

and Allen (132) published a note on herbicides and spina bifida. They examined all the children referred to in the television program and found one case of an open neural tube defect (spina bifida cystica) while the other children were normal in every respect. It was possible that these apparently "normal" children had spina bifida occulta, however, in none of them had radiography been done and it was probable that the children had nothing more than sacral dimples.

As a final note in relation to this episode, the following brief article appeared in the *New Zealand Medical Journal* (9):

Publicity on certain chemicals as causation of malformations of the human fetus has been widespread. Some of the publicity has been sensation mongering and not all the remarks from the profession have been in keeping with a balanced assessment of scientific evidence. It is proper that there should be intelligent public awareness of the various environmental hazards that may come from the use of chemicals...in farming...however, those who would write of their experiences in medical journals must remember that disasters are the staple of the sensation mongers in the news media industry.

Until recent publicity there had been no suggestion that 2,4,5-T, which has been used for over 20 years in New Zealand, was responsible for congenital malfunctions either in man or in farm animals. It is the duty of the physicians (and scientists) who have any concern for science to attempt to make valid observations that can be repeated. In the problem at issue, fetal malformations are nature's common mistakes which we have no desire to perpetrate or to increase, although they are the inevitable price that is paid for our place on the evolutionary scale. There are extensive gaps in our knowledge but they will be filled only by patient work. Unresolved problems of fetotoxicity can only be solved by accurate record keeping at all stages of pregnancy.

The Missouri Horse Arena Episode

Many of the episodes discussed in this chapter involved "suspected" TCDD poisoning; however, the Missouri Horse Arena Episode is one in which TCDD was confirmed to be the causative agent.

In 1972, The Missouri Division of Health and The Center for Disease Control, Atlanta, Georgia (13) reported an investigation of a horse arena in eastern Missouri where 54 of 57 horses exposed to the arena had died of an illness characterized by skin lesions, severe weight loss, and hepatotoxicity. Birds, dogs, cats, insects, and rodents were also found dead in and around the arena, and one 6-year-old girl exposed developed hemorrhagic cystitis (characterized by blood in the urine). Analysis of urine cultures for bacterial and viral pathogens were negative. Immediately prior to the onset of illness, the arena had been sprayed with salvage oil for dust control.

The report (13) also noted that similar horse illnesses and deaths occurred in two other horse arenas in the eastern Missouri area sprayed by the same salvage oil

company. The three arenas had been sprayed within 1 month of each other. Subsequent to investigation, soil from all three arenas was excavated and disposed. No further problems occurred since the excavations.

As with earlier episodes, the report soon received national attention. Unfortunately, some newspapers misquoted the report by implying that the cause of the incident was a result of spraying contaminated 2,4,5-T herbicide (12).

Carter et al. (44) and Kimbrough et al. (122) have published detailed chemical, epidemiological, and pathological data of the episode. The investigations concluded that a hexachlorophene factory in southwestern Missouri had accumulated distillate residues containing 306 to 356 ppm TCDD. It was these distillate residues that were subsequently disposed of via a salvage oil company and sprayed on the horse arenas. Furthermore, as Kimbrough et al. (122) noted, the investigation demonstrated that the improper disposal of toxic chemical wastes may have serious consequences. Companies responsible for the disposal of such wastes should be aware of the toxicity of these chemical waste products and should practice proper methods of disposal.

Commoner and Scott (46) have reviewed the Missouri Horse Arena Episode in an attempt to provide consultative data to the Italian Government in the wake of the Seveso, Italy episode. Their review focused on the human reactions (symptoms) to accidental TCDD exposure and the problem of soil degradation of TCDD. They also provided an excellent chronological account of the episode.

The response of the horses to TCDD in the above episode is of special interest. In 1970, Pinsent and Lane (160) reported on a illness in four horses, and the subsequent death of one, following the spraying of a brushwood killer (2,4-D and 2,4,5-T) to destroy nettles around the margin of a pasture containing the horses. The horse that died had remained on the pasture for 12 days. The postmortem examination revealed extensive lesions in the esophagus and stomach with degenerative changes involving the liver and kidney. The authors concluded that neither the clinical picture nor the postmortem findings supported a plant poisoning syndrome, and thus it was not possible for the possibility of poisoning by the herbicides. In view of the findings by Kimbrough et al. (112), it would appear that the horses may have been exposed to TCDD.

Beale et al. (24) have recently reexamined the young girl who had developed hemorrhagic cystitis following repeated exposure to TCDD in one of the horse arenas sprayed with waste oils (see Ref. 13). In the 5-year interval since exposure, the patient had grown normally, and both her height and weight were above the 75th percentiles. Detailed physical, chemical, and neurological examinations were also conducted and found to be normal. The same studies were done on the patient's sister and mother, exposed simultaneously, but less extensively to dioxin, and the results were also normal. Beale et al. (24) concluded: "Our experience demonstrates that people exposed to dioxin can recover completely with no apparent sequela from the toxin. It remains to be determined whether the

exposure to dioxin in the their offspring."

The Seveso, Italy Episode

Perhaps the most public episode in Seveso, Italy concern. Hundreds of scientists either on-site inspection this episode. In addition that its outcome could cl

Although the Seveso herbicides, it did, however synthesis, that is, trichloro hexachlorophene), this associated with its industrial trichlorophenol product accident?

A voluminous amount has been only 2 years layman oriented, factually humanistic interest. The titled "A Deadly Saga over Seveso," and "The drama of this industrial Parks and Sullam (15 collection of selected September 1976. In the stated:

The social, economic Italy out of that poison long shadow on the face burned and disfigured of people for many years industrial regulations incident forces the attention

Data on levels of TCDD of human or animal following information The episode of TCDD small town 40 km north

exposure to dioxin in these children will result in abnormal pregnancies or affect their offspring."

The Seveso, Italy Episode

Perhaps the most publicized chemical accident in modern times is the TCDD episode in Seveso, Italy. This episode has attracted worldwide interest and concern. Hundreds of scientists, physicians, and veterinarians have participated in either on-site inspections, conferences, or consultations into the various facets of this episode. In addition, the episode has now acquired such political significance that its outcome could change the political structure of a nation.

Although the Seveso, Italy episode did not involve 2,4,5-T or other phenoxy herbicides, it did, however, involve the potential raw material required for their synthesis, that is, trichlorophenol. Thus, in relation to the phenoxy herbicides (and hexachlorophene), this episode represents to many people an inherent danger associated with its industrial production. Hence, the question: can we do without trichlorophenol products and thus insure our safety from another such industrial accident?

A voluminous amount of literature has been written on this episode, although it has been only 2 years since it occurred. Much of this material has been either layman oriented, factually confused, politically pointed, or limited primarily to humanistic interest. Thus, we have seen in newspapers and magazines, articles titled "A Deadly Saga," "The Graveyard on Milan's Doorstep," "Toxic Cloud over Seveso," and "The Poison That Fell From The Sky." However, the human drama of this industrial accident cannot, and must not, be minimized.

Parks and Sullam (158) have assembled, translated, and reviewed an impressive collection of selected articles from the Italian press for the period 10 July to September 1976. In the introduction to this collection of articles, Parks and Sullam stated:

The social, economic, moral, medical and administrative problems which fell on Italy out of that poisonous cloud are of vast extent and complexity. They cast a very long shadow on the future, involving the rebuilding of shattered lives, the care of burned and disfigured children, health care and the monitoring of health for thousands of people for many years to come, and the shaping of policy decisions regarding industrial regulations and the operations of multinational enterprises to which this incident forces the attention of the Italian Government.

Data on levels of TCDD found, the magnitude of the contamination, or the extent of human or animal illnesses or injuries are still sketchy. Nevertheless, the following information on the episode is available from published documents.

The episode of TCDD poisoning occurred on 10 July 1976 in Seveso, Italy, a small town 40 km north of Milan (95,174). The source of the TCDD was a

TCDD is the dioxin of most concern. It occurs primarily in pesticide made from trichlorophenol, for example, 2,4,5-T and silvex herbicides. Quantitatively it is a very potent teratogen; however, qualitatively the nature of the teratogenic effect of TCDD is far less than many other compounds, such as thalidamide or Vitamin A. The one teratogenic response most commonly associated with TCDD is cleft palate. TCDD tends to cause death of the embryo or fetus rather than a wide range of abnormalities. Present data suggest that in mammals TCDD may be carcinogenic. TCDD tends to accumulate in the liver of rodents, but in nonhuman primates it is associated with tissues having a high lipid content, particularly the skin, muscle, and fat. In man, exposure to TCDD is characterized by the appearance of chloracne and its absence makes it unlikely that systemic disorders present are related to TCDD. Asthenic and vegetative symptoms are often present in overexposure, but are difficult to interpret. They would normally be expected to clear with time. There is no conclusive evidence at this time that TCDD is mutagenic, teratogenic, or carcinogenic in man.

Most TCDD that is applied to the environment during pesticide applications, probably photodegrades within the first 24 hr. It is probably not translocated in plants with the soil then serving as the residual reservoir. The half-life in soil varies from 200-340 days, depending upon soil type and climate. Microbial degradation is probably responsible for the soil disappearance of TCDD. Animals that come in contact with contaminated soil or vegetation, will bioconcentrate TCDD in their liver; however, at present, there are no field data available that indicate that the levels of TCDD found in these animals have a biological effect.

With the current production technology, phenoxy herbicides may be produced containing less than 0.1 ppm TCDD. When these herbicides are properly applied to the environment, TCDD residues are nondetectable. Whether significant bioaccumulation occurs in livestock feeding on herbicide-treated rangeland at sufficient levels to be present in meat consumed by man remains to be determined. On this determination will depend the future use of trichlorophenol-based herbicides.

LITERATURE CITED

1. Adamson, L. 1974. Spray now—Pay later? *Environ. Action*, pp. 9-13; July 6, 1974.
2. Advisory Committee on 2,4,5-T. 1971. Report of the Advisory Committee on 2,4,5-T to the Administrator of the Environmental Protection Agency. 76 p.
3. Ahling, B., A. Lindskog, B. Jansson, and G. Sundstrom. 1977. Formation of polychlorinated dibenzo-*p*-dioxins and dibenzofurans during composition of a 2,4,5-T formulation. *Chemosphere* 6(8):461-468.
4. Albro, P. W. and B. J. Corbett. 1977. Extraction and cleanup of animal tissues for subsequent determination of mixtures of chlorinated dibenzo-*p*-dioxins and dibenzofurans. *Chemosphere* 6(7):381-385.

