was inactive as an initiator. It was also tested in rats by bladder implantation in wax pellets; an increased incidence of bladder tumours was observed.

No data on the teratogenicity of this compound were available.

Benz[*c*]acridine was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system.

There is *inadequate evidence* that benz[*c*]acridine is active in short-term tests.

5.2 Human data

Benz[*c*]acridine is present as a minor component of the total content of polynuclear aromatic compounds in the environment. Human exposure to benz[*c*]acridine occurs primarily through the inhalation of polluted air and by ingestion of food and water contaminated with combustion products.

5.3 Evaluation

There is *limited evidence* that benz[*c*]acridine is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 3 \(1973\)](#)

Subsequent evaluation: Suppl. 7 (1987) (p. 58: **Group 3**)

Synonyms

- 12-Azabenz(*a*)anthracene
- B(*c*)AC
- 3,4-Benzacridine
- 3,4-Benzoacridine
- α -Chrysidine
- α -Naphthacridine

BENZ[a]ANTHRACENE

VOL.: 32 (1983) (p.135)

CAS No.: 56-55-3

Chem. Abstr. Name: Benz(a)anthracene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Benz[a]anthracene has been shown to be carcinogenic to experimental animals.

The available data on reproductive toxicity and teratogenicity were inadequate for evaluation.

Benz[a]anthracene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system and was mutagenic to *Drosophila melanogaster*; it was also mutagenic to mammalian cells *in vitro* in the presence of an exogenous metabolic system. This compound was positive in one study of sister chromatid exchange. It induced unscheduled DNA synthesis in cultured mammalian cells and morphological transformation. In one in-vivo study, it induced sister chromatid exchange in hamsters; reports from in-vivo studies on the induction of chromosomal aberrations were conflicting.

There is *sufficient evidence* that benz[a]anthracene is active in short-term tests.

5.2 Human data

Benz[a]anthracene is present as a major component of the total content of polynuclear aromatic compounds in the environment. Human exposure to benz[a]anthracene occurs primarily through smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

There is *sufficient evidence* that benz[a]anthracene is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 3 \(1973\)](#)

Subsequent evaluation: Suppl. 7 (1987) (p. 58: **Group 2A**)

Synonyms

- BA
- Benzanthracene
- 1,2-Benz(a)anthracene
- Benzanthrene
- 1,2-Benzanthracene
- Benzoanthracene
- 1,2-Benzoanthracene
- Benzo(a)anthracene
- 2,3-Benzophenanthrene

- Benz(*b*)phenanthrene
- 2,3-Benzphenanthrene
- Naphthanthracene
- Tetraphene

Last updated: 17 April 1998

BENZO[*b*]FLUORANTHENE

VOL.: 32 (1983) (p. 147)

CAS No.: 205-99-2

Chem. Abstr. Name: Benz(*e*)acephenanthrylene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Benzo[*b*]fluoranthene has been shown to be carcinogenic to experimental animals.

No data on the teratogenicity of this compound were available.

Benzo[*b*]fluoranthene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system. In the one available study it was reported to induce sister chromatid exchange but not chromosomal aberrations in bone-marrow cells of hamsters treated *in vivo*.

There is *inadequate evidence* that benzo[*b*]fluoranthene is active in short-term tests.

5.2 Human data

Benzo[*b*]fluoranthene is present as a major component of the total content of polynuclear aromatic compounds in the environment. Human exposure to benzo[*b*]fluoranthene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

There is *sufficient evidence* that benzo[*b*]fluoranthene is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 3 \(1973\)](#)

Subsequent evaluation: Suppl. 7 (1987) (p. 58: **Group 2B**)

Synonyms

- 3,4-Benz(*e*)acephenanthrylene
- 2,3-Benzfluoranthene
- 3,4-Benzfluoranthene
- 2,3-Benzofluoranthene
- 3,4-Benzofluoranthene
- Benzo(*e*)fluoranthene
- B(*b*)F

BENZO[*j*]FLUORANTHENE

VOL.: 32 (1983) (p. 155)

CAS No.: 205-82-3

Chem. Abstr. Name: Benzo(*j*)fluoranthene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Benzo[*j*]fluoranthene was tested for carcinogenicity in female mice by skin application and produced benign and malignant skin tumours. It was also tested in a mouse-skin initiation-promotion assay and was active as an initiator. In one study in rats involving direct injection of benzo[*j*]fluoranthene into the pulmonary tissue, it produced squamous-cell carcinomas in a dose-related manner.

No study on the teratogenicity of this compound was available.

In the one available study, benzo[*j*]fluoranthene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system.

There is inadequate evidence that benzo[*j*]fluoranthene is active in short-term tests.

5.2 Human data

Benzo[*j*]fluoranthene is present as a component of the total content of polynuclear aromatic compounds of the environment. Human exposure to benzo[*j*]fluoranthene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

There is *sufficient evidence* that benzo[*j*]fluoranthene is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 3 \(1973\)](#)

Subsequent evaluation: Suppl. 7 (1987) (p. 58: **Group 2B**)

Synonyms

- 7,8-Benzofluoranthene
- 10,11-Benzofluoranthene
- Benzo(*l*)fluoranthene
- Benzo-12,13-fluoranthene
- B(*j*)F
- Dibenzo(*a,jk*)fluorene

BENZO[*k*]FLUORANTHENE

VOL.: 32 (1983) (p. 163)

CAS No.: 207-08-9

Chem. Abstr. Name: Benzo(*k*)fluoranthene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Benzo[*k*]fluoranthene was tested for carcinogenicity in females of two strains of mice by skin application and produced a few skin tumours. It was also tested in a mouse-skin initiation-promotion assay and was active as an initiator. In one experiment involving subcutaneous injection of benzo[*k*]fluoranthene to mice, it produced sarcomas at the site of injection. Benzo[*k*]fluoranthene produced squamous-cell carcinomas of the lung in rats in a dose-related manner following its direct injection into pulmonary tissue.

No data on the teratogenicity of this compound were available.

Benzo[*k*]fluoranthene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system.

There is *inadequate evidence* that benzo[*k*]fluoranthene is active in short-term tests.

