

Cancer in Adults and Pesticide Exposure

Summary of Selected Studies

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Some Notes on the Table

This table is a selective summary of studies of cancer in adults with potential occupational and environmental exposure to pesticides. Most are from articles published in English in peer-reviewed journals. The studies are listed in chronological order by author – the most recent first.

The source of pesticide exposure could be their occupation as farmers, agricultural workers, sprayers, exterminators, formulators, or other jobs. The exposure could be from household, lawn/garden, pet, or other pesticide use. Or it could be from potential pesticide exposures from living on a farm, in an agricultural spray area, near a pesticide factory, or other environmental exposures.

How The Studies Are Done

Epidemiology is the study of diseases and their causes in human populations. It compares groups of people with an exposure to those without it, or people with a disease to those without it.

In the studies in this table, groups of people with cancer or with pesticide exposure are the “*cases*”. Groups of people without cancer or without pesticide exposure are the “*controls*”.

The aim is to find out if the people with cancer (the cases) are more likely to have exposure to pesticides than the people without cancer (the controls). Or to find out if the people with pesticide exposure are more likely to have cancer than the controls.

How Study Results are Reported

Study results are reported as risk ratios. These ratios indicate whether the people with cancer were *more* likely to be exposed to pesticides (at increased risk), *equally* likely to be exposed to pesticides (no difference in risk), or *less* likely to be exposed to pesticides (at decreased risk) than the people without cancer.

Or whether the people with pesticide exposure were *more* likely to have cancer (at increased risk), *equally* likely to have cancer (no difference in risk), or *less* likely to have cancer (at decreased risk) than the people without pesticide exposure.

For example: In a study of Non-Hodgkin lymphoma*, the cases would be people with lymphoma, and the controls people without it. There are three possible outcomes. The people with lymphoma could be more likely, equally likely, or less likely to have been exposed to pesticides.

1. More likely: If the ratio is greater than 1 (> 1), this means that the people with lymphoma were more likely to have been exposed to pesticides – that pesticide exposure *increases* the risk of lymphoma. The size of the ratio indicates how much the risk is increased. The larger the number the greater the risk. A ratio of 1.4 means a 40% increase in risk. A ratio of 2.0 means a doubling of the risk, or a 200% increase. At least a doubling of the risk is considered more important than ratios less than 2.

2. Equally likely: If the ratio is equal to one ($= 1$) this means that there was no difference in pesticide exposure found in the people with or without lymphoma – pesticides did *not* increase the risk of lymphoma.

3. Less likely: If the ratio is less than one (< 1), this means that people with lymphoma were less likely to have been exposed to pesticides than people without it, that pesticide exposure *decreases* the risk of lymphoma. The smaller the number the lower the risk. A ratio of 0.80 means that people with lymphoma are 20% less likely to have been exposed to pesticides. A ratio of 0.40, that they are 60% less likely.

When studying humans, it is impossible to determine every factor that might influence the results of a study. It might have occurred anyway, by chance. It is possible that any increase in risk was not from pesticides, but something else. This could be something the researcher didn't think of, or didn't even ask about. Or it could be from the pesticide exposure in combination with other unknown or unstudied factors.

Therefore, finding an increase in risk does not mean that pesticides “cause” lymphoma.

This is why it is common to report any increase in risk by stating that “pesticide exposure increases the risk of lymphoma”, or “pesticide exposure is a risk factor for lymphoma”, and not that pesticides “cause” lymphoma.

Are the Study Results “Significant”?

There are methods to determine how strong the link or associations between lymphoma and pesticides are, or if they occurred by chance. They are called tests of statistical significance. The statistical part is usually left out, and the results reported as “significant” or “not significant”. The two most common tests are the “p” value, and confidence intervals.

1. “p” value: This tests whether the findings could have occurred by chance 5% of the time or less. The 5% is converted to a fraction and written as 0.05. For example, you will see the results as “ $p = 0.05$ ” (read as p equals point 0 5), or “ $p < 0.05$ ” (read as p less than point 0 5), or “ $p \leq 0.05$ ” (read as p less than or equal to point 0 5).

If the “p” value is less than or equal to 0.05, the findings are considered to be statistically significant; that is, they are unlikely to have occurred by chance. The smaller the “p” value the more significant the findings. For example” $p \leq 0.01$ ” (read as p less than or equal to point 0 1) means that it could have occurred by chance 1% of the time or less.

2. Confidence intervals: Another widely used test is called the confidence interval. It shows how close the risk ratio found in the study is to the “true” or expected value. The chosen level is usually 95%. This means that 95% of the time the study results will lie within the calculated interval. Another way of saying this is that 5% of the time they will not.