5. Allen, J. R., D. A. Barsotti, J. P. Van Miller, L. J. Abrahamson, and J. J. Lalich. 1977. Morphological changes in monkeys consuming a diet containing low levels of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Food Cosmet. Toxicol.* 15:401-410.
6. Allen, J. R., J. P. Van Miller, and D. H. Norback. 1975. Tissue distribution, excretion and biological effects of [¹⁴C]tetrachlorodibenzo-*p*-dioxin in rats. *Food Cosmet. Toxicol.* 13(5):501-505.
7. Anonymous. 1967. Search for chick edema factor. *Chem. Eng. News* 45(5):10.
8. Anonymous. 1970. Globe's mystery. 23 February 1970. *Time* 95(8):42.
9. Anonymous. 1972. Fetotoxicity. *N. Z. Med. J.* 75(480):304-305.
10. Anonymous. 1972. Report of the Subcommittee on 2,4,5-T. Agricultural Chemicals Board; Wellington, New Zealand, p 1-10.
11. Anonymous. 1972. Spectrum: A sharp increase. *Environment* 14(4):24.
12. Anonymous. 1974. Death of animals laid to chemicals. *New York Times*, p. 36; August 28, 1974.
13. Anonymous. 1974. Illness associated with TCDD-contaminated soil—Missouri. *Morb. Morb.* 23(34):299.
14. Anonymous. 1974. Vietnam foliage hit hard by herbicides. *Chem. Eng. News* 52(9):6-7.
15. Anonymous. 1975. Comments of The Dow Chemical Company on the paper by Lucile Adamson, "Spray Now - Pay Later?" Published in *Environmental Action*, July 1974, pp. 9-13; The Dow Chemical Co. Midland, MI.
16. Anonymous. 1975. Comments by The Dow Chemical Company on the presentation made by Dr. Theodore D. Sterling, Royal Commission Hearings on Herbicides and Pesticides; Vancouver, British Columbia, Canada. July 16, 1974. The Dow Chemical Co. Midland, MI.
17. Anonymous. 1976. Report of pilot plant operation and proposed reprocessing of herbicide Orange. May 24-July 8, 1976. Defense Supply Agency: Alexandria, VA.
18. Anonymous. 1977. Dioxin: Position document, draft. Dioxin Working Group. April 1977. U.S. Environmental Protection Agency; Washington, D.C.
19. Bartleson, F. D., D. D. Harrison, and J. D. Morgan. 1975. Field studies of wildlife exposed to TCDD contaminated soils. Tech. Rep. AFATL-TR-75-49. Air Force Armament Laboratory, Eglin Air Force Base, FL. 41 p.
20. Bauer, H., K. H. Schulz, and U. Spiegelberg. 1961. Berufliche Vergiftungen bei der Herstellung von Chlorophenol-Verbindungen. *Arch. Gewerbepath. Gewerbehyg.* 18:538-555.
21. Baughman, R. W. and M. S. Meselson. 1973. An analytical method for detecting TCDD (dioxin): Levels of TCDD in samples from Vietnam. *Environ. Health Perspect.*, Exp. Issue No. 5, p. 27-35.
22. Baughman, R. W. and M. S. Meselson. 1973. An improved analysis for tetrachlorodibenzo-*p*-dioxins. *Adv. Chem. Ser.* 120:92-104.
23. Baughman, R. W. 1976. Tetrachlorodibenzo-*p*-dioxins in the environment. High resolution mass spectrometry at the picogram level. *Diss. Abstr. Int.* 36(7):3380B.

24. Beale, M. G., W. T. Shearer, M. M. Karl, and A. M. Robson. 1977. Long-term effects of dioxin exposure. Letter to Editor. *Lancet* 1(8014):748.
25. Beatty, P. W., M. A. Holscher, and R. A. Neal. 1976. Toxicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in larval and adult forms of *Rana catesbeiana*. *Bull. Environ. Contam. Toxicol.* 16(5):578-581.
26. Bennett, G. M., D. P. Earp, and S. Glasstone. 1934. The valency angle of oxygen. *J. Chem. Soc. (London)* 1179-1180.
27. Berry, D. L., P. K. Zachariah, M. J. Namkung, and M. R. Juchau. 1976. Trans-placental induction of carcinogen-hydroxylating systems with 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Toxicol. Appl. Pharmacol.* 36:569-584.
28. Blair, E. H. (Ed.) 1973. *Chlorodioxins—Origin and Fate*. *Adv. Chem. Ser.* 120:141 p.
29. Blaser, W. E., R. A. Bredeweg, L. A. Shadoff, and R. H. Stehl. 1976. Determination of chlorinated dibenzo-*p*-dioxins in pentachlorophenol by gas chromatography-mass spectrometry. *Anal. Chem.* 48(7):984-986.
30. Bleiberg, J., M. Wallen, R. Brodtkin, and I. L. Applebaum. 1964. Industrially acquired porphyria. *Arch. Dermatol.* 89:793-797.
31. Boer, F. P. and P. P. North. 1972. The crystal and molecular structure of 2,7-dichlorodibenzo-*p*-dioxin. *Acta Crystallogr.* B28:1613-1618.
32. Boer, F. P., M. A. Neuman, and O. Aniline. 1972. 2,8-Dichlorodibenzo-*p*-dioxin. *Acta Crystallogr.* B28(9):2878-2880.
33. Boer, F. P., F. P. van Remoortere, and W. W. Muelder. 1972. The preparation and structure of 2,3,7,8-tetrachloro-*p*-dioxin and 2,7-dichloro-*p*-dioxin. *J. Am. Chem. Soc.* 94(3):1006-1007.
34. Boer, F. P., F. P. van Remoortere, P. P. North, and M. A. Neuman. 1972. The crystal and molecular structure of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Acta Crystallogr.* B28:1023-1029.
35. Boer, F. P., M. A. Neuman, F. P. van Remoortere, P. P. North, and H. W. Rinn. 1973. X-ray diffraction studies of chlorinated dibenzo-*p*-dioxins. *Adv. Chem. Ser.* 120:14-25.
36. Botre, C., A. Memoli, and F. Alhaique. 1978. TCDD solubilization and photodecomposition in aqueous solutions. *Environ. Sci. Technol.* 12(3):335-336.
37. Buser, H. R. and H. P. Bosshardt. 1974. Determination of 2,3,7,8-tetrachlorodibenzo-1,4-dioxin at parts per billion levels in technical grade 2,4,5-trichlorophenoxyacetic acid, in 2,4,5-T alkyl ester and 2,4,5-T amine salt herbicide formulations by quadrupole mass fragmentography. *J. Chromatogr.* 90(1):71-77.
38. Buser, H. R. and H. P. H. Bosshardt. 1976. Determination of polychlorinated dibenzo-*p*-dioxins and dibenzofurans in commercial pentachlorophenols by combined gas chromatography-mass spectrometry. *J. Assoc. Off. Agric. Chem.* 59(3):562-569.
39. Buu-Hoi, N. P., D. P. Hien, G. Saint-Ruf, and J. Servoisidoine. 1971. Canceromimetic properties of tetrachloro-2,3,7,8-dibenzo-*p*-dioxin. *C. R. Hebd. Seances Acad. Sci., Ser. D.* 272:1447-1450.
40. Buu-Hoi, N. P., D. P. Hien, G. Saint-Ruf, and J. Servoisidoine. 1971. Tetrachlorodibenzodioxin - intimations of carcinogenicity? *Food Cosmet. Toxicol.* 9:909.
41. Buu-Hoi, N. P., G. Sain properties and identification of pyrolysate of defoliant on vegetation. *C. R. Hebd. Seances Acad. Sci., Ser. D.*
42. Campbell, A. D. and D. International Symposium on Pollutants, B. Wesley (Ed.).
43. Cantrell, J. S., N. C. Wei structure of a hydroperoxide of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Acta Crystallogr.*
44. Carter, C. D., R. D. Kimbrell, F. Barthel. 1975. Tetrachlorodibenzo-*p*-dioxin in arenas. *Science* 188:738-740.
45. Chen, J. T. 1973. Infrared spectra of related compounds. *J. Assoc. Off. Agric. Chem.*
46. Commoner, B. and R. E. Smith. 1973. Effects and control of dioxins. *The Biology of Natural Synthesis*
47. Cook, R. E. 1971. Compounds of dioxin. *J. Assoc. Off. Agric. Chem.*
48. Cordes, A. W. and C. K. Ingold. 1962. 1621-1623.
49. Courtney, K. D., D. W. Mitchell. 1970. Teratogenicity of dioxin. *J. Assoc. Off. Agric. Chem.*
50. Courtney, K. D. and J. L. Smith. 1970. p-henoxyacetic acid as a model for dioxin. *Pharmacol.* 20(3):396-400.
51. Courtney, K. D. 1976. A review of the toxicity of dioxin. *Environ. Contam. Toxicol.* 2:1-10.
52. Crosby, D. G., A. S. Haycock. 1973. The decomposition of chlorinated dibenzo-*p*-dioxins. *J. Assoc. Off. Agric. Chem.*
53. Crosby, D. G., K. W. Haycock. 1973. The degradation of dioxins. *Exp. Issue No. 5*, p. 25.
54. Crosby, D. G. and A. S. Haycock. 1973. p-henoxyacetic acid (2,4,5-T). *J. Assoc. Off. Agric. Chem.*
55. Crosby, D. G. and A. S. Haycock. 1973. Dioxins. *Chemosphere* 2:1-10.
56. Crosby, D. G. and A. S. Haycock. 1973. Tetrachlorodibenzo-*p*-dioxin. *J. Assoc. Off. Agric. Chem.*
57. Crow, K. D. 1970. Chlorinated dibenzo-*p*-dioxins. *J. Assoc. Off. Agric. Chem.*
58. Crummett, W. B. and J. W. Fisher. 1973. Dioxins and dibenzofurans. *Pestic. Abstr.* 7(3):163.