5.2 Human data

Benzo[*k*]fluoranthene is present as a component of the total content of polynuclear aromatic compounds in the environment. Human exposure to benzo[*k*]fluoranthene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

There is *sufficient evidence* that benzo[*k*]fluoranthene is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 58: **Group 2B**)

Synonyms

- 8,9-Benzfluoranthene
- 8,9-Benzofluoranthene
- 11,12-Benzofluoranthene
- 2,3,1',8'-Binaphthylene
- Dibenzo(*b,jk*)fluorene

BENZO[*ghi*]FLUORANTHENE

VOL.: 32 (1983) (p. 171)

CAS No.: 203-12-3

Chem. Abstr. Name: Benzo(*ghi*)fluoranthene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Benzo[*ghi*]fluoranthene was tested for carcinogenicity in one study in female mice by skin painting; no skin tumour was observed.

No data on the teratogenicity of this compound were available.

In the one available study, benzo[*ghi*]fluoranthene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system.

There is *inadequate evidence* that benzo[*ghi*]fluoranthene is active in short-term tests.

5.2 Human data

Benzo[*ghi*]fluoranthene is present as a component of the total content of polynuclear aromatic compounds in the environment. Human exposure to benzo[*ghi*]fluoranthene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

The available data are *inadequate* to permit an evaluation of the carcinogenicity of benzo[*ghi*]fluoranthene to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 58: **Group 3**)

Synonyms

- Benzo(mno)fluoranthene
- 7,10-Benzofluoranthene

BENZO[a]FLUORENE

VOL.: 32 (1983) (p. 177)

CAS No.: 238-84-6

Chem. Abstr. Name: 11*H*-Benzo(*a*)fluorene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Benzo[a]fluorene was tested for carcinogenicity in mice in one study by skin application and in a mouse-skin initiation-promotion assay. Negative results were obtained in both studies. In a study involving subcutaneous administration of benzo[a]fluorene to mice, no injection-site tumour was observed.

No data on the teratogenicity of this chemical were available.

The available data were inadequate to evaluate the mutagenicity of benzo[a]fluorene to *Salmonella typhimurium*.

There is *inadequate evidence* that benzo[a]fluorene is active in short-term tests.

5.2 Human data

Benzo[a]fluorene is present as a minor component of the total content of polynuclear aromatic compounds in the environment. Human exposure to benzo[a]fluorene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated with combustion products.

5.3 Evaluation

The available data were *inadequate* to permit an evaluation of the carcinogenicity of benzo[a]fluorene to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 58: **Group 3**)

Synonyms

- 1,2-Benzofluorene
- Chrysofluorene
- α -Naphthofluorene

BENZO[*b*]FLUORENE

VOL.: 32 (1983) (p. 183)

CAS No.: 243-17-4

Chem. Abstr. Name: 11*H*-Benzo(*b*)fluorene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Benzo[*b*]fluorene was tested in a mouse-skin initiation-promotion assay; it did not show initiating activity.

No data on the teratogenicity of this compound were available.

There are conflicting reports regarding the mutagenicity of benzo[*b*]fluorene to *Salmonella typhimurium*.

There is *inadequate evidence* that benzo[*b*]fluorene is active in short-term tests.

5.2 Human data

Benzo[*b*]fluorene is present as a minor component of the total content of polynuclear aromatic compounds in the environment. Human exposure to benzo[*b*]fluorene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated with combustion products.

5.3 Evaluation

The available data were *inadequate* to permit an evaluation of the carcinogenicity of benzo[*b*]fluorene to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 58: **Group 3**)

Synonym

- 2,3-Benzofluorene

BENZO[c]FLUORENE

VOL.: 32 (1983) (p.189)

CAS No.: 205-12-9

Chem. Abstr. Name: 7*H*-Benzo(c)fluorene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Benzo[c]fluorene was tested for carcinogenicity in mice in one experiment by skin application and in one mouse-skin initiation-promotion assay. There was no indication of carcinogenic or initiating activity.

No data on the teratogenicity of this compound were available.

The single report of mutagenicity of benzo[c]fluorene in *Salmonella typhimurium* was inconclusive.

There is *inadequate evidence* that benzo[c]fluorene is active in short-term tests.

5.2 Human data

Benzo[c]fluorene is present as a minor component of the total content of polynuclear aromatic compounds in the environment. Human exposure to benzo[c]fluorene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated with combustion products.

5.3 Evaluation

The available data were *inadequate* to permit an evaluation of the carcinogenicity of benzo[c]fluorene to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 58: **Group 3**)

Synonym

- 3,4-Benzofluorene

BENZO[*ghi*]PERYLENE

VOL.: 32 (1983) (p. 195)

CAS No.: 191-24-2

Chem. Abstr. Name: Benzo(*ghi*)perylene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Benzo[*ghi*]perylene was tested for carcinogenicity in two studies by skin application to female mice, and no carcinogenic effect was observed. It was tested in three studies in the mouse-skin initiation-promotion assay, also with negative results. In two studies in mice by subcutaneous injection, no tumour was observed at the injection site. The results of a test using intrapulmonary injection in rats were inadequate for evaluation, although some pulmonary tumours occurred. When benzo[*ghi*]perylene was administered simultaneously with benzo[*a*]pyrene to the skin of mice, an increased number of skin tumours was observed over that with benzo[*a*]pyrene alone.

No data on teratogenicity of this compound were available.

Benzo[*ghi*]perylene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system. It was negative in one study of morphological transformation in mammalian cells.

There is *inadequate evidence* that benzo[*ghi*]perylene is active in short-term tests.

5.2 Human data

Benzo[*ghi*]perylene is present as a major component of the total content of polynuclear aromatic compounds in the environment. Human exposure to benzo[*ghi*]perylene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

The available data were *inadequate* to permit an evaluation of the carcinogenicity of benzo[*ghi*]perylene to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 58: **Group 3**)

Synonyms

- 1,12-Benzoperylene
- 1,12-Benzperylene

BENZO[c]PHENANTHRENE

VOL.: 32 (1983) (p. 205)

CAS No.: 195-19-7

Chem. Abstr. Name: Benzo(c)phenanthrene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Benzo[c]phenanthrene was tested in a mouse-skin initiation-promotion assay and was active as an initiator. Other experiments in mice by skin application and in mice and rats by subcutaneous injection were considered inadequate for evaluation.

No data on the teratogenicity of this chemical were available.

In the one study evaluated, benzo[c]phenanthrene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system.

There is *inadequate evidence* that benzo[c]phenanthrene is active in short-term tests.

5.2 Human data

Benzo[c]phenanthrene is present as a minor component of the total content of polynuclear aromatic compounds in the environment. Human exposure to benzo[c]phenanthrene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

The available data are *inadequate* to permit an evaluation of the carcinogenicity of benzo[c]phenanthrene to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 58: **Group 3**)

Synonyms

- 3,4-Benzophenanthrene
- 3,4-Benzphenanthrene
- Tetrahelicene

BENZO[*a*]PYRENE

VOL.: 32 (1983) (p. 211)

CAS No.: 50-32-8

Chem. Abstr. Name: Benzo(a)pyrene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Benzo[*a*]pyrene has been shown to be carcinogenic to experimental animals.