Because it is an interval, there are two numbers with the lower number written first. If the lower number of the confidence interval is less than or equal to one (≤ 1), then the increase in risk is “not significant” or “non-significant”. If the lower number of the interval is greater than one (>1) then the increase in risk is considered “significant”.

If the number of cases is small, the confidence interval can be very wide. When there is a very wide interval between the lowest and the highest number, the less confidence you have in the findings. It usually means that the number of cases found were very small.

The larger the number of people in the study (the sample size), the narrower the confidence interval, and the more significant the findings.

Ratios Used in the Tables

FR	Fecundability Ratio	SMR	Standardized Mortality Ratio
MbOR	Morbidity Odds Ratio	SHR	Standardized Hospital Ratio
OR	Odds Ratio	SMbR	Standardized Morbidity Ratio
PMR	Proportionate Mortality Ratio	SIR	Standardized Incidence Ratio
PCMR	Proportionate Cancer Mortality Ratio	SPiR	Standardized Proportional Incidence Ratio
PR	Prevalence Ratio	SPR	Standard Proportional Ratio
RR	Relative Risk (or Rate Ratio)	SRR	Standardized Rate Ratio

* Lymphoma is used as an example, but the discussion refers to all of the cancers listed in the table.

Study Type No. of Cases	Year, Location Population	Type of Cancer Exposure/Occupation	Results (95% CI)	Author Year Pub.
Mortality Prospective cohort 52,395 farmers 32,347 spouses	Agricultural Health Study Iowa, North Carolina	Cause of Death All cancers combined Lung cancer Female genital organs Prostate Bladder Liver cancer Multiple myeloma Leukemia Hodgkin disease Thyroid cancer Soft tissue sarcoma - applicators Soft tissue sarcoma -spouses Non-Hodgkin lymph. farmers/spouses	SMR 0.5 sig 0.3 sig 0.4 sig 0.6 sig 0.6 sig 2.1 not sig 1.6 not sig 1.4 not sig 2.9 sig 2.9 sig 1.6 sig. 1.1 sig 1.0	2002 Blair
Case-control 100 cases 200 controls	Parma, Italy	Kidney cancer Pesticide expos. 10 yrs or more ¹ Copper sulfate exp. 10 yrs or more	OR 2.0 (0.8-4.7) 2.7 (1.3-5.5)	2002 Buzio
Pooled analysis 2 case- control studies 515 cases 1,141 controls	Sweden Herbicide exposed workers	Non-Hod.Lymp / Hairy Cell Leuk. ² Herbicide exposure ³ Glyphosate MCPA Insecticide exposure Fungicide exposure Impregnating agents (wood)	OR 1.75 (1.26-2.42) 3.04 (1.08-8.52) 2.62 (1.40-4.88) 1.43 (1.08-1.87) 3.11 (1.56-6.27) 1.48 (1.11-1.96)	2002 Hardell
Ecological	1993-1997 Kentucky Atrazine use areas	Atrazine exposure ⁴ Breast cancer Ovarian cancer Highest quartile Middle quartile Lowest quartile	RR No associations 1.01 (0.83-1.21) 0.77 (0.66-0.90) 0.76 (0.65-0.88).	2002 Hopenhayn- Rich
1279 Cases 5370 controls	1994-1997 Canada - 8 provinces	Kidney Cancer Herbicide exposure Pesticide exposure	OR 1.6 (1.3-2.0) 1.8 (1.4-2.3)	2002 Hu
95 Cases 95 Hospital controls	1994-1996 Mexico City	Breast Cancer beta-HCH serum 3 rd vs 1 st tertile HCB ³⁵ serum 3 rd vs 1 st tertile	OR 1.05 (0.46-2.40) 0.46 (0.20-1.07)	2002 López-C
12 Case-control studies	Seven European countries Pooled analysis occupational exposures	Sinonasal Adenocarcinoma ⁵ Men - hi formaldehyde expos grp Women - hi formaldehyde exp grp Sinonasal Squamous Cell Carcinoma Men - hi formaldehyde expos. grp Women - hi formaldehyde exp grp	OR 3.0 (1.5-5.7) 6.2 (2.0-19.7) 2.5 (0.6-10.1) 3.5 (1.2-10.5)	2002 Luc