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41. Buu-Hoi, N. P., G. Saint-Ruf, P. Bigot, and M. Mangane. 1971. Preparation, properties and identification of dioxin (2,3,7,8-tetrachlorodibenzo-*p*-dioxin) in the pyrolysate of defoliants containing 2,4,5-T and its esters and in contaminated vegetation. *C. R. Hebd. Seances Acad. Sci.*, Ser. D, 273:708-711.
42. Campbell, A. D. and D. Firestone. 1971. Chick edema factor—toxic dioxins. In *International Symposium on Identification and Measurement of Environmental Pollutants*, B. Wesley (Ed.). National Research Council: Ottawa, pp. 195-198.
43. Cantrell, J. S., N. C. Webb, and A. J. Mabis. 1969. The identification and crystal structure of a hydropericardium-producing factor: 1,2,3,7,8,9-hexa-chlorodibenzo-*p*-dioxin. *Acta Crystallogr.* B25:150-156.
44. Carter, C. D., R. D. Kimbrough, J. A. Liddle, R. E. Cline, M. M. Zack, Jr., and W. F. Barthel. 1975. Tetrachlorodibenzodioxin: An accidental poisoning episode in horse arenas. *Science* 188:738-740.
45. Chen, J. T. 1973. Infrared studies of chlorinated dibenzo-*p*-dioxins and structurally related compounds. *J. Assoc. Off. Anal. Chem.* 56(4):962-975.
46. Commoner, B. and R. E. Scott. 1976. Accidental contamination of soil with dioxin in Missouri: Effects and countermeasures. *Mim.*, 27 p. September 24, 1976. Center for the Biology of Natural Systems. Washington University: St. Louis, MO.
47. Cook, R. E. 1971. Completely destroyed. *Yale Alumni Mag.* 34(8):26-29.
48. Cordes, A. W. and C. K. Fair. 1974. Dibenzo-*p*-dioxin. *Acta Crystallogr. Sect. B30*, 6:1621-1623.
49. Courtney, K. D., D. W. Gaylor, M. D. Hogan, H. L. Falk, R. R. Bates, and I. Mitchell. 1970. Teratogenic evaluation of 2,4,5-T. *Science* 168(3933):864-866.
50. Courtney, K. D. and J. A. Moore. 1971. Teratology studies with 2,4,5-trichlorophenoxyacetic acid and 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Toxicol. Appl. Pharmacol.* 20(3):396-403.
51. Courtney, K. D. 1976. Mouse teratology studies with chloro-dibenzo-*p*-dioxins. *Bull. Environ. Contam. Toxicol.* 16(6):674-681.
52. Crosby D. G., A. S. Wong, J. R. Plimmer, and E. A. Woolson. 1971. Photodecomposition of chlorinated dibenzo-*p*-dioxins. *Science* 173(3998):748-749.
53. Crosby, D. G., K. W. Moilanen, and A. S. Wong. 1973. Environmental generation and degradation of dibenzodioxins and dibenzofurans. *Environ. Health Perspect.*, Exp. Issue No. 5, p. 259-266.
54. Crosby, D. G. and A. S. Wong. 1973. Photodecomposition of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) in water. *J. Agric. Food Chem.* 21(6):1052-1054.
55. Crosby, D. G. and A. S. Wong. 1976. Photochemical generation of chlorinated dioxins. *Chemosphere* 5:327-332.
56. Crosby, D. G. and A. S. Wong. 1977. Environmental degradation of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD). *Science* 195:1337-1338.
57. Crow, K. D. 1970. Chloracne. *Trans. St. John's Hosp. Dermatol. Soc.* 56:79-99.
58. Crummett, W. B. and R. H. Stehl. 1973. Determination of chlorinated dibenzo-*p*-dioxins and dibenzofurans in various materials. *Environ. Health Perspect.* 5:15-25. *Pestic. Abstr.* 7(3):163, 1974.

59. Cupello, J. M. and A. L. Young. 1976. Radiochemical bioassay of TCDD uptake in plant material. Extract. Annual Research Progress Report No. 11. Dean of Faculty, United States Air Force Academy, p.22.
60. Cutler, M. R. 1978. Remarks to the National USDA/EPA Symposium on the use of herbicides in forestry. USDA-SEA, Washington, D.C. 7 p.
61. Cutting, R. T., T. H. Phuoc, J. M. Ballo, M. W. Beneson, and C. H. Evans. 1970. Congenital malformations, hydatidiform moles, and stillbirths in the Republic of Vietnam, 1960-1969. Government Printing Office: Washington, D.C.
62. Dalderup, L. M. 1974. Safety measures for taking down buildings contaminated with toxic materials. II. *T. Soc. Genesek*. 52:616-623.
63. Darling, L. and H. Hultgren. 1977. Cytogenetic effects on in vivo bone-marrow cells of *Mus musculus* induced by a commercial 2,4,5-T ester product. *Hereditas* 85(1):123-134.
64. Denivelle, L., R. Fort, and P. Van Hai. 1960. Structural study on some pentachloro (pentachlorophenoxy) cyclohexadienones and some tetrachloro (pentachlorophenoxy) phenols derived therefrom. *Bull. Soc. Chim. Fr.* 8-9:1538-1543.
65. DiGiovanni, J., A. Viaje, D. L. Berry, T. J. Slaga, and M. R. Juchau. 1977. Tumor-initiating ability of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) and Arochlor 1254 in the two-stage system of mouse skin carcinogenesis. *Bull. Environ. Contam. Toxicol.* 18(5):552-557.
66. Dost, F., J. Witt, M. Newton, and L. A. Norris. 1975. Statement on 2,4,5-T and TCDD. *J. For.* 73(7):410-412.
67. Douglass, C. D. and D. F. Flick. 1961. Collaborative bioassay for chick edema factor. *J. Assoc. Off. Agric. Chem.* 44(3):449-456.
68. Dugois, P. and L. Columb. 1956. Acne chlorique au 2,4,5-trichlorophenol. *Bull. Soc. Franc. Derm. Syph.* 63:262-263.
69. Edmunds, J. W., D. F. Lee, and C. M. L. Nickels. 1973. Determination of 2,3,7,8-tetrachlorodibenzo-1,4-dioxin in 2,4,5-T and 2,4,5-T alkyl ester herbicides. *Pestic. Sci.* 4(1):101-105.
70. Elvidge, D. A. 1971. The gas chromatographic determination of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in 2,4,5-T, 2,4,5-T ethyl butyl ester, formulations of 2,4,5-T esters and 2,4,5-trichlorophenol. *Analyst* 96(1147):721-727.
71. Emerson, J. L., D. J. Thompson, R. J. Strebing, C. G. Gerbig, and V. B. Robinson. 1971. Teratogenic studies of 2,4,5-T in the rat and rabbit. *Food Cosmet. Toxicol.* 9:395-404.
72. Emmelin, L. 1977. Conference on phenoxy acids. Current Sweden - Environment, Planning and Conservation. Swedish Institute, Bull. No. 72. p. 1-5.
73. Environmental Defense Society. 1972. The case against 2,4,5-T. *N.Z. Environ.* 2:16-21.
74. Epstein, S. S. 1970. A family likeness. *Environment* 12(6):16-25.
75. Erne, K. 1972. Toxicological aspects of phenoxy herbicides use—some recent results. *Swed. Weed Conf.* 13:C1-C2.
76. Erne, K. 1973. Toxicity. 24:273-275.
77. Fair, S. D. 1963. No p 14(2):54-55.
78. Firestone, D. 1977. The In Chlorinated Phenoxy Environmental Effects. I
79. Firestone, D., W. Ibrahim. 1977. Determination of microcoulometric fats or fatty acids. *J. Ass*
80. Firestone, D., D. F. Flick. 1977. Chick edema factors in cl
81. Firestone, D., J. Ress. 1977. Determination of polychlorophenols. *J. Assoc*
82. Firestone, D. 1973. Etic Issue No. 5, p. 59-66.
83. Fowler, D. L. and J. N. Agric. Stabil. Conserv.
84. Friedman, L., D. Fires. Studies of the chicken 140.
85. Fries, G. F. and G. S. N. dibenzo-*p*-dioxin by-ra
86. Forth, W. 1977. 2,3,7,8-Seveso. *Deut. Arzt. Fo*
87. Gehring, P. J., P. G. A. evaluation of the toxic Menlman, R. E. Shapcology—New Concept Chapter 8, p. 193-270.
88. Gilman, H. and J. J. D. Chem. Soc. 79:1439-1
89. Giovanardi, A. 1976. Seveso and Media. Milan, Italy. August 1
90. Goldmann, P. J. 1973. tetrachlorodibenzodio
91. Gray, A. P., S. P. Cer. polychlorinated dibenz
92. Green, L. 1978. 41 Ve poisoning. Los Angele