Benzo[*a*]pyrene is embryotoxic and teratogenic in mice; the inducibility of aryl hydrocarbon hydroxylase activity in dams and fetuses is an important factor in determining these effects. A reduction in fertility in both male and female offspring was observed in mice following exposure to benzo[*a*]pyrene *in utero*.

Benzo[*a*]pyrene undergoes metabolism to reactive electrophiles capable of binding covalently to DNA. It was active in assays for bacterial DNA repair, bacteriophage induction and bacterial mutation; mutation in *Drosophila melanogaster*; DNA binding, DNA repair, sister chromatid exchange, chromosomal aberrations, point mutation and transformation in mammalian cells in culture; and in tests in mammals *in vivo*, including DNA binding, sister chromatid exchange, chromosomal aberration, sperm abnormality and the somatic specific locus (spot) test.

There is *sufficient evidence* that benzo[*a*]pyrene is active in short-term tests.

5.2 Human data

Benzo[*a*]pyrene is present as a component of the total content of polynuclear aromatic compounds in the environment. Human exposure to benzo[*a*]pyrene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

There is *sufficient evidence* that benzo[*a*]pyrene is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 3 \(1973\)](#)

Subsequent evaluation: Suppl. 7 (1987) (p. 58: **Group 2A**)

Synonyms

- Benzo[*def*]chrysene
- 1,2-Benzopyrene
- 3,4-Benzopyrene
- 6,7-Benzopyrene
- 3,4-Benzpyrene
- 3,4-Benz(a)pyrene
- Benz(a)pyrene

- BP
- B(a)P

Last updated: 17 April 1998

BENZO[e]PYRENE

VOL.: 32 (1983) (p. 225)

CAS No.: 192-97-2

Chem. Abstr. Name: Benzo(e)pyrene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Benzo[e]pyrene was tested for carcinogenicity in mice by skin application in two studies, and skin tumours were observed in one experiment. Benzo[e]pyrene was also tested in various studies in mice in the mouse-skin initiation-promotion assay; promoting activity was detected after initiation with 9,10-dimethylbenz[a]anthracene in one study; the initiating activity was not clearly evident in other studies in which 12-O-tetradecanoylphorbol-13-acetate was used as a promoting agent.

Multiple intraperitoneal administrations of benzo[e]pyrene to newborn mice did not result in a significant increase of tumours in two studies.

In rats, pulmonary injection of benzo[e]pyrene at various dose levels resulted in one squamous-cell carcinoma of the lung at the highest dose level and one pulmonary sarcoma at the mid-dose level.

No data on the teratogenicity of this chemical were available.

Benzo[e]pyrene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system. It did not induce mitotic recombination in yeast. It did not induce mutations or sister chromatid exchange in cultured mammalian cells and was negative in assays for morphological transformation. It induced unscheduled DNA synthesis in HeLa cells in the presence of an exogenous metabolic system, but not in primary rat hepatocytes. In the one available report, it did not induce chromosomal aberrations in vitro. In the one available in-vivo study, it induced sister chromatid exchange, but not chromosomal aberrations in hamster bone marrow.

There is *limited evidence* that benzo[e]pyrene is active in short-term tests.

5.2 Human data

Benzo[e]pyrene is present as a major component of the total content of polynuclear aromatic compounds in the environment. Human exposure to benzo[e]pyrene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

The available data are *inadequate* to permit an evaluation of the carcinogenicity of benzo[e]pyrene to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 3 \(1973\)](#)

Subsequent evaluation: Suppl. 7 (1987) (p. 58: **Group 3**)

Synonyms

- 1,2-Benzopyrene
- 4,5-Benzopyrene
- 1,2-Benzpyrene
- 4,5-Benzpyrene
- B(e)P

Last updated: 17 April 1998

CARBAZOLE

VOL.: 32 (1983) (p. 239)

CAS No.: 86-74-8

Chem. Abstr. Name: 9*H*-Carbazole

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Carbazole was tested for carcinogenicity in mice by administration in the diet, by skin application and by subcutaneous injection. In the study by oral administration, a dose-dependent increase in the incidence of liver neoplastic nodules and hepatocellular carcinomas was observed. Papillomas and carcinomas of the forestomach occurred in animals receiving the high-dose level. The other studies in mice were considered inadequate for evaluation.

No data on the teratogenicity of this compound were available.

Carbazole was not mutagenic to *Salmonella typhimurium*.

There is *inadequate evidence* that carbazole is active in short-term tests.

5.2 Human data

Carbazole is present as a major component of the total content of polynuclear aromatic compounds in the environment, arising primarily from the combustion of tobacco and coal.

5.3 Evaluation

There is *limited evidence* that carbazole is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: [Vol. 71 \(1999\)](#)

Synonyms

- 9-Azafluorene
- Dibenzopyrrole
- Dibenzo(*b,d*)pyrrole
- Diphenylenimine

CHRYSENE

VOL.: 32 (1983) (p. 247)

CAS No.: 218-01-9

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Chrysene was tested for carcinogenicity in several studies by skin application to mice and produced skin tumours; in one study, an enhancing effect was observed when chrysene was tested simultaneously with *n*-dodecane. Chrysene was also tested in the mouse-skin initiation-promotion assay and was active as an initiator. Local tumours were observed following its subcutaneous injection in mice. Perinatal administration of chrysene to mice by subcutaneous or intraperitoneal injection increased the incidences of liver tumours.

No relevant data on the teratogenicity of this chemical were available.

Chrysene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system. It did not induce mitotic recombination in yeast, unscheduled DNA synthesis in primary rat hepatocytes, or mutations in Chinese hamster V79 cells. However, in one study each in mice and hamsters it induced sister chromatid exchange and chromosomal aberrations, respectively. It was positive in one of two reported studies of morphological transformation in mammalian cells.

There is *limited evidence* that chrysene is active in short-term tests.