Case-control	Canada Farmers exposed to pesticides	Non-Hodgkin lymphoma More than 13 head of swine Raising bison, elk or ostriches Personal history of cancer > 4 and ≤ 15 ys farm residence Occup. expos.diesel fue/exhaust	OR Increase sig	2002 McDuffie
1,177 Glioma 330 Meningioma 2,478 Controls	International 8 Countries	Brain Cancer (Glioma) General farm work Contact with farm animals/pets	OR 0.66 (0.5-0.9) No association	2002 Menegoz
Ecological 2,277 males 2,458 females	1990-1999 Gaza	Cancer in males ⁶ Insecticide exposure Fungicideexposure Herbicide exposure Nematicide exposure Other types of pesticides All types of pesticides	Correlation Coeff. 0.992 0.952 0.812 0.925 0.992 0.994	2002 Safi
Case-control	US Chlorophenol exp.	Sinonasal Cancer 2,4,5-T exposure	OR 5.9 (1.5-23.7)	2002 Zhu
Case-control	Brazil	Lung Cancer Agricultural workers	OR No increased risk	2001 Algranti
Cohort mortality 1,517 males	1945-1994 Dow Chemical Co. 2,4-D formulators	Non-Hodgkin lymphoma Compared to US rates Compared to Dow Chemical rates	SMR 1.00 (0.21-2.92) 2.63 (0.85-8.33)	2001 Burns
44 cancerous 21 benign	US	Breast tissue 8-OHdG ⁷ cancerous tissues 8-OHdG ⁷ noncancerous tissue DDE and DDT levels	Median concentration 10.5 fmol/mg DNA 8.5 fmol/mg DNA ns No differences	2001 Charles
Mortality Migrant farmworkers ⁸	1984-1993 24 US States	Type of Cancer Buccal cavity women non-white Men non-white Total cohort Larynx males white Total cohort Esophagus men non-white Total cohort Stomach men white Total cohort Skin women non-white Cervix total cohort Colon total cohort Beast total cohort Kidney total cohort Pancreas women non-white Lymphohematopoietic total cohort Non-Hodgkin lymphoma Multiple myeloma men non-white	PCMR 2.04 (1.05-3.57) 1.53 (1.19-1.94) 1.25 (1.05-1.49) 1.63 (1.18-2.20) 1.37 (1.08-1.73) 1.33 (1.07-1.62) 1.18 (1.01-1.37) 1.38 (1.12-1.69) 1.22 (1.05-1.41) 2.66 (1.07-5.49) 1.93 (1.41-2.58) 0.83 (0.75-0.92) 0.82 (0.68-0.99) 0.70 (0.55-0.89) 0.64 (0.39-0.99) 0.88 (0.79-0.97) 0.80 (0.66-0.96) 0.52 (0.31-0.82)	2001 Colt

2,737 Cases 1,779 controls	Italy 12 areas	Hematolymphopoietic malignancies Agric. tractor drivers, orchard, vineyard, tree workers (males)	OR Increased risk	2001 Costantini
315 Breast cancer cases 219 Hospital controls 307 Population controls	Quebec City Canada	Breast Cancer vs Controls Pesticide plasma lipid levels Lymph-node invasion p,p'-DDE highest v lowest quartiles Lymph-node involvement, large tumor p,p'-DDE 2 nd vs 1 st tertile p,p'-DDE 3 rd vs 1 st tertile β-HCH, oxychlorane, transnonachlor	Findings No differences OR 2.54 (1.20-5.35) OR 2.33 (0.94-5.77) OR 3.51 (1.41-8.73) Similar associations	2001 Demers
Case-control 522 cases 540 controls	1988-198 Crete, Greece Female greenhouse workers exposed to pesticides ⁹	Mammogram Abnormalities Findings increased in exposed ¹⁰ Fibrocystic changes, lipoma Malignant changes or tumours. Exposed women 40-49 yrs Entire exposed group Exposed women 50-75 yrs	Detection Increased < 0.05 No sig. difference Increased No sig. difference No sig. difference	2001 Dolapsakis
445 Cases 1,025 controls	1992-1996 Southern France	Non-Hodgkin Lymphoma Agricultural work	OR 1.5 (1.0-2.1)	2001 Fabbro-P
Ecological Mortality N=359	1985-1994 Belgium Pest./ Crop areas	Potato Growing Areas Breast cancer Prostate cancer	SMR 2.77 ns 1.04 ns	2001 Janssens
Case-control 484 cases 2,095 controls	1986-1989 US Occupational pesticide exposure	Pancreatic Cancer Pesticides exposure - low Pesticides exposure - mod/high Fungicides - occup. exposure Herbicides - occup. exposure	OR 1.3 sig 1.4 sig 1.5 sig 1.6 sig	2001 Ji
Case report Father & son ¹¹	Japan	Nasal NK/T-cell lymphoma Farmers heavy pesticide exposure	—	2001 Kojya
1400 cases 1642 controls	US, 5 studies Pooled re-analyses	Breast Cancer DDE (lipid-adj.) 1 st vs 5 th quintile	OR 0.99 (0.77-1.27)	2001 Laden
381 Cases 381 Controls	1997 US - Nurses' Health Study	Breast Cancer DDE (plasma) 1 st vs 5 th quintile DDE (median) cases vs controls	OR 0.82 (0.49-1.37) No associations	2001 Laden