76. Erne, K. 1973. Toxicity studies with phenoxy herbicides on reindeer. *Sven. Vet.* 24:273-275.
77. Fair, S. D. 1963. No place to hide: How defoliants expose the Viet Cong. *Army* 14(2):54-55.
78. Firestone, D. 1977. The 2,3,7,8-tetrachlorodibenzo-*p*-dioxin problem: A review. In *Chlorinated Phenoxy Acids and Their Dioxins: Mode of Action, Health Risks and Environmental Effects*. *Ecol. Bull.* (Stockholm), 27 (in press).
79. Firestone, D., W. Ibrahim, and W. Horwitz. 1963. Chick edema factor. III. Application of microcoulometric gas chromatography to detection of chick edema factor in fats or fatty acids. *J. Assoc. Off. Anal. Chem.* 46(3):384-396.
80. Firestone, D., D. F. Flick, J. Ress, and G. R. Higginbotham. 1971. Distribution of chick edema factors in chick tissues. *J. Assoc. Off. Anal. Chem.* 54(6):1293-1298.
81. Firestone, D., J. Ress, N. L. Brown, R. P. Barron, and J. W. Damico. 1972. Determination of polychlorodibenzo-*p*-dioxins and related compounds in commercial chlorophenols. *J. Assoc. Off. Anal. Chem.* 55(1):85-92.
82. Firestone, D. 1973. Etiology of chick edema disease. *Environ. Health Perspect.*, Exp. Issue No. 5, p. 59-66.
83. Fowler, D. L. and J. N. Mahan. 1976. The pesticide review 1976. U.S. Dep. Agric., Agric. Stabil. Conserv. Serv., Washington, D.C.
84. Friedman, L., D. Firestone, W. Horwitz, D. Banes, M. Anstead, and G. Shue. 1959. Studies of the chicken edema disease factor. *J. Assoc. Off. Anal. Chem.* 42(1):129-140.
85. Fries, G. F. and G. S. Marrow. 1975. Retention and excretion of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin by rats. *J. Agric. Food Chem.* 23(2):265-269.
86. Forth, W. 1977. 2,3,7,8-Tetrachlorodibenzo-1,4-dioxin (TCDD): Das Unglück von Seveso. *Deut. Arzt. Fort. Aktuelle Med.* 44(3):2617-2626.
87. Gehring, P. J., P. G. Watanabe, and G. E. Blau. 1976. Pharmacokinetic studies in evaluation of the toxicological and environmental hazard of chemicals. In M. A. Menlman, R. E. Shapiro, and H. Blumenthal (Eds.), *Advances in Modern Toxicology—New Concepts in Safety Evaluation*. John Wiley & Sons: New York, Vol. 1, Chapter 8, p. 193-270.
88. Gilman, H. and J. J. Dietrich. 1957. Halogen derivatives of dibenzo-*p*-dioxin. *J. Am. Chem. Soc.* 79:1439-1441.
89. Giovanardi, A. 1976. Decontamination program for the dioxin-contaminated areas of Seveso and Media. Giunta Regionale Della Lombardia. Ministero Della Sanita: Milan, Italy. August 18, 1976, p. 1-17.
90. Goldmann, P. J. 1973. Severe acute chloracne, a mass intoxication due to 2,3,6,7-tetrachlorodibenzodioxin. *Hautarzt* 24:149-152.
91. Gray, A. P., S. P. Cepa, I. J. Solomon, and O. Aniline. 1976. Synthesis of specific polychlorinated dibenzo-*p*-dioxins. *J. Org. Chem.* 41(14):2435-2437.
92. Green, L. 1978. 41 Veterans in Midwest reportedly show indications of Viet herbicide poisoning. *Los Angeles Times* Part I; p. 16, March 23, 1978.

93. Green, S. and F. S. Moreland. 1975. Cytogenetic evaluation of several dioxins in the rat. *Toxicol. Appl. Pharmacol.* 33(1):161.
94. Greig, J. B., G. Jones, W. H. Butler, and J. M. Barnes. 1973. Toxic effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Food Cosmet. Toxicol.* 11:585-595.
95. Hay, A. 1976. Toxic cloud over Seveso. *Nature* 262(5570): 636-638.
96. Hay, A. 1976. Seveso: The aftermath. *Nature* 263(5578):538-540.
97. Helling, C. S. 1971. Pesticide mobility in soils. II. Applications of soil thin-layer chromatography. *Proc. Soil Sci. Soc. Am.* 35(5):737-743.
98. Helling, C. S., A. R. Isensee, E. A. Woolson, P. D. J. Ensor, G. E. Jones, J. R. Plimmer, and P. C. Kearney. 1973. Chlorodioxins in pesticides, soils and plants. *J. Environ. Qual.* 2(2):171-178.
99. Higasi, K. 1941. The molecular structures of diphenylene dioxide and phenoxythin as revealed by dipole moment data. *Sci. Pap. Inst. Phys. Chem. Res.* 38:331-340.
100. Higginbotham, G. R., A. Huang, D. Firestone, J. Verret, J. Ress, and A. D. Campbell. 1968. Chemical and toxicological evaluations of isolated and synthetic chloro-derivatives of dibenzo-*p*-dioxin. *Nature* 220:702-703.
101. Honorof, I. 1973. Down's Syndrome - it can happen here. *A Report to the Consumer* 3(59):1-3. Sherman Oaks, CA.
102. Huff, J. E. and J. S. Wassom. 1974. Hazardous contaminants: Chlorinated dibenzodioxins and chlorinated dibenzofurans. In E. P. Savage (Ed.), *Environmental Chemicals—Human and Animal Health*. Proc. 2nd Ann. Conf., held at Colorado State Univ., Ft. Collins, Colo., July 25-29, 1973. Spons. by Colo. State Univ., Coll. Vet. Med. and Biomed. Sci., Inst. Rur. Environ. Develop. and Div. Pestic. Progr., Environmental Protection Agency, pp. 175-197.
103. Hummel, R. A. 1977. Clean-up techniques for the determination of parts per trillion residue levels of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD). *J. Agric. Food Chem.* 25(5):1049-1053.
104. Hussain, D., L. Ehrenberg, G. Loeffroth, and T. Gejvall. 1972. Mutagenic effects of TCDD on bacterial systems. *Ambio* 1:32-33.
105. International Agency for Research on Cancer. 1977. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man. Vol. 15. Some Fumigants, the Herbicides 2,4-D and 2,4,5-T, Chlorinated Dibenzodioxins and Miscellaneous Industrial Chemicals. World Health Organization; Lyon, France. 354 p.
106. Isensee, A. R. and G. E. Jones. 1971. Absorption and translocation of root and foliage applied 2,4-dichlorophenol, 2,7-dichlorodibenzo-*p*-dioxin, and 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *J. Agric. Food Chem.* 19(6):1210-1214.
107. Isensee, A. R. and G. E. Jones. 1972. Distribution of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) in aquatic model ecosystem. *Environ. Sci. Technol.* 9(7):668-672.
108. Jackson, W. T. 1972. Regulation of mitosis. III. Cytological effects of 2,4,5-T and of dioxin contaminants in 2,4,5-T formulations. *J. Cell Sci.* 10:15-25.
109. Jensen, N. E. 1972. Chloracne: Three cases. *Proc. R. Soc. Med.* 65(8):687-688.
110. Jensen, S. and L. Renberg. 1973. Chlorinated dimers present in several technical chlorophenols used as fungicides. *Environ. Health Perspect., Exp. Issue No. 5*, p. 37-39.
111. Jirasek, L., J. Kalensky, and others. 1973. Chlorinated dibenzodioxins and penta-*p*-chlorodibenzodioxins during the manufacture of 2,4,5-T. *Environ. Health Perspect.* 46:279-303.
112. Johnson, R. L., P. J. Gelboin, and others. 1973. Inactivation of Q₁₀ by 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Environ. Health Perspect.* 46:279-303.
113. Jones, E. L. and H. Kizek. 1973. The effect of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin applied to the potent. *Dermatol.* 9:511-517.
114. Jones, G. and J. B. Greig. 1973. Toxic effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Food Cosmet. Toxicol.* 11:585-595.
115. Julia, M. and M. Baillargues. 1973. Toxic effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Food Cosmet. Toxicol.* 11:585-595.
116. Kaupp, J. and H. Klus. 1973. Toxic effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Food Cosmet. Toxicol.* 11:585-595.
117. Kearney, P. C., E. A. Woolson, and others. 1973. Chlorodioxins in pesticides, soils and plants. *J. Environ. Qual.* 2(2):171-178.
118. Kearney, P. C., E. A. Woolson, and others. 1973. Chlorodioxins in pesticides, soils and plants. *J. Environ. Qual.* 2(2):171-178.
119. Khera, K. S. and J. A. R. 1973. Toxic effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Food Cosmet. Toxicol.* 11:585-595.
120. Kimbrough, R. D. 1973. Toxic effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Food Cosmet. Toxicol.* 11:585-595.
121. Kimbrough, R. D. 1974. Toxic effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Food Cosmet. Toxicol.* 11:585-595.
122. Kimbrough, R. D., C. D. Kimbrough, and others. 1973. Toxic effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Food Cosmet. Toxicol.* 11:585-595.
123. Kimmig, J. and K. H. Schramm. 1973. Toxic effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Food Cosmet. Toxicol.* 11:585-595.
124. King, M. E., A. M. Schramm, and others. 1973. Toxic effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Food Cosmet. Toxicol.* 11:585-595.
125. Kociba, R. J., P. A. Kociba, and others. 1973. Toxic effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Food Cosmet. Toxicol.* 11:585-595.
126. Kociba, R. J., D. G. Kociba, and others. 1973. Toxic effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Food Cosmet. Toxicol.* 11:585-595.
127. Kondorosi, A., I. Fedor, and others. 1973. Inactivation of Q₁₀ by 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Environ. Health Perspect.* 46:279-303.
128. Kulka, M. 1961. Octahedral. *Environ. Health Perspect.* 46:279-303.