5.2 Human data

Chrysene is present as a major component of the total content of polynuclear aromatic compounds in the environment. Human exposure to chrysene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

There is *limited evidence* that chrysene is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 3 \(1973\)](#)

Subsequent evaluation: Suppl. 7 (1987) (p. 60: **Group 3**)

Synonyms

- 1,2-Benzophenanthrene
 - Benzo(*a*)phenanthrene
 - 1,2-Benzphenanthrene
 - Benz(*a*)phenanthrene
 - 1,2,5,6-Dibenzonaphthalene
-

Last updated: 17 April 1998

CORONENE

VOL.: 32 (1983) (p. 263)

CAS No.: 191-07-1

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Coronene was tested for carcinogenicity in one experiment in mice by skin application. No significant increase in the incidence of skin tumours was observed. It was also tested in the mouse-skin initiation-promotion assay and was active as an initiator.

No data on the teratogenicity of this compound were available.

Coronene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system.

There is *inadequate evidence* that coronene is active in short-term tests.

5.2 Human data

Coronene is present as a minor component of the total content of polynuclear aromatic compounds in the environment; it is a major component of the polycyclic aromatic compound content of gasoline engine exhaust.

5.3 Evaluation

The available data are *inadequate* to permit an evaluation of the carcinogenicity of coronene to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 61: **Group 3**)

Synonym

- Hexabenzobenzene

CYCLOPENTA[cd]PYRENE

VOL.: 32 (1983) (p. 269)

CAS No.: 27208-37-3

Chem. Abstr. Name: Cyclopenta(cd)pyrene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Cyclopenta[cd]pyrene was tested for carcinogenicity in two studies in female mice by skin application; it produced skin tumours in one study. It was also tested in the mouse-skin initiation-promotion assay in three studies and was active as an initiator.

No data were available on the teratogenicity of this chemical.

Cyclopenta[cd]pyrene was mutagenic to *Salmonella typhimurium* and to mammalian cells *in vitro* in the presence of an exogenous metabolic system. It induced morphological transformation in mammalian cells.

There is *sufficient evidence* that cyclopenta[cd]pyrene is active in short-term tests.

N.B. - Subsequent to the meeting, the Secretariat became aware of a study (Cavalieri *et al.*, 1983) in which cyclopenta[cd]pyrene was tested alone or in combination with benzo[a]pyrene by repeated application to the skin of female Swiss mice. At the end of the experiment, analysis of the incidence of malignant skin tumours showed that the two compounds acted synergistically.

5.2 Human data

Cyclopenta[cd]pyrene is present as a minor component of the total content of polynuclear aromatic compounds in the environment but occurs as a major polynuclear aromatic component of gasoline engine exhaust.

N.B. - Studies on occupational exposure to polynuclear aromatic compounds will be considered in future *IARC Monographs*.

5.3 Evaluation

There is *limited evidence* that cyclopenta[cd]pyrene is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 61: **Group 3**)

Synonyms

- Acepyrene
 - Cyclopenteno[cd]pyrene
-

Last updated: 17 April 1998

DIBENZ[*a,h*]ACRIDINE

VOL.: 32 (1983) (p. 277)

CAS No.: 226-36-8

Chem. Abstr. Name: Dibenz(*a,h*)acridine

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Dibenz[*a,h*]acridine has been shown to be carcinogenic to experimental animals.

No data on the teratogenicity of this compound were available.

Both positive and negative results were obtained in tests of mutagenicity in *Salmonella typhimurium*.

There is *inadequate evidence* that dibenz[*a,h*]acridine is active in short-term tests.

5.2 Human data

Dibenz[*a,h*]acridine is present as a minor component of the total content of polynuclear aromatic compounds in tobacco smoke and urban pollutants.

5.3 Evaluation

There is *sufficient evidence* that dibenz[*a,h*]acridine is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 3 \(1973\)](#)

Subsequent evaluation: Suppl. 7 (1987) (p. 61: **Group 2B**)

Synonyms

- 7-Azadibenz(*a,h*)anthracene
- DB(*a,h*)AC
- 1,2:5,6-Dibenzacridine
- 1,2,5,6-Dibenzacridine
- Dibenz(*a,d*)acridine
- 1,2,5,6-Dibenzoacridine
- 1,2,5,6-Dinaphthacridine

DIBENZ[*a,j*]ACRIDINE

VOL.: 32 (1983) (p. 283)

CAS No.: 224-42-0

Chem. Abstr. Name: Dibenz(*a,j*)acridine

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Dibenz[*a,j*]acridine has been shown to be carcinogenic to experimental animals.

No data on the teratogenicity of this compound were available.

Dibenz[*a,j*]acridine was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system. It did not induce unscheduled DNA synthesis in rat hepatocytes.

There is *inadequate evidence* that dibenz[*a,j*]acridine is active in short-term tests.

5.2 Human data

Dibenz[*a,j*]acridine occurs in tobacco smoke and urban pollutants.

5.3 Evaluation

There is *sufficient evidence* that dibenz[*a,j*]acridine is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 3 \(1973\)](#)

Subsequent evaluation: Suppl. 7 (1987) (p. 61: **Group 2B**)

Synonyms

- 7-Azadibenz(*a,j*)anthracene
- DB(*a,j*)AC
- 1,2:7,8-Dibenzacridine
- 1,2,7,8-Dibenzacridine
- 3,4,5,6-Dibenzacridine
- Dibenz(*a,f*)acridine
- Dibenzo(*a,j*)acridine
- 3,4,6,7-Dinaphthacridine

DIBENZ[a,c]ANTHRACENE

VOL.: 32 (1983) (p. 289)

CAS No.: 215-58-7

Chem. Abstr. Name: Benzo(b)triphenylene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Dibenz[a,c]anthracene was tested for carcinogenicity in one experiment by skin application to female mice and produced skin tumours. It was also tested in three experiments using the mouse-skin initiation-promotion assay and showed initiating activity.

No data on the teratogenicity of this chemical were available.

In the presence of an exogenous metabolic system, dibenz[a,c]anthracene was mutagenic to *Salmonella typhimurium* and mammalian cells in culture. It was positive in an assay for differential survival, using DNA repair-proficient/-deficient strains of *Bacillus subtilis*, and induced unscheduled DNA repair synthesis in cultured mammalian cells. In two of three studies it induced morphological transformation in mammalian cells.

There is *sufficient evidence* that dibenz[a,c]anthracene is active in short-term tests.

5.2 Human data

Dibenz[a,c]anthracene is present as a minor component of the total content of polynuclear aromatic compounds in the environment. Human exposure to dibenz[a,c]anthracene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

There is *limited evidence* that dibenz[a,c]anthracene is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 61: **Group 3**)

Synonyms

- Dibenzo[a,c]anthracene
- 1,2:3,4-Dibenzanthracene
- 1,2:3,4-Dibenzoanthracene

DIBENZ[*a,h*]ANTHRACENE

VOL.: 32 (1983) (p. 299)

CAS No.: 53-70-3

Chem. Abstr. Name: Dibenz(*a,h*)anthracene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Dibenz[*a,h*]anthracene has been shown to be carcinogenic to experimental animals.

