

DEPARTMENT OF HEALTH SERVICES

714/744 P STREET

PO BOX 942732

SACRAMENTO, CA 94234-7320

FAX NUMBER (916)324-1788 ATSS (8)454-1788

DATE: MARCH 5, 1991

TO: DAN MERCER

AGENCY: _____

PHONE: _____ FAX: _____

FROM: N. RILEY

PHONE: (916) 321-4498 ATSS: (8) _____

NUMBER OF PAGES: 8
(INCLUDING COVER)

INFORMATION: X

CONFIDENTIAL: _____

PLS COMMENT: _____

URGENT: _____

PER YOUR REQUEST: _____

COMMENTS:

I THOUGHT YOU MIGHT FIND THIS USEFUL.
I AM NOT FAXING THE APPENDIX - I'LL DROP
A COMPLETE COPY IN THE MAIL.

N. RILEY

IF YOU NEED ASSISTANCE WITH THIS TRANSMITTAL, PLEASE CONTACT
(916)323-6750.

Society of Toxicology meeting in Dallas 2/25-3/1/91

Toxicologist 11(1): 199 (1991)

TOTAL THRESHOLD LIMIT CONCENTRATION VALUES ARE NOT APPROPRIATE FOR REMEDIATION OF PESTICIDES IN FARMLAND

Fred Martz, Ph.D., D.A.B.T.

Toxicology and Risk Assessment Section
Toxic Substances Control Program
California Department of Health Services
P.O. Box 942732, Sacramento, CA 94234-7320

Total Threshold Limit Concentrations (TTLCs) provide a legal basis in California for classification of waste as being hazardous. TTLCs were derived from fish bioaccumulation data, and are not health-based values. However, TTLCs are often used for remediation of organochlorine pesticides in farmland being developed for residential use. With DDT, use of TTLCs is especially problematic because DDT occurs in soil statewide above the TTLC of 1 ppm. Risk estimates for DDT, with soil as the exclusive medium of exposure, were calculated using dermal exposure and soil ingestion rates of 450 mg/day or 100 mg/day, respectively (Sedman, Environmental Health Perspectives, 79:291-313, 1989; USEPA, Risk Assessment Guidance for Superfund, Interim Final, 12/89). The results show that remediation of DDT to the TTLC of 1 ppm is overconservative, with a risk of 6×10^{-7} . Consequently, remediation of DDT to the TTLC can waste resources and increase housing costs with no benefit to public health. In contrast, remediation of aldrin, dieldrin, chlordane, heptachlor, lindane, mirex, or toxaphene to their TTLCs is not health protective, with risks up to 2×10^{-5} (dieldrin). Therefore, TTLCs are inappropriate for soil remediation, due to waste of resources or non-mitigation of significant health risks. The misuse of TTLCs clearly shows that healthbased risk assessments are necessary guidance tools for soil remediation.

DISCLAIMER

This presentation is solely the author's judgement, and does not necessarily represent Department of Health Services policy.

INTRODUCTION

1. DDT, DDD, and/or DDE (DDTr) are ubiquitous in the California environment due to widespread usage prior to cancellation of DDT two decades ago. The extent of contamination was analyzed by the California Department of Food and Agriculture (CDFA, 1985). "CDFA collected 99 soil samples in 32 California counties from locations where DDT had been used in the past. All samples contained DDTr..."
2. DDTr and other persistent organochlorine pesticides are considered to be hazardous materials by the State of California (Title 22).
3. The concentration of DDTr in soil commonly exceeds the Total Threshold Limit Concentration (TTLC). TTLCs are promulgated values used in California to determine whether or not "waste" containing hazardous materials (including soil) is hazardous waste. Therefore, soil containing DDTr, by legal definition, could be hazardous waste.
4. Population influx and demographics have driven the development of agricultural land for new uses, such as housing. Developers, lenders, and local government agencies are concerned about hazardous waste liability associated with hazardous materials in soil, including DDTr.
5. However, Toxic Substances Control Program has no policy or formal guidance covering DDTr in soil if:
 - o DDTr in soil is due to prior legal application on crops,
 - o The land is still used for agriculture, or
 - o Soil is not removed and disposed of off site during land development.
6. In the absence of formal guidance, TTLC values are frequently considered by regulatory personnel as "clean-up" numbers to be used to determine whether soil containing DDTr requires remediation.
7. The purpose of this poster is to show that TTLCs are inappropriate for remediation of soil containing pesticides which are defined as hazardous materials but are present in soil due to legal application. Considered are:
 - o Waste of resources in unnecessary clean-up activities, and conversely,
 - o Whether remediation activities are health-protective.

METHODS

Exposure to soil by ingestion and contact with skin were considered as the exclusive routes of exposure for this exercise. Several exposure scenarios were developed using guidance provided by Sedman (1989), equations in the USEPA Risk Assessment Guidance for Superfund manual (USEPA, 1989a), and information in the Exposure Factors Handbook (USEPA, 1989b). Scenarios include the following:

Adult, residential, 70 year lifetime;

Adult, 30 year residential, individuals work away from home, a typical exposure;

Adult, 30 year residential, individuals work at home, a typical exposure;

Adult, 30 year residential, individuals work at home, a reasonable maximal exposure;

Child, age 1-19 residential, a reasonable maximal exposure;

Child, age 6-19 community park, a reasonable maximal exposure.

Assumptions are itemized in Appendices 1-6.

Three pesticides were considered: DDT, dieldrin, and chlordane. The TTLC values are 1 ppm, 8 ppm, or 2.5 ppm, respectively. Oral absorption of all three was assumed to be 100%. Dermal absorption from soil was estimated to be 5% for DDT, based on data from Wester et al. (1990). For dieldrin and chlordane, dermal absorption was estimated to be 10%, in the absence of data. Oral slope factors for DDT, dieldrin, and chlordane were obtained from the USEPA IRIS data base, and were 0.34, 16, or 1.3 (mg/kg-day)¹, respectively.