111. Jirasek, L., J. Kalensky, and K. Kubec. 1973. Chloracne and porphyria cutanea tarda during the manufacture of herbicides. *Cesk. Dermatol.* 48(5):306-317.
112. Johnson, R. L., P. J. Gehring, R. J. Kociba, and B. A. Schwetz. 1973. Chlorinated dibenzodioxins and pentachlorophenol. *Environ. Health Perspect.*, Exp. Issue No. 5, p. 171-175.
113. Jones, E. L. and H. Kizek. 1962. A technique for testing acnegenic potency in rabbits, applied to the potent acnegen 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *J. Invest. Dermatol.* 9:511-517.
114. Jones, G. and J. B. Greig. 1975. Pathological changes in the liver of mice given 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Experientia* 31(11):1315-1317.
115. Julia, M. and M. Baillarge. 1953. Facteurs de croissance des plantes. IV. Sur quelques acides *p*-phenoxy-phenyl-acetiques substitues. *Bull. Soc. Chim. Fr.* p. 644-647.
116. Kaupp, J. and H. Klug. 1960. Perchlorodiphenylene dioxide. German Patent 1,092,480. Applied June 27, 1959. Granted November 10, 1960. 2 p.
117. Kearney, P. C., E. A. Woolson, and C. P. Ellington, Jr. 1972. Persistence and metabolism of chlorodioxins in soils. *Environ. Sci. Technol.* 6(12):1017-1019.
118. Kearney, P. C., E. A. Woolson, A. R. Isensee, and C. S. Helling. 1973. Tetrachlorodibenzodioxin in the environment: Sources, fate, and decontamination. *Environ. Health Perspect.*, Exp. Issue No. 5, p. 273-277.
119. Khera, K. S. and J. A. Ruddick. 1973. Polychlorodibenzo-*p*-dioxins: Perinatal effects and the dominant lethal test in Wistar rats. *Adv. Chem. Ser.* 120:70-84.
120. Kimbrough, R. D. 1972. Toxicity of chlorinated hydrocarbons and related compounds. *Arch. Environ. Health* 25(2):125-131.
121. Kimbrough, R. D. 1974. The toxicity of polychlorinated polycyclic compounds and related chemicals. *Crit. Rev. Toxicol.* 2:445-498.
122. Kimbrough, R. D., C. D. Carter, J. A. Liddle, R. E. Cline, and P. E. Phillips. 1977. Epidemiology and pathology of a tetrachlorodibenzodioxin poisoning episode. *Arch. Environ. Health* 28:77-85.
123. Kimmig, J. and K. H. Schulz. 1957. Berufliche akne (sog. chlorakne) durch chlorierte aromatische zyklische aether. *Dermatologica* 115:540-546.
124. King, M. E., A. M. Shefner, and R. R. Bates. 1973. Carcinogenesis bioassay of chlorinated dibenzodioxins in related chemicals. *Environ. Health Perspect.*, Exp. Issue No. 5, p. 163-170.
125. Kociba, R. J., P. A. Keeler, C. N. Park, and P. J. Gehring. 1975. 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD): Results of a 13-week oral toxicity study in rats. *Toxicol. Appl. Pharmacol.* 33(1):182-183.
126. Kociba, R. J., D. G. Keyes, J. E. Beyer, R. M. Carreon, C. E. Wade, D. A. Dittenber, R. P. Kalnins, L. E. Frauson, C. N. Park, S. D. Barnard, R. A. Hummel, and C. G. Humiston. 1978. Results of a 2 year chronic toxicity and oncogenicity study of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) in rats. *Toxicol. Appl. Pharmacol.* 46:279-303.
127. Kondorosi, A., I. Fedorcsak, F. Solymosy, L. Ehrenberg, and S. Osterman-Golkar. 1973. Inactivation of Q β RNA by electrophiles. *Mutat. Res.* 17(2):149-161.
128. Kulka, M. 1961. Octahalogenodibenzo-*p*-dioxins. *Can. J. Chem.* 39:1973-1976.

129. Kulka, M. 1965. Perhalodibenzo-*p*-dioxins. Canadian Patent No. 702, 144, Application No. 822,656. Filed May 3, 1971; Issued January 19, 1965. 13 p.
130. Langer, H. G., T. P. Brady, and P. R. Briggs. 1973. Formation of dibenzodioxins and other condensation products from chlorinated phenols and derivatives. *Environ. Health Perspect.*, Exp. Issue No. 5, p. 3-7.
131. Londono, F. 1966. Acne ocupacional, a proposito de 5 casos producidos por matamalezas. *Med. Cui.* 3:225-232.
132. Lowry, R. B. and A. B. Allen. 1977. Herbicides and spina bifida. *Can. Med. Assoc. J.* 117:580.
133. Mahle, N. H., H. S. Higgins, and M. E. Getzendaner. 1977. Search for the presence of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in bovine milk. *Bull. Environ. Contam. Toxicol.* 18(2):123-130.
134. Matsumura, F. and H. J. Benezet. 1973. Studies on the bioaccumulation and microbial degradation of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Environ. Health Perspect.*, Exp. Issue No. 5, p. 253-258.
135. May, G. 1973. Chloracne from the accidental production of tetrachlorodibenzodioxin. *Br. J. Indust. Med.* 30:276-283.
136. McConnell, E. E. and J. A. Moore. 1976. The comparative toxicity of chlorinated dibenzo-*p*-dioxin isomers in mice and guinea pigs. *Toxicol. Appl. Pharmacol.* 37(1):146.
137. McConnell, E. E., J. A. Moore, and D. W. Dalgard. 1978. Toxicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in rhesus monkeys (*Macaca mulatta*) following a single oral dose. *Toxicol. Appl. Pharmacol.* 43:175-187.
138. McGinty, L. 1976. The graveyard on Milan's doorstep. *New Sci.* 171(1014):383-385.
139. McNulty, W. P. 1977. Toxicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin for rhesus monkeys: A brief report. *Bull. Environ. Contam. Toxicol.* 18(1):108-109.
140. McQueen, E. G., A. M. O. Veale, W. S. Alexander, and M. N. Bates. 1977. 2,4,5-T and human birth defects. *Mim.*, N. Z. Dep. Health, Div. Publ. Health.
141. Meselson, M. S., A. H. Westing, and J. D. Constable. 1971. Background Material Relevant to Presentations at the 1970 Annual Meeting of the AAAS. Concerning the Herbicide Assessment Commission for the American Association for the Advancement of Science. *Mim.*, 47 p. Washington, D.C.
142. Metcalfe, L. D. 1972. Proposed source of chick edema factor. *J. Assoc. Off. Anal. Chem.* 55(3):542-546.
143. Miller, R. A., L. A. Norris, and C. L. Hawkes. 1973. Toxicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) in aquatic organisms. *Environ. Health Perspect.*, Exp. Issue No. 5, p. 177-186.
144. Mivra, H., A. Omori, and M. Shibue. 1974. The effect of chlorophenols on the excretion of porphyrins in urine. *Jap. J. Indust. Health* 16(6):575-577.
145. Mounts, T. L., H. J. Dutton, C. D. Evans, and J. C. Cowan. 1976. Chick edema factor: Removal from soybean oil. *J. Am. Oil Chem. Soc.* 53(3):105-107.
146. Muellder, W. W. and L. A. Shadoff. 1973. The preparation of uniformly labeled ¹⁴C-2,7-dichlorodibenzo-*p*-dioxin and ¹⁴C-2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Adv. Chem. Ser.* 120:1-6.
147. Murray, F. J., F. A. Smith, and J. Schwetz. 1977. Three-gene chlorodibenzo-*p*-dioxin. *Toxicol. Appl. Pharmacol.* 43:189-197.
148. National Academy of Sciences. 1977. Part A. Summary and conclusions. Vietnam; Division of Biological Research Council, National Academy of Sciences.
149. National Cancer Institute. 1977. *Mutagenic Activities of Selected Chemicals*. Bionetics Research Laboratories.
150. Neal, P. 1967. Note on an in vivo test for the presence of fat-soluble factors in fats and fatty acids. *Anal. Chem.* 50(6):1338-1340.
151. Neubert, D., P. Zens, A. F. Smith, and J. Schwetz. 1977. Embryotoxic effects of TCDD. *Environ. Health Perspect.*, Exp. Issue No. 5, p. 67-79.
152. Neuman, M. A., P. P. N. Neuman, and J. Schwetz. 1977. Structure of octachlorodibenzo-*p*-dioxin. *J. Org. Chem.* 42:1338-1340.
153. Newton, M. and S. P. S. Newton. 1977. Toxicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) in guinea pigs. *Contam. Toxicol.* (in press).
154. Nilsson, C. A. and L. Renberg. 1977. *J. Chromatogr.* 89:325-333.
155. Norback, D. H., J. F. E. Norback, and J. Schwetz. 1977. Excretion of octachlorodibenzo-*p*-dioxin. *Toxicol. Appl. Pharmacol.* 32(2):330-338.
156. Norris, L. A. and R. A. Miller. 1973. Toxicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) in guppies. *Toxicol. Appl. Pharmacol.* 12(1):76-80.
157. Oliver, N. E. 1969. Chlorinated hydrocarbons. *Environ. Health Perspect.* 31:1-10.
158. Parks, M. and E. Sullum. 1977. Carson Trust for the Living.
159. Pazderova, J., E. Lukas, J. John, A. Jirasek, and J. Schwetz. 1977. Carbons formed in the pyrolysis of TCDD. *Lek.* 26(9):332-339.
160. Pinsent, P. J. N. and J. Schwetz. 1977. Poisoning in the horse. *Vet. Rec.* 100:1-10.
161. Plimmer, J. R. and U. I. K. Plimmer. 1973. 2,4-dichlorophenol: Assay and toxicity. *Toxicol. Appl. Pharmacol.* 17:407-408.
162. Plimmer, J. R. 1973. Toxicity of insoluble contaminants. *Environ. Health Perspect.* 48:1-10.
163. Plimmer, J. R., U. I. K. Plimmer, and J. Schwetz. 1977. Toxicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) in guinea pigs. *Toxicol. Appl. Pharmacol.* 43:189-197.