Dibenz[*a,h*]anthracene is embryotoxic to rats when given at high doses. The available data on teratogenicity were inadequate for evaluation

Dibenz[*a,h*]anthracene was positive in differential survival assays using DNA-repair-proficient/-deficient strains of bacteria and was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system. In cultured mammalian cells, dibenz[*a,h*]anthracene was mutagenic and induced unscheduled DNA synthesis in the presence of an exogenous metabolic system. It was positive in assays for morphological transformation. In the one available study, it induced sister chromatid exchange but not chromosomal aberrations *in vivo*.

There is *sufficient evidence* that dibenz[*a,h*]anthracene is active in short-term tests.

5.2 Human data

Dibenz[*a,h*]anthracene is present as a minor component of the total content of polynuclear aromatic compounds in the environment. Human exposure to dibenz[*a,h*]anthracene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated with combustion products.

5.3 Evaluation

There is *sufficient evidence* that dibenz[*a,h*]anthracene is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 3 \(1973\)](#)

Subsequent evaluation: Suppl. 7 (1987) (p. 58: **Group 2A**)

Synonyms

- 1,2:5,6-Benzanthracene
- DBA
- DB(*a,h*)A
- 1,2:5,6-Dibenzanthracene
- 1,2,5,6-Dibenzanthracene
- 1,2:5,6-Dibenz(*a*)anthracene
- 1,2,7,8-Dibenzanthracene
- 1,2:5,6-Dibenzoanthracene

- Dibenzo[*a,h*]anthracene

Last updated: 17 April 1998

DIBENZ[*a,j*]ANTHRACENE

VOL.: 32 (1983) (p. 309)

CAS No.: 224-41-9

Chem. Abstr. Name: Dibenz(*a,j*)anthracene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Dibenz[*a,j*]anthracene was tested for carcinogenicity in female mice by skin application and produced skin tumours. It was also tested in mice by subcutaneous injection and produced a few tumours at the site of injection.

No data were available on the teratogenicity of this compound.

In the one available study, dibenz[*a,j*]anthracene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system.

There is *inadequate evidence* that dibenz[*a,j*]anthracene is active in short-term tests.

5.2 Human data

Dibenz[*a,j*]anthracene is present as a minor component of the total content of polynuclear aromatic compounds in the environment. Human exposure to dibenz[*a,j*]anthracene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

N.B. - Studies on occupational exposure to polynuclear aromatic compounds will be considered in future IARC Monographs.

5.3 Evaluation

There is *limited evidence* that dibenz[*a,j*]anthracene is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 61: **Group 3**)

Synonyms

- 1,2:7,8-Dibenzanthracene
- 3,4,5,6-Dibenzanthracene
- Dibenzo-1,2,7,8-anthracene
- Dibenzo[*a,j*]anthracene

7H-DIBENZO[c,g]CARBAZOLE

VOL.: 32 (1983) (p. 315)

CAS No.: 194-59-2

Chem. Abstr. Name: 7H-Dibenzo(c,g)carbazole

5. Summary of Data Reported and Evaluation

5.1 Experimental data

7H-Dibenzo[c,g]carbazole has been shown to be carcinogenic to experimental animals.

No data on the teratogenicity of this compound were available.

There were insufficient data available to evaluate the mutagenicity of 7H-dibenzo[c,g]carbazole to *Salmonella typhimurium*.

There is *inadequate evidence* that 7H-dibenzo[c,g]carbazole is active in short-term tests.

5.2 Human data

7H-Dibenzo[c,g]carbazole occurs in tobacco smoke.

5.3 Evaluation

There is *sufficient evidence* that 7H-dibenzo[c,g]carbazole is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 3 \(1973\)](#)

Subsequent evaluation: Suppl. 7 (1987) (p. 61: **Group 2B**)

Synonyms

- 7-Aza-7H-dibenzo(c,g)fluorene
- 3,4,5,6-Dibenzocarbazole

DIBENZO[*a,e*]FLUORANTHENE

VOL.: 32 (1983) (p. 321)

CAS No.: 5385-75-1

Chem. Abstr. Name: Dibenz(*a,e*)aceanthrylene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Dibenzo[*a,e*]fluoranthene was tested for carcinogenicity in one study by skin application to mice and produced skin tumours. It was also tested in the mouse-skin initiation-promotion assay and was active as an initiator.

Dibenzo[*a,e*]fluoranthene was tested in mice by subcutaneous administration and produced sarcomas at the injection site.

No data on the teratogenicity of this chemical were available.

No data were available to evaluate the activity of dibenzo[*a,e*]fluoranthene in short-term tests.

5.2 Human data

Dibenzo[*a,e*]fluoranthene is present as a minor component of the total content of polynuclear aromatic compounds in the environment. Human exposure to dibenzo[*a,e*]fluoranthene occurs primarily through the smoking of tobacco; it may also occur through inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

There is *limited evidence* that dibenzo[*a,e*]fluoranthene is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 61: **Group 3**)

Synonym

- 2,3,5,6-Dibenzofluoranthene

DIBENZO[a,e]PYRENE

VOL.: 32 (1983) (p. 327)

CAS No.: 192-65-4

Chem. Abstr. Name: Naphtho(1,2,3,4-*def*)chrysene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Dibenzo[a,e]pyrene has been shown to be carcinogenic to experimental animals.

No data on the teratogenicity of this compound were available.

In the one study evaluated, dibenzo[a,e]pyrene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system.

There is *inadequate evidence* that dibenzo[a,e]pyrene is active in short-term tests.

5.2 Human data

Dibenzo[a,e]pyrene is present as a minor component of the total content of polynuclear aromatic compounds in the environment. Human exposure to dibenzo[a,e]pyrene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated with combustion products.

5.3 Evaluation

There is *sufficient evidence* that dibenzo[a,e]pyrene is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 3 \(1973\)](#)

Subsequent evaluation: Suppl. 7 (1987) (p. 62: **Group 2B**)

Synonyms

- DB(a,e)P
- 1,2:4,5-Dibenzopyrene
- 1,2,4,5-Dibenzopyrene
- Naphtho(1,2,3,4,*def*)chrysene

DIBENZO[*a,h*]PYRENE

VOL.: 32 (1983) (p. 331)

CAS No.: 189-64-0

Chem. Abstr. Name: Dibenzo(*b,def*)chrysene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Dibenzo[*a,h*]pyrene has been shown to be carcinogenic to experimental animals.