Exposure estimates are summarized in Table 1, whereas upper bound risk estimates are shown in Table 2. Appendices 1-6 at the bottom of the poster provide itemized listings of assumptions used in each exposure scenario.

TABLE 1

LIFETIME AVERAGE DAILY DOSE (mg/kg-day)
TO PESTICIDES IN SOIL AT THE TTLC CONCENTRATION

	Scenario	DDT	Dieldrin	Chlordane
Adult	Residential Lifetime ¹	1.9×10^{-6}	1.8×10^{-5}	5.5×10^{-6}
Adult	Works Away From Home, A Typical Exposure ²	3.9×10^{-7}	4.3×10^{-6}	1.3×10^{-6}
Adult	Homemaker or Work Home, A Typical Exposure ³	6.0×10^{-7}	6.6×10^{-6}	2.1×10^{-6}
Adult	Homemaker or Work Home, A Reasonable Maximal Exposure ⁴	1.0×10^{-6}	1.3×10^{-5}	3.9×10^{-6}
Child	Age 1-19, A Reasonable Maximal Exposure ⁵	1.3×10^{-6}	1.3×10^{-5}	4.0×10^{-6}
Child	Age 6 to 19, Community Park, A Reasonable Maximal Exposure ⁶	1.8×10^{-7}	1.7×10^{-6}	5.4×10^{-7}

¹ Appendix 1; ² Appendix 2; ³ Appendix 3; ⁴ Appendix 4; ⁵ Appendix 5; ⁶ Appendix 6

TABLE 2

**UPPERBOUND CANCER RISK FROM
PESTICIDES IN SOIL AT THE TTLC CONCENTRATION**

	Scenario	DDT	Dieldrin	Chlordane
Adult	Residential Lifetime¹	6.5×10^{-7}	2.8×10^{-4}	7.2×10^{-6}
Adult	Works Away From Home, A Typical Exposure²	1.3×10^{-7}	6.8×10^{-5}	1.7×10^{-6}
Adult	Homemaker or Work Home, A Typical Exposure³	2.0×10^{-7}	1.1×10^{-4}	2.7×10^{-6}
Adult	Homemaker or Work Home, A Reasonable Maximal Exposure⁴	3.3×10^{-7}	2.0×10^{-4}	5.1×10^{-6}
Child	Age 1-19, A Reasonable Maximal Exposure⁵	4.4×10^{-7}	2.0×10^{-4}	5.2×10^{-6}
Child	Age 6 to 19, Community Park, A Reasonable Maximal Exposure⁶	6.0×10^{-8}	2.7×10^{-5}	7.0×10^{-7}

¹ Appendix 1; ² Appendix 2; ³ Appendix 3; ⁴ Appendix 4; ⁵ Appendix 5; ⁶ Appendix 6

SUMMARY

1. California agricultural land commonly contains DDT due to previous legal usage. Dieldrin and chlordane are sometimes detected.
2. The soil concentration of DDT often exceeds the TTLC value, which defines that soil as being hazardous waste if removed from the site.
3. Six exposure scenarios were based on plausible assumptions and standard criteria, assuming soil is the exclusive medium of exposure and soil ingestion and dermal contact are the sole exposure routes.
4. In all six scenarios, upperbound cancer risk estimates show that:
 - o No significant risk is associated with DDT in soil at a concentration defined as hazardous waste by the TTLC,
 - o Dieldrin in soil at the TTLC level poses a risk which is greater than 10^{-5} under all six exposure scenarios, and
 - o Risk from chlordane in soil at the TTLC level is greater than 10^{-6} , in five of the six scenarios.

CONCLUSION

1. Use of hazardous waste criterion, i.e. the TTLC, for remediation decisions concerning DDT in soil is over-protective even by conservative modeling, and will waste valuable remediation resources as a consequence.
2. Use of the TTLC for decisions regarding dieldrin or chlordane in soil may not be health-protective.
3. A health-based risk assessment developed with a case-specific exposure scenarios is essential to avoid either of the above mistakes.

REFERENCES

California Administrative Code (a), Title 22, Division 4, Chapter 30, Article 9: Hazardous Wastes and Hazardous Materials, Section 66680

California Administrative Code (b), Title 22, Division 4, Chapter 30, Article 11: Criteria for Identification of Hazardous and Extremely Hazardous Wastes, Section 66669.

CDFA (1985). Agricultural Sources of DDT Residues in California's Environment. Environmental Monitoring and Peat Management Branch, California Department of Food and Agriculture.

Sedman, R.H. (1989). The development of Applied Action Levels for soil contact: A scenario for the exposure of humans to soil in a residential setting. Environmental Health Perspectives 79:291-313.

USEPA (1989a). Risk Assessment Guidance for Superfund, Human Health Evaluation Manual. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. Document Number EPA\540\1-89\002, December 1989.

USEPA (1989b). Exposure Factors Handbook. Office of Health and Environmental Assessment, U.S. Environmental Protection Agency. Document Number EPA\600\8-89\043, March, 1989.

USEPA (1990). Integrated Risk Information System (IRIS) database.

Wester, R.C., Maibach, H.I., Bucks, D.A., Sedik, L., Melendres, J., Liao, C., and DiZio, S. (1990). Percutaneous absorption of [¹⁴C]DDT and [¹⁴C] benzo[a]pyrene from soil. Fundam. Appl. Toxicol. 15:510-516. Note that Toxics Substances Control Program funded this study.