147. Murray, F. J., F. A. Smith, K. D. Nitschke, C. G. Humiston, R. J. Kociba, and B. A. Schwetz. 1977. Three-generation reproduction study of rats ingesting 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Toxicol. Appl. Pharmacol.* 35(1):139-140.
148. National Academy of Sciences. 1974. The effects of herbicides in South Vietnam. Part A. Summary and conclusions. Committee on the Effects of Herbicides in Vietnam; Division of Biological Sciences: Assembly of Life Sciences. National Research Council, National Academy of Sciences: Washington, D.C.
149. National Cancer Institute. 1967. *Evaluation of the Carcinogenic, Teratogenic, and Mutagenic Activities of Selected Pesticides and Industrial Chemicals*. Four Volumes; Bionetics Research Laboratory: Bethesda, MD.
150. Neal, P. 1967. Note on an improved clean-up method for the detection of chick edema factors in fats and fatty acids by electron capture gas chromatography. *J. Assoc. Off. Anal. Chem.* 50(6):1338-1340.
151. Neubert, D., P. Zens, A. Rothenwallner, and H. J. Merker. 1973. A survey of the embryotoxic effects of TCDD in mammalian species. *Environ. Health Perspect.*, Expt. Issue No. 5, p. 67-79.
152. Neuman, M. A., P. P. North, and F. P. Boer. 1972. The crystal and molecular structure of octachlorodibenzo-*p*-dioxin. *Acta Crystallogr.* B28:2313-2317.
153. Newton, M. and S. P. Snyder. 1979. Exposure of forest herbivores to 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) in areas sprayed with 2,4,5-T. *Bull. Environ. Contam. Toxicol.* (in press).
154. Nilsson, C. A. and L. Renberg. 1974. Further studies on impurities in chlorophenols. *J. Chromatogr.* 89:325-333.
155. Norback, D. H., J. F. Engblom, and J. R. Allen. 1975. Tissue distribution and excretion of octachlorodibenzo-*p*-dioxin in the rat. *Toxicol. Appl. Pharmacol.* 32(2):330-338.
156. Norris, L. A. and R. A. Miller. 1974. The toxicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) in guppies (*Poecilia reticulatus* Peters). *Bull. Environ. Contam. Toxicol.* 12(1):76-80.
157. Oliver, N. E. 1969. Chloracne. *Arch. Dermatol.* 99:127-128.
158. Parks, M. and E. Sullum. 1976. The chemical cloud that fell on Seveso. Rachel Carson Trust for the Living Environment, Inc., Washington, D.C. 116 p.
159. Pazderova, J., E. Lukas, M. Nemcova, M. Spacilova, L. Jirasek, J. Kalensky, J. John, A. Jirasek, and J. Pickova. 1974. Chronic poisoning by chlorinated hydrocarbons formed in the production of 2,4,5-sodium trichlorophenoxyacetate. *Prac. Lek.* 26(9):332-339.
160. Pinsent, P. J. N. and J. G. Lane. 1970. A case of possible 2,4,-D and 2,4,5-T poisoning in the horse. *Vet. Rec.* 87:247.
161. Plimmer, J. R. and U. I. Klingebiel. 1971. Riboflavin photosensitized oxidation of 2,4-dichlorophenol: Assessment of possible chlorinated dioxin formation. *Science* 174:407-408.
162. Plimmer, J. R. 1973. Technical pentachlorophenol: Origin and analysis of base-insoluble contaminants. *Environ. Health Perspect.*, Exp. Issue No. 5, pp. 41-48.
163. Plimmer, J. R., U. I. Klingebiel, D. G. Crosby, and A. S. Wong. 1973. Photo-

- chemistry of dibenzo-*p*-dioxins. *Adv. Chem. Ser.* 120:44-54.
164. Plummer, J. R., J. M. Ruth, and E. A. Woolson. 1973. Mass spectrometric identification of the hepta- and octa-chlorinated dibenzo-*p*-dioxins and dibenzofurans in technical pentachlorophenol. *J. Agric. Food Chem.* 21(1):90-93.
 165. Pohland, A. E. and G. C. Yang. 1972. Preparation and characterization of chlorinated dibenzo-*p*-dioxins. *J. Agric. Food Chem.* 20(6):1093-1099.
 166. Poland, A. P., D. Smith, G. Metter, and P. Possick. 1971. A health survey of workers in a 2,4-D and 2,4,5-T plant. *Arch. Environ. Health* 22:316-327.
 167. Poland, A. and E. Glover. 1973. Studies on the mechanism of toxicity of the chlorinated dibenzo-*p*-dioxins. *Environ. Health Perspect.*, Exp. Issue No. 5, pp. 245-251.
 168. Poland, A. and E. Glover. 1973. 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin: A potent inducer of δ -aminolevulinic acid synthetase. *Science* 179:476-477.
 169. Poland, A. and E. Glover. 1974. Genetic expression of aryl hydrocarbon hydroxylase activity. Induction of monooxygenase activities and cytochrome P₁-450 formation by 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in mice genetically "nonresponsive" to other aromatic hydrocarbons. *J. Biol. Chem.* 249(17):5599-5606.
 170. Poland, A. and E. Glover. 1975. Genetic expression of aryl hydrocarbon hydroxylase by 2,3,7,8-tetrachlorodibenzo-*p*-dioxin: Evidence for a receptor mutation in genetically nonresponsive mice. *Mol. Pharmacol.* 11(4):389-398.
 171. Poland, A. and A. Kende. 1976. 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin: Environmental contaminant and molecular probe. *Fed. Proc. Am. Soc. Exp. Biol.* 35(12):2404-2411.
 172. Ramstad, T., N. H. Mahle, and R. Matalon. 1977. Automated clean-up of herbicides by adsorption chromatography for the determination of 2,3,7,8-tetrachlorodibenzo-*p*-dioxins. *Anal. Chem.* 49(3):386-390.
 173. Rappe, E. and C. A. Nilsson. 1972. An artifact in the gas chromatographic determination of impurities in pentachlorophenol. *J. Chromatogr.* 67:247-253.
 174. Rawls, R. L. and D. A. O'Sullivan. 1976. Italy seeks answers following toxic release. *Chem. Eng. News* 54(35):27-35.
 175. Roan, C. C. and D. P. Morgan. 1972. Alleged effects on human health of the use of herbicides in the area around Globe, Arizona. Mim., Arizona Community Pesticide Studies Project. March 6, 1972. University of Arizona; Tucson, AZ.
 176. Rose, H. A. and S. P. R. Rose. 1972. Chemical spraying as reported by refugees from S. Vietnam. *Science* 177(4050):710-712.
 177. Rose, J. Q., J. C. Ramsey, T. H. Wentzler, R. A. Hummel, and P. J. Gehring. 1976. The fate of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin following single and repeated oral doses to the rat. *Toxicol. Appl. Pharmacol.* 36:209-226.
 178. Ross, R. T. 1976. 2,4,5-T/Dioxins: Analytical Collaborators Meeting, June 15, 1976. June 25, 1976, Memorandum of the United States Environmental Protection Agency; Washington D.C., p. 3.
 179. Safe, S., W. D. Jamieson, O. Hutzinger, and A. E. Pohland. 1975. Mass and ion kinetic energy spectra of some chlorinated dibenzo-*p*-dioxins. *Anal. Chem.* 47(2):327-329.
 180. Saint-Ruf, G. 1972. Formu phenoxy)-propionate. *Nat*
 181. Sanger, V. L., L. Scott, A toxemia in chickens. *J. An*
 182. Sare, W. M. and P. I. agricultural chemical: 2,4.
 183. Schwartz, L., L. Tulipan, tional Diseases of the Skin.
 184. Schwetz, B. A., J. M. N Emerson, and C. G. Geri *Adv. Chem. Ser.* 120:55-69
 185. Schwetz, B. A., J. M. N Emerson, and C. G. Geri *Environ. Health Perspect.*
 186. Shadoff, L. A., R. A. H: tetrachlorodibenzo-*p*-diox: trichlorophenoxyacetic ac *Toxicol.* 18(4):478-485.
 187. Smith, F. A., B. A. Schw tetrachlorodibenzo-*p*-dioxi
 188. Sparschu, G. L., F. L. Du 2,3,7,8-tetrachlorodibenzo
 189. Stehl, R. H., R. R. Pape stability of pentachloroph: bustion. *Adv. Chem. Ser.* 1
 190. Stehl, R. H. and L. L. I phenoxy compounds: For 197(4307):1008-1009.
 191. Sterling, T. D. 1975. Toxi and 2,3,7,8-tetrachlorodi: Royal Commission Heari: Hearings of the Assembly: March 19, 1975.) 24 p.
 192. Stockholm International *Consequences of the Secc: national; Stockholm, Swec*
 193. Suskind, R. R. 1976. A Presentation to a Conferen: Rougemont, N.C.
 194. Telegina, K. A. and L. I. i the skin in workers occupi: acetic acid. *Vestn. Dermal*
 195. Thigpen, J. E., R. E. Fai susceptibility to bacterial

180. Saint-Ruf, G. 1972. Formation of dioxin in the pyrolysis of sodium *a*-(2,4,5-trichlorophenoxy)-propionate. *Naturwissenschaften* 59(12):648.
181. Sanger, V. L., L. Scott, A. Hamdy, C. Gale, and W. D. Pounden. 1958. Alimentary toxemia in chickens. *J. Am. Vet. Med. Assoc.* 133:172-176.
182. Sare, W. M. and P. I. Forbes. 1972. Possible dysmorphogenic effects of an agricultural chemical: 2,4,5-T. *N. Z. Med. J.* 75(476):37-38.
183. Schwartz, L., L. Tulipan, and D. Birmingham. 1967. Occupational acne. In *Occupational Diseases of the Skin*. Lea and Febiger: Philadelphia, pp. 336-345.
184. Schwetz, B. A., J. M. Norris, B. L. Sparschu, V. K. Rowe, P. J. Gehring, J. L. Emerson, and C. G. Gerbig. 1973. Toxicology of chlorinated dibenzo-*p*-dioxins. *Adv. Chem. Ser.* 120:55-69.
185. Schwetz, B. A., J. M. Norris, G. L. Sparschu, V. K. Rowe, P. J. Gehring, J. L. Emerson, and C. G. Gerbig. 1973. Toxicology of chlorinated dibenzo-*p*-dioxins. *Environ. Health Perspect.*, Exp. Issue No. 5, p. 87-99.
186. Shadoff, L. A., R. A. Hummel, and L. Lamparski. 1977. A search for 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) in an environment exposed annually to 2,4,5-trichlorophenoxyacetic acid ester (2,4,5-T) herbicides. *Bull. Environ. Contam. Toxicol.* 18(4):478-485.
187. Smith, F. A., B. A. Schwetz, and P. J. Gehring. 1975. Teratogenicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in CF-1 mice. *Toxicol. Appl. Pharmacol.* 33(1):124.
188. Sparschu, G. L., F. L. Dunn, and V. K. Rowe. 1971. Study of the teratogenicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in the rat. *Food Cosmet. Toxicol.* 9:405-412.
189. Stehl, R. H., R. R. Papenfuss, R. A. Bredeweg, and R. W. Roberts. 1973. The stability of pentachlorophenol and chlorinated dioxins to sunlight, heat, and combustion. *Adv. Chem. Ser.* 120:119-125.
190. Stehl, R. H. and L. L. Lamparski. 1977. Combustion of several 2,4,5-trichlorophenoxy compounds: Formation of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Science* 197(4307):1008-1009.
191. Sterling, T. D. 1975. Toxic and teratogenic effect of 2,4,5-trichlorophenoxyacetic acid and 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. (Summary of evidence presented to the Royal Commission Hearings on Herbicides and Pesticides, July 16, 1974 and to Hearings of the Assembly Committee on Natural Resources of the State of Wisconsin; March 19, 1975.) 24 p.
192. Stockholm International Peace Research Institute (SIPRI). 1976. *Ecological Consequences of the Second Indochina War*. SIPRI and Almqvist & Wikell International; Stockholm, Sweden. 119 p.
193. Suskind, R. R. 1976. A review of occupational exposures to dibenzo-*p*-dioxins. Presentation to a Conference on Dibenzodioxins/Dibenzofuran. November 18, 1976. Rougemont, N.C.
194. Telegina, K. A. and L. I. Bikbulatova. 1970. Affection of the follicular apparatus of the skin in workers occupied in production of butyl ether of 2,4,5-trichlorophenoxyacetic acid. *Vestn. Dermatol. Venerol.* 44:35-39.
195. Thigpen, J. E., R. E. Faith, E. E. McConnel, and J. A. Moore. 1975. Increased susceptibility to bacterial infection as a sequela of exposure to 2,3,7,8-tetrachloro-