No data on the teratogenicity of this compound were available.

In one study, dibenzo[*a,h*]pyrene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system.

There is *inadequate evidence* that dibenzo[*a,h*]pyrene is active in short-term tests.

5.2 Human data

Dibenzo[*a,h*]pyrene is present as a minor component of the total content of polynuclear aromatic compounds in the environment. Human exposure to dibenzo[*a,h*]pyrene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated with combustion products.

N.B. - Studies on occupational exposure to polynuclear aromatic compounds will be considered in future IARC Monographs.

5.3 Evaluation

There is *sufficient evidence* that dibenzo[*a,h*]pyrene is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 3 \(1973\)](#)

Subsequent evaluation: Suppl. 7 (1987) (p. 62: **Group 2B**)

Synonyms

- DB(*a,h*)P
- 1,2,6,7-Dibenzopyrene
- 3,4:8,9-Dibenzopyrene
- 3,4,8,9-Dibenzopyrene

DIBENZO[a,i]PYRENE

VOL.: 32 (1983) (p. 337)

CAS No.: 189-55-9

Chem. Abstr. Name: Benzo(rst)pentaphene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Dibenzo[a,i]pyrene has been shown to be carcinogenic to experimental animals.

No data on the teratogenicity of this compound were available.

Dibenzo[a,i]pyrene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system. It was positive in assays for differential killing in strains of DNA-repair-proficient/-deficient bacteria. It did not induce unscheduled DNA synthesis in rat hepatocytes.

There is *inadequate evidence* that dibenzo[a,i]pyrene is active in short-term tests.

5.2 Human data

Dibenzo[a,i]pyrene is present as a minor component of the total content of polynuclear aromatic compounds in the environment. Human exposure to dibenzo[a,i]pyrene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated with combustion products.

N.B. - Studies on occupational exposure to polynuclear aromatic compounds will be considered in future *IARC Monographs*.

5.3 Evaluation

There is *sufficient evidence* that dibenzo[a,i]pyrene is carcinogenic to experimental animals.

N.B. - In the absence of adequate data on humans, it is reasonable, for practical purposes, to consider chemicals for which there is *sufficient evidence* of carcinogenicity in animals as if they presented a carcinogenic risk to humans.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 3 \(1973\)](#)

Subsequent evaluation: Suppl. 7 (1987) (p. 62: **Group 2B**)

Synonyms

- DB(a,i)P
- 1,2,7,8-Dibenzopyrene
- 3,4:9,10-Dibenzopyrene
- Dibenzo(b,h)pyrene

- 1,2:7,8-Dibenzpyrene
- 3,4,9,10-Dibenzpyrene

Last updated: 17 April 1998

DIBENZO[*a,l*]PYRENE

VOL.: 32 (1983) (p. 343)

CAS No.: 191-30-0

Chem. Abstr. Name: Dibenzo(*def,p*)chrysene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Dibenzo[*a,l*]pyrene was tested for carcinogenicity in mice in one study by skin application and in one study by subcutaneous administration. It induced tumours at the sites of application.

No data on the teratogenicity of this compound were available.

No data were available to evaluate the activity of dibenzo[*a,l*]pyrene in short-term tests.

5.2 Human data

Dibenzo[*a,l*]pyrene is present as a minor component of the total content of polynuclear aromatic compounds in the environment. Human exposure to dibenzo[*a,l*]pyrene occurs mainly through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated with combustion products.

5.3 Evaluation

There is *sufficient evidence* that dibenzo[*a,l*]pyrene is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 3 \(1973\)](#)

Subsequent evaluation: Suppl. 7 (1987) (p. 62: **Group 2B**)

Synonyms

- Ba 51-090462
- DB(*a,l*)P
- 1,2:3,4-Dibenzopyrene
- 1,2,3,4-Dibenzopyrene
- 1,2,9,10-Dibenzopyrene
- 2,3:4,5-Dibenzopyrene
- 4,5,6,7-Dibenzopyrene

1,4-DIMETHYLPHENANTHRENE

VOL.: 32 (1983) (p. 349)

CAS No.: 22349-59-3

Chem. Abstr. Name: Phenanthrene, 1,4-dimethyl-

5. Summary of Data Reported and Evaluation

5.1 Experimental data

1,4-Dimethylphenanthrene was tested only for tumour-initiating activity in the mouse-skin initiation-promotion assay. It was active as an initiator.

No data on the teratogenicity of this compound were available.

1,4-Dimethylphenanthrene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system and induced unscheduled DNA synthesis in cultured primary rat hepatocytes.

There is *limited evidence* that 1,4-dimethylphenanthrene is active in short-term tests.

5.2 Human data

Humans are exposed to dimethylphenanthrenes in tobacco smoke and urban air; however, 1,4-dimethylphenanthrene has not been specifically identified.

5.3 Evaluation

The available data were *inadequate* to permit an evaluation of the carcinogenicity of 1,4-dimethylphenanthrene *per se* to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 62: **Group 3**)

FLUORANTHENE

VOL.: 32 (1983) (p. 355)

CAS No.: 206-44-0

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Fluoranthene was tested for carcinogenicity by skin application in mice in two studies, and no tumorigenic effect was observed. It was also tested in the mouse-skin initiation-promotion assay and was inactive as an initiator. A study in mice by subcutaneous administration was considered inadequate for evaluation. When fluoranthene was administered to mice by skin application together with benzo[a]pyrene, an excess of skin tumours was produced over that induced by the same dose of benzo[a]pyrene alone.

No data were available on the teratogenicity of fluoranthene.

Fluoranthene was mutagenic to *Salmonella typhimurium* and to cultured human lymphoblastoid cells in the presence of an exogenous metabolic system.

There is *limited evidence* that fluoranthene is active in short-term tests.

5.2 Human data

Fluoranthene is present as a major component of the total content of polynuclear aromatic compounds in the environment. Human exposure to fluoranthene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

The available data provide no evidence that fluoranthene *per se* is carcinogenic to experimental animals.

Subsequent evaluation: Suppl. 7 (1987) (p. 63: **Group 3**)

Synonyms

- 1,2-Benzacenaphthene
- Benzo(*jk*)fluorene
- Idryl
- 1,2-(1,8-Naphthalenediyl)benzene
- 1,2-(1,8-Naphthylene)benzene

FLUORENE

VOL.: 32 (1983) (p. 365)

CAS No.: 86-73-7

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Fluorene was tested for carcinogenicity in mice by skin application and by subcutaneous administration and in female rats by oral administration in the diet. The studies were considered inadequate for evaluation.