Case control 517 cases 1506) controls males	Canada Pesticide exposure at least 10 hours per year	Non-Hodgkin lymphoma Phenoxy herbicides Dicamba Carbamate Organophosphorus insecticides Amide fungicides Fumigant carbon tetrachloride 2,4-D Mecoprop Dicamba Malathion DDT, Carbaryl Aldrin, lindane	OR 1.38 (1.06-1.81) 1.88 (1.32-2.68) 1.92 (1.22-3.04) 1.73 (1.27-2.36) 2.42 (1.19-5.14) 2.42 (1.19-5.14) Multivariate Analysis 1.32 (1.01-1.73) 2.33 (1.58-3.44) 1.68 (1.00-2.81) 1.83 (1.31-2.55) 2.11 (1.21-3.69) 2.11 (1.21-3.69)	2001 McDuffie
Cancer incidence ¹²	1987-1997 California United Farm Workers union members	Type of Cancer Leukemia Stomach cancer Uterine cervix Uterine corpus Brain cancer	MbOR 1.59 (1.07-2.37) 1.69 (1.24-2.27) 1.63 (1.11-2.44) 1.68 (1.05-2.67) 1.57 (0.96-2.53)	2001 Mills
144 Cases 283 controls	1997-1999 Brescia, Italy	Liver Cancer Field-crop farm workers (males)	OR Increased not sig.	2001 Porru
1279 of 1525 new cases ¹³	1990-1992 Italy 5 rural areas Agricultural workers	Work in Agriculture Stomach Rectum Larynx Prostate Prostate - applied pesticides	OR 1.4 (0.9-2.0) 1.5 (0.8-2.7) 1.4 (0.8-2.5) 1.4 (1.0-2.1) 1.7 (1.2-2.6)	2001 Settimi
Mortality 36,269 cases	1961-1979 Sweden	Prostate cancer Agriculture-related industries	SIR Increased sig	2001 Sharma-W
400 Cases 476 controls	1979-1985 Montreal	Prostate Cancer Pesticides/garden (leisure exposures)	OR 2.3 (1.3-4.2)	2001 Sharpe
Case-control 30 cancers 30 controls	India Eastern Utah Pradesh, Western Bihar regions Agric. Pesticides water pollution	Biliary concentration BHC ¹⁴ Carcinoma gallbladder Cholelithiasis Biliary concentration DDT ¹³ Carcinoma gallbladder Cholelithiasis Biliary concentration aldrin ¹³ Carcinoma gallbladder Cholelithiasis Biliary concentration endosulfan ¹³ Carcinoma gallbladder Cholelithiasis.	Mean in ppm 0.0471 p < 0.04 0.0352 0.418 p < 0.03 0.0103 0.0008 0.0005 p < 0.06 0.00132 p < 0.9 0.0126	2001 Shukla
748 Cases 2236 controls	Pooled data from Kansas, Nebraska, Iowa, Minnesota white male farmers	Non-Hodgkin's lymphoma Organophosphate pesticide use Direct interviews Proxy interviews Small cell lymphocytic lymphoma Diazinon use - direct interviews	OR 1.5 sig 1.2 3.0 2.8 ¹⁵	2001 Waddell

217 Cases 213 Controls	1995-1997 Canada Kingston and Toronto	Breast Cancer DDE (breast fat) ER- highest tertile DDE (breast fat) ER+ highest tertile	OR 2.4 (1.0-5.4) 1.1 (0.6-1.9).	2001 Woolcott
3 Case-control studies,985 white men 2,895 controls	U.S. 4 Midwestern states Farmers	Non-Hodgkin Lymphoma Carbamate insecticide use ever Sevin - if personally handled First use ≥20 yrs before diagnosis	OR 30% to 50% increase Consistent association Consistent association	2001 Zheng
Case-control 168 cases 264 controls	Spain Occupational pesticide exposure	Pancreatic Cancer Agricultural workers - women Agricultural workers - men	OR Increased No increase	2000 Alguacil