204 The Chlorinated Dibenzo-*p*-Dioxins

- dibenzo-*p*-dioxin. *Infect. Immun.* 12(6):1319-1324.
196. Tomita, M., S. Ueda, and M. Narisada. 1959. Studies on the dibenzo-*p*-dioxin derivatives. XXVII. Synthesis of polyhalodibenzo-*p*-dioxins. *Yakugaku Zasshi* 79:186-192.
197. Ton That, T., A. Tran Thi, T. Nguyen Dang, P. Pham Hoang, B. Nguyen Nhu, B. Ton That, S. Hoang Van, and S. Do Kim. 1973. Le cancer primaire du foie au Vietnam. *Chirurgie* 99:427-436.
198. Tschirley, F. H., Binns, W., C. Cueto, B. C. Eliason, H. E. Heggstad, G. H. Hepting, P. F. Sand, and R. F. Stephens. 1970. Investigations of spray project near Globe, Arizona. Investigation conducted February 1970. Mime., U.S. Dep. Agric., Office of Science and Education. 29 p.
199. Tung, T. T., T. K. Anh, B. Q. Tuyen, D. X. Tra, and N. X. Huyen. 1971. Clinical effects of massive and continuous utilization of defoliants on civilians, preliminary survey. *Vietnamese Studies* 29:53-81.
200. Van Miller, J. P., J. J. Lalich, and J. R. Allen. 1977. Increased incidence of neoplasms in rats exposed to low levels of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Chemosphere* 9:537-544.
201. Van Miller, J. P., R. J. Marlar, and J. R. Allen. 1976. Tissues distribution and excretion of tritiated tetrachlorodibenzo-*p*-dioxin in nonhuman primates and rats. *Food Cosmet. Toxicol.* 14(1):31-34.
202. Villanueva, E. C., V. W. Burse, and R. W. Jennings. 1973. Chlorodibenzo-*p*-dioxin contamination of two commercially available pentachlorophenols. *J. Agric. Food Chem.* 21(4):739-740.
203. Villanueva, E. C., R. W. Jennings, V. W. Burse, and R. D. Kimbrough. 1974. Evidence of chlorodibenzo-*p*-dioxin and chlorodibenzofuran in hexachlorobenzene. *J. Agric. Food Chem.* 22(5):916-917.
204. Vinopal, J. H., I. Yamamoto, and J. E. Casida. 1971. Preparation of tritium-labeled 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) and structure activity investigations of TCDD and other related dibenzo-*p*-dioxins. Am. Chem. Soc., Abstr. Pap., 162nd Nat. Meet., Pestic. Chem. Sec., Abstr. No. 79.
205. Vinopal, J. H. and J. E. Casida. 1973. Metabolic stability of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in mammalian liver microsomal systems and in living mice. *Arch. Environ. Contam. Toxicol.* 1(2):122-133.
206. Vos, J. G., J. A. Moore, and J. G. Zinkl. 1974. Toxicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) in C57B1/6 mice. *Toxicol. Appl. Pharmacol.* 29(1):229-241.
207. Waldbott, G. L. 1973. Mutagenic pollutants. In *Health Effects of Environmental Pollutants*. C. V. Mosby Co.: St. Louis, pp. 207-216.
208. Walsh, J. 1977. Seveso: The questions persist where dioxin created a wasteland. *Science* 197(4308):1064-1067.
209. Whiteside, T. 1977. A reporter at large: The pendulum and the toxic cloud. *The New Yorker*; 25 July 1977. p. 30-55.
210. Williams, D. T., H. M. Cunningham, and B. J. Blanchfield. 1972. Distribution and

excretion studies of octachlorodibenzo-*p*-dioxin. *Toxicol.* 7(1):57-62.

211. Woolson, E. A., R. F. Thomas. 1971. Dibenzo-*p*-dioxin content in selected eagle samples. *Adv. Chem. Ser.* 100:1-12.
212. Woolson, E. A. and P. D. J. En. 1971. Eagle samples. *Adv. Chem. Ser.* 100:1-12.
213. Worden, A. N. 1973. Toxicology of dioxins. *Chem. Ind. (London)* 1973:1-12.
214. Woolton, J. C., N. R. Artman. 1973. Hydropericardium-producing factor. *Am. J. Pathol.* 45(3):739-746.
215. Yartzoff, A., D. Firestone, D. 1961. Studies of the chick edema syndrome. *J. Chem. Soc.* 38:60-62.
216. Young, A. L. 1974. Ecological effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) at Eglin AFB Reservation. Environmental and Flame Munition. Air Force Armament Laboratory.
217. Young, A. L., J. A. Calcagni. 1974. Toxicology, environmental fate, and excretion of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. Technical Report OEH-74-1. Health Laboratory, Aerospace Corporation.
218. Young, A. L., C. E. Thalken. 1974. Consequences of massive quantitative release of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin: a five-year field study. Paper presented at the 1974 Symposium on Environmental Effects of Chemical Warfare Agents, February 14, 1974; Las Vegas.
219. Young, A. L., C. E. Thalken. 1974. Effects of repetitive aerial application of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin at Eglin AFB, Florida. Technical Report OEH-74-1. Factors Office, Air Force Armament Laboratory, Department of Chemistry and Physics, 80840. 127 p.
220. Young, A. L., P. J. Lehn, and C. E. Thalken. 1974. Effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin on an aquatic ecosystem. *Weed Sci.* 22:1-12.
221. Young, A. L., C. E. Thalken. 1976. Fate of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in the environment. Summary and decontamination procedures. Chemistry and Biological Sciences Division, Air Force Armament Laboratory, Eglin AFB, Florida.
222. Zitko, V. 1972. Absence of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in aquatic animals. *Bull. Environ. Contam. Toxicol.* 1:1-12.
223. Zitko, V., O. Hutzinger, and J. G. Zinkl. 1974. Fundy-Gulf of Maine area. 2,3,7,8-tetrachlorodibenzo-*p*-dioxin, chlorinated dibenzofurans, and polychlorinated biphenyls. *Perspect. Biol. Med.* 1:47-50.

- excretion studies of octachlorodibenzo-*p*-dioxin in the rat. *Bull. Environ. Contam. Toxicol.* 7(1):57-62.
211. Woolson, E. A., R. F. Thomas, and P. D. J. Ensor. 1972. Survey of polychloro-dibenzo-*p*-dioxin content in selected pesticides. *J. Agric. Food Chem.* 20(2):351-354.
 212. Woolson, E. A. and P. D. J. Ensor. 1973. Dioxin residues in lakeland sand and bald eagle samples. *Adv. Chem. Ser.* 120:112-118.
 213. Worden, A. N. 1973. Toxicology and the environment. *Toxicology* 1(1):3-27.
 214. Wootton, J. C., N. R. Artman, and J. Craig Alexander. 1962. Isolation of three hydropericardium-producing factors from a toxic fat. *J. Assoc. Off. Anal. Chem.* 45(3):739-746.
 215. Yartsoff, A., D. Firestone, D. Banes, W. Horwitz, L. Friedman, and S. Nesheim. 1961. Studies of the chick edema factor. II. Isolation of a toxic substance. *J. Am. Oil. Chem. Soc.* 38:60-62.
 216. Young, A. L. 1974. Ecological Studies on a Herbicide-Equipment Test Area (TA C-52A), Eglin AFB Reservation, Florida. Technical Report AFATL-TR-74-12. Environics and Flame Munitions Branch; Flame, Incendiary and Explosives Division, Air Force Armament Laboratory, Eglin Air Force Base, FL. 32540. 141 p.
 217. Young, A. L., J. A. Calcagni, C. E. Thalken, and J. W. Tremblay. 1978. The toxicology, environmental fate, and human risk of Herbicide Orange and its associated dioxin. Technical Report OEHL-TR-78-92. USAF Occupational and Environmental Health Laboratory, Aerospace Medical Division, Brooks Air Force Base, TX. 247 p.
 218. Young, A. L., C. E. Thalken, W. E. Ward, and W. J. Cairney. 1974. The ecological consequences of massive quantities of 2,4-D and 2,4,5-T herbicides. Summary of a five-year field study. Paper presented to the Weed Science Society of America; February 14, 1974; Las Vegas, NV. 6 p.
 219. Young, A. L., C. E. Thalken, and W. E. Ward. 1975. Studies of the ecological impact of repetitive aerial applications of herbicides on the ecosystem of test area C-52A, Eglin AFB, Florida. Technical Report AFATL-TR-75-142. Environics and Human Factors Office, Air Force Armament Laboratory, Eglin Air Force Base, FL and Department of Chemistry and Biological Sciences. U.S. Air Force Academy, CO 80840. 127 p.
 220. Young, A. L., P. J. Lehn, and M. F. Mettee. 1976. Absence of TCDD toxicity in an aquatic ecosystem. *Weed Sci. Soc. Am., Abstr. No.* 107. p 46.
 221. Young, A. L., C. E. Thalken, E. L. Arnold, J. M. Cupello, and L. G. Cockerham. 1976. Fate of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) in the environment: Summary and decontamination recommendations. USAFA-TR-76-18. Department of Chemistry and Biological Sciences, USAF Academy, CO 80840. 41 p.
 222. Zitko, V. 1972. Absence of chlorinated dibenzodioxins and dibenzofurans from aquatic animals. *Bull. Environ. Contam. Toxicol.* 7(2/3):105-110.
 223. Zitko, V., O. Hutzinger, and P. M. K. Choi. 1972. Contamination of the Bay of Fundy-Gulf of Maine area with polychlorinated biphenyls, polychlorinated terphenyls, chlorinated dibenzodioxins, and dibenzofurans. *Environ. Health Perspect.* 1:47-50.