No data were available on the teratogenicity of fluorene.

Fluorene was not mutagenic to *Salmonella typhimurium*. In the one available study, it did not induce unscheduled DNA synthesis in primary rat hepatocyte cultures.

There is *inadequate evidence* that fluorene is active in short-term tests.

5.2 Human data

Fluorene is present as a major component of the total content of polynuclear aromatic compounds in the environment. Human exposure to fluorene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

The available data are *inadequate* to permit an evaluation of the carcinogenicity of fluorene to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 63: **Group 3**)

Synonyms

- *ortho*-Biphenylenemethane
- Diphenylenemethane
- 2,2'-Methylenebiphenyl

INDENO[1,2,3-*cd*]PYRENE

VOL.: 32 (1983) (p. 373)

CAS No.: 193-39-5

Chem. Abstr. Name: Indeno(1,2,3-*cd*)pyrene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Indeno[1,2,3-*cd*]pyrene has been shown to be carcinogenic to experimental animals (see 'General Remarks on the Substances Considered', in this volume and IARC, 1973).

No data on the teratogenicity of this compound were available.

Indeno[1,2,3-*cd*]pyrene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system.

There is *inadequate evidence* that indeno[1,2,3-*cd*]pyrene is active in short-term tests.

5.2 Human data

Indeno[1,2,3-*cd*]pyrene is present as a component of the polynuclear aromatic compound content in the environment. Human exposure to indeno[1,2,3-*cd*]pyrene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

There is *sufficient evidence* that indeno[1,2,3-*cd*]pyrene is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 3 \(1973\)](#)

Subsequent evaluation: Suppl. 7 (1987) (p. 64: **Group 2B**)

Synonyms

- IP
- *ortho*-Phenylene-pyrene
- 1,10-(*ortho*-Phenylene)pyrene
- 1,10-(1,2-Phenylene)pyrene
- 2,3-*ortho*-Phenylene-pyrene

1-, 2-, 3-, 4-, 5- AND 6-METHYLCHRYSENES

VOL.: 32 (1983) (p.379)

CAS No.: 3351-28-8

Chem. Abstr. Name: Chrysene, 1-methyl-

CAS No.: 3351-32-4

Chem. Abstr. Name: Chrysene, 2-methyl-

CAS No.: 3351-31-3

Chem. Abstr. Name: Chrysene, 3-methyl-

CAS No.: 3351-30-2

Chem. Abstr. Name: Chrysene, 4-methyl-

CAS No.: 3697-24-3

Chem. Abstr. Name: Chrysene, 5-methyl-

CAS No.: 1705-85-7

Chem. Abstr. Name: Chrysene, 6-methyl-

5. Summary of Data Reported and Evaluation

5.1 Experimental data

In comparative studies carried out in the same laboratory, 1-, 2-, 3-, 4-, 5- and 6-methylchrysenes were tested for carcinogenicity by skin application to female mice and in the mouse-skin initiation-promotion assay. 5-Methylchrysene induced the highest incidence of malignant skin tumours, when tested alone or together with a promoter. An intermediate response was observed with 2-, 3-, 4- and 6-methylchrysenes when tested as carcinogens; however, 1-methylchrysene was inactive. All the chrysene derivatives showed varying degrees of initiating activity.

5-Methylchrysene, when tested by subcutaneous injection in mice, produced a high incidence of sarcomas at the site of injection.

No data on the teratogenicity of these compounds were available.

1-, 2-, 3-, 4-, 5- and 6-Methylchrysenes were mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system. 5-Methylchrysene induced DNA damage in primary rat hepatocytes.

There is *inadequate evidence* that 1-, 2-, 3-, 4- and 6-methylchrysenes are active in short-term tests. There is *limited evidence* that 5-methylchrysene is active in short-term tests.

5.2 Human data

1-, 2-, 3-, 4-, 5- and 6-Methylchrysenes are present as minor components of the total content of polynuclear aromatic compounds in the environment. They occur primarily in products deriving from organic matter containing steroids, such as tobacco smoke and some petroleum-derived products.

5.3 Evaluation

There is *inadequate evidence* that 1-methylchrysene is carcinogenic to experimental animals.

There is *limited evidence* that 2-, 3-, 4- and 6-methylchrysenes are carcinogenic to experimental animals.

There is *sufficient evidence* that 5-methylchrysene is carcinogenic to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 66: 1-, 2-, 3-, 4-, and 6-Methylchrysenes - **Group 3**; 5-methylchrysene - **Group 2B**)

Synonym for 1-Methylchrysene

- 3-Methylchrysene

Synonym for 2-Methylchrysene

- 4-Methylchrysene

Synonym for 3-Methylchrysene

- 5-Methylchrysene

Synonym for 4-Methylchrysene

- 6-Methylchrysene

Synonym for 5-Methylchrysene

- 1-Methylchrysene

Synonym for 6-Methylchrysene

- 2-Methylchrysene

2- AND 3-METHYLFLUORANTHENES

VOL.: 32 (1983) (p.399)

CAS No.: 33543-31-6

Chem. Abstr. Name: Fluoranthene, 2-methyl-

CAS No.: 1706-01-0

Chem. Abstr. Name: Fluoranthene, 3-methyl-

5. Summary of Data Reported and Evaluation

5.1 Experimental data

2-Methylfluoranthene was tested for carcinogenicity in one experiment in mice by skin application and produced benign and malignant skin tumours. It was also tested in the mouse-skin initiation-promotion assay in one experiment and was active as an initiator.

3-Methylfluoranthene was tested in only one experiment in the mouse-skin initiation-promotion assay, and benign skin tumours occurred.

No data on the teratogenicity of these compounds were available.

In the one available study, 2- and 3-methylfluoranthenes were mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system.

There is *inadequate evidence* that 2- and 3-methylfluoranthenes are active in short-term tests.

5.2 Human data

2- and 3-Methylfluoranthenes are present as minor components of the total content of polynuclear aromatic compounds in tobacco smoke; however, they are also expected to occur in other combustion products contaminating the environment.

5.3 Evaluation

There is *limited evidence* that 2-methylfluoranthene is carcinogenic to experimental animals.

The available data were *inadequate* to permit an evaluation of the carcinogenicity of 3-methylfluoranthene to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 66: **Group 3**)

Synonyms for 2-Methylfluoranthene

- 3-Methylfluoranthrene

Synonyms for 3-Methylfluoranthene

- **4-Methylfluoranthene**

Last updated 02/27/98

1-METHYLPHENANTHRENE

VOL.: 32 (1983) (p. 405)

CAS No.: 832-69-9

Chem. Abstr. Name: Phenanthrene, 1-methyl-

5. Summary of Data Reported and Evaluation

5.1 Experimental data

1-Methylphenanthrene was tested in the mouse-skin initiation-promotion assay in one study and was inactive as an initiator.

No data on the teratogenicity of this chemical were available.

1-Methylphenanthrene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system. It induced unscheduled DNA synthesis in cultured primary hepatocytes from rats and was mutagenic to human lymphoblasts *in vitro* in the presence of an exogenous metabolic system.

There is *sufficient evidence* that 1-methylphenanthrene is active in short-term tests.

5.2 Human data

1-Methylphenanthrene is present as a major component of the total content of polynuclear aromatic compounds in the environment. Human exposure to 1-methylphenanthrene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

The available data are *inadequate* to permit an evaluation of the carcinogenicity of 1-methylphenanthrene to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 66: **Group 3**)

PERYLENE

VOL.: 32 (1983) (p. 411)

CAS No.: 198-55-0

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Perylene was tested for carcinogenicity by skin application to mice in one experiment, and no carcinogenic effect was observed. It was also tested in the mouse-skin initiation-promotion assay in one study, with negative results.

No data on the teratogenicity of this compound were available.

Perylene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system. In one study, it did not induce mutations in cultured human lymphoblastoid cells. The data from one study on chromosomal effects were inadequate to make an evaluation.

There is *inadequate evidence* that perylene is active in short-term tests.

5.2 Human data

Perylene is present as a minor component of the total content of polynuclear aromatic compounds of the environment. Human exposure to perylene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated with combustion products.

5.3 Evaluation

The available data are *inadequate* to permit an evaluation of the carcinogenicity of perylene in experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 69: **Group 3**)

Synonyms

- Dibenz(*de,k*)anthracene
- Peri-dinaphthalene
- Perilene

PHENANTHRENE

VOL.: 32 (1983) (p. 419)

CAS No.: 85-01-8

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Phenanthrene was tested for carcinogenicity in two fragmentary studies in mice by skin painting and no skin tumour was reported. In the six studies in which phenanthrene was tested in the mouse-skin initiation-promotion assay, it was active as an initiator in one study, inactive as an initiator in four others, and inactive as a promoter in one study.

Phenanthrene administered by intraperitoneal or subcutaneous injection to neonatal mice did not increase the incidence of tumours over that in controls. Experiments involving a single oral administration to rats and a single subcutaneous injection to mice were inadequate for evaluation.

No data on the teratogenicity of this compound were available.

Phenanthrene has generally been reported to be non-mutagenic to *Salmonella typhimurium*; however, in one study it was reported to be mutagenic to *Salmonella typhimurium* in the presence of a high concentration of an exogenous metabolic system. It gave negative results in an assay for differential survival using DNA-repair-proficient/-deficient strains of *Bacillus subtilis*. It did not induce DNA repair, chromosomal aberrations or sister chromatid exchange in cultured mammalian cells. It did induce mutation in one experiment in human cells in culture in the presence of an exogenous metabolic system, and induced sister chromatid exchange in Chinese hamster bone-marrow cells *in vivo*. The compound failed to induce morphological transformation.

There is *limited evidence* that phenanthrene is active in short-term tests.

5.2 Human data

Phenanthrene occurs as a major component of the total content of polynuclear aromatic compounds in the environment. Human exposure to phenanthrene occurs primarily through the smoking of tobacco, inhalation of polluted air or by ingestion of food or water contaminated by combustion effluents.

5.3 Evaluation

The available data are *inadequate* to permit an evaluation of the carcinogenicity of phenanthrene to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 69: **Group 3**)

Synonyms

- Phenanthren
- Phenantrin

Last updated: 17 April 1998

PYRENE

VOL.: 32 (1983) (p. 431)

CAS No.: 129-00-0

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Pyrene was tested for carcinogenicity in several experiments by skin application to mice, and no skin tumour was observed. It was also tested in several studies in the mouse-skin initiation-promotion assay, with inconclusive results. When tested on mice skin simultaneously with benzo[a]pyrene it enhanced the carcinogenic effects of benzo[a]pyrene.

A study in mice by subcutaneous injection was inadequate for evaluation of carcinogenicity.

Intratracheal administration to hamsters of pyrene attached to haematite did not produce tumours.

No data on the teratogenicity of this compound were available.

Pyrene has been tested extensively in both in-vitro and in-vivo short-term tests. It was negative in assays for differential survival in DNA-repair-proficient/-deficient strains of bacteria and was mutagenic in some assays in *Salmonella typhimurium* in the presence of an exogenous metabolic system. Tests for genetic activity in yeast were negative. It was not mutagenic to *Drosophila melanogaster*. It did induce mutations and unscheduled DNA synthesis in some in-vitro assays in mammalian cells. Pyrene did not induce morphological transformation. In tests in mammals *in-vivo* it did not induce sister chromatid exchange or micronuclei.

There is *limited evidence* that pyrene is active in short-term tests.

5.2 Human data

Pyrene is present as a major component of the total content of polynuclear aromatic compounds in the environment. Human exposure to pyrene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

The available data provide no evidence that pyrene *per se* is carcinogenic to experimental animals.

Subsequent evaluation: Suppl. 7 (1987) (p. 71: **Group 3**)

Synonyms

- Benzo(*def*)phenanthrene
- β -Pyrene

TRIPHENYLENE

VOL.: 32 (1983) (p. 447)

CAS No.: 217-59-4

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Triphenylene was tested for carcinogenicity in one study by skin application to male mice. No increase in the incidence of skin tumours was observed.

No data on the teratogenicity of this compound were available.

Triphenylene was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system.

There is *inadequate evidence* that triphenylene is active in short-term tests.

5.2 Human data

Triphenylene is present as a major component of the total content of polynuclear aromatic compounds in the environment. Human exposure to triphenylene occurs primarily through the smoking of tobacco, inhalation of polluted air and by ingestion of food and water contaminated by combustion effluents.

5.3 Evaluation

The available data are *inadequate* to permit an evaluation of the carcinogenicity of triphenylene to experimental animals.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 73: **Group 3**)

Synonyms

- Benzo(1)phenanthrene
- 9,10-Benzophenanthrene
- 9,10-Benzphenanthrene
- 1,2,3,4-Dibenznaphthalene
- Isochrysene