- dibenzo-*p*-dioxin. *Infect. Immun.* 12(6):1319-1324.
196. Tomita, M., S. Ueda, and M. Narisada. 1959. Studies on the dibenzo-*p*-dioxin derivatives. XXVII. Synthesis of polyhalodibenzo-*p*-dioxins. *Yakugaku Zasshi* 79:186-192.
 197. Ton That, T., A. Tran Thi, T. Nguyen Dang, P. Pham Hoang, B. Nguyen Nhu, B. Ton That, S. Hoang Van, and S. Do Kim. 1973. Le cancer primaire du foie au Vietnam. *Chirurgie* 99:427-436.
 198. Tschirley, F. H., Binns, W., C. Cueto, B. C. Eliason, H. E. Heggestad, G. H. Hepting, P. F. Sand, and R. F. Stephens. 1970. Investigations of spray project near Globe, Arizona. Investigation conducted February 1970. Mimeo., U.S. Dep. Agric., Office of Science and Education. 29 p.
 199. Tung, T. T., T. K. Anh, B. Q. Tuyen, D. X. Tra, and N. X. Huyen. 1971. Clinical effects of massive and continuous utilization of defoliants on civilians, preliminary survey. *Vietnamese Studies* 29:53-81.
 200. Van Miller, J. P., J. J. Lalich, and J. R. Allen. 1977. Increased incidence of neoplasms in rats exposed to low levels of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Chemosphere* 9:537-544.
 201. Van Miller, J. P., R. J. Marlar, and J. R. Allen. 1976. Tissues distribution and excretion of tritiated tetrachlorodibenzo-*p*-dioxin in nonhuman primates and rats. *Food Cosmet. Toxicol.* 14(1):31-34.
 202. Villanueva, E. C., V. W. Burse, and R. W. Jennings. 1973. Chlorodibenzo-*p*-dioxin contamination of two commercially available pentachlorophenols. *J. Agric. Food Chem.* 21(4):739-740.
 203. Villanueva, E. C., R. W. Jennings, V. W. Burse, and R. D. Kimbrough. 1974. Evidence of chlorodibenzo-*p*-dioxin and chlorodibenzofuran in hexachlorobenzene. *J. Agric. Food Chem.* 22(5):916-917.
 204. Vinopal, J. H., I. Yamamoto, and J. E. Casida. 1971. Preparation of tritium-labeled 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) and structure activity investigations of TCDD and other related dibenzo-*p*-dioxins. Am. Chem. Soc., Abstr. Pap., 162nd Nat. Meet., Pestic. Chem. Sec., Abstr. No. 79.
 205. Vinopal, J. H. and J. E. Casida. 1973. Metabolic stability of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in mammalian liver microsomal systems and in living mice. *Arch. Environ. Contam. Toxicol.* 1(2):122-133.
 206. Vos, J. G., J. A. Moore, and J. G. Zinkl. 1974. Toxicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) in C57B1/6 mice. *Toxicol. Appl. Pharmacol.* 29(1):229-241.
 207. Waldbott, G. L. 1973. Mutagenic pollutants. In *Health Effects of Environmental Pollutants*. C. V. Mosby Co.: St. Louis, pp. 207-216.
 208. Walsh, J. 1977. Seveso: The questions persist where dioxin created a wasteland. *Science* 197(4308):1064-1067.
 209. Whiteside, T. 1977. A reporter at large: The pendulum and the toxic cloud. *The New Yorker*, 25 July 1977. p. 30-55.
 210. Williams, D. T., H. M. Cunningham, and B. J. Blanchfield. 1972. Distribution and excretion studies of octachlorodibenzo-*p*-dioxin. *Toxicol.* 7(1):57-62.
 211. Woolson, E. A., R. F. Tho. 1972. Studies on the dibenzo-*p*-dioxin content in eagle samples. *Adv. Chem. Ser.* 117:1-12.
 212. Woolson, E. A. and P. D. J. 1972. Studies on the dibenzo-*p*-dioxin content in eagle samples. *Adv. Chem. Ser.* 117:1-12.
 213. Worden, A. N. 1973. Toxicology of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Toxicol. Appl. Pharmacol.* 25(3):739-746.
 214. Wootton, J. C., N. R. Art. 1973. Studies on the hydropericardium-producing 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. *Toxicol. Appl. Pharmacol.* 25(3):739-746.
 215. Yartzoff, A., D. Firestone. 1961. Studies of the chick embryo. *Chem. Soc.* 38:60-62.
 216. Young, A. L. 1974. Ecology of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) at Eglin AFB Reservoir. Environics and Flame Munit Air Force Armament Laboratory.
 217. Young, A. L., J. A. Calce. 1974. Toxicology, environmental fate of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin. Technical Report Of Health Laboratory, Aerospace.
 218. Young, A. L., C. E. Thalke. 1974. Consequences of massive quantities of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in a five-year field study. Paper presented at the 1974 Las Vegas Conference, February 14, 1974; Las Vegas.
 219. Young, A. L., C. E. Thalke. 1974. Repetitive aerial application of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin at Eglin AFB, Florida. Technical Report, Factors Office, Air Force Department of Chemistry at Eglin AFB, 80840. 127 p.
 220. Young, A. L., P. J. Lehn, and J. A. Calce. 1974. 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in an aquatic ecosystem. *Weed Res.* 14:1-12.
 221. Young, A. L., C. E. Thalke. 1976. Fate of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in an aquatic ecosystem. Summary and decontamination. *Chemistry and Biological Sciences* 1:1-12.
 222. Zitko, V. 1972. Absence of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in aquatic animals. *Bull. Environ. Contam. Toxicol.* 7:1-12.
 223. Zitko, V., O. Hutzinger, as Fundy-Gulf of Maine ar terphenyls, chlorinated di. *Perspect.* 1:47-50.

excretion studies of octachlorodibenzo-*p*-dioxin in the rat. *Bull. Environ. Contam. Toxicol.* 7(1):57-62.

211. Woolson, E. A., R. F. Thomas, and P. D. J. Ensor. 1972. Survey of polychloro-dibenzo-*p*-dioxin content in selected pesticides. *J. Agric. Food Chem.* 20(2):351-354.
212. Woolson, E. A. and P. D. J. Ensor. 1973. Dioxin residues in lakeland sand and bald eagle samples. *Adv. Chem. Ser.* 120:112-118.
213. Worden, A. N. 1973. Toxicology and the environment. *Toxicology* 1(1):3-27.
214. Woolton, J. C., N. R. Artman, and J. Craig Alexander. 1962. Isolation of three hydropericardium-producing factors from a toxic fat. *J. Assoc. Off. Anal. Chem.* 45(3):739-746.
215. Yartsoff, A., D. Firestone, D. Banes, W. Horwitz, L. Friedman, and S. Nesheim. 1961. Studies of the chick edema factor. II. Isolation of a toxic substance. *J. Am. Oil. Chem. Soc.* 38:60-62.
216. Young, A. L. 1974. Ecological Studies on a Herbicide-Equipment Test Area (TA C-52A), Eglin AFB Reservation, Florida. Technical Report AFATL-TR-74-12. Environics and Flame Munitions Branch; Flame, Incendiary and Explosives Division, Air Force Armament Laboratory, Eglin Air Force Base, FL. 32540. 141 p.
217. Young, A. L., J. A. Calcagni, C. E. Thalken, and J. W. Tremblay. 1978. The toxicology, environmental fate, and human risk of Herbicide Orange and its associated dioxin. Technical Report OEHL-TR-78-92. USAF Occupational and Environmental Health Laboratory, Aerospace Medical Division, Brooks Air Force Base, TX. 247 p.
218. Young, A. L., C. E. Thalken, W. E. Ward, and W. J. Cairney. 1974. The ecological consequences of massive quantities of 2,4-D and 2,4,5-T herbicides. Summary of a five-year field study. Paper presented to the Weed Science Society of America; February 14, 1974; Las Vegas, NV. 6 p.
219. Young, A. L., C. E. Thalken, and W. E. Ward. 1975. Studies of the ecological impact of repetitive aerial applications of herbicides on the ecosystem of test area C-52A, Eglin AFB, Florida. Technical Report AFATL-TR-75-142. Environics and Human Factors Office, Air Force Armament Laboratory, Eglin Air Force Base, FL and Department of Chemistry and Biological Sciences. U.S. Air Force Academy, CO 80840. 127 p.
220. Young, A. L., P. J. Lehn, and M. F. Mettee. 1976. Absence of TCDD toxicity in an aquatic ecosystem. *Weed Sci. Soc. Am., Abstr. No.* 107. p 46.
221. Young, A. L., C. E. Thalken, E. L. Arnold, J. M. Cupello, and L. G. Cockerham. 1976. Fate of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) in the environment: Summary and decontamination recommendations. USAFA-TR-76-18. Department of Chemistry and Biological Sciences, USAF Academy, CO 80840. 41 p.
222. Zitko, V. 1972. Absence of chlorinated dibenzodioxins and dibenzofurans from aquatic animals. *Bull. Environ. Contam. Toxicol.* 7(2/3):105-110.
223. Zitko, V., O. Hutzinger, and P. M. K. Choi. 1972. Contamination of the Bay of Fundy-Gulf of Maine area with polychlorinated biphenyls, polychlorinated terphenyls, chlorinated dibenzodioxins, and dibenzofurans. *Environ. Health Perspect.* 1:47-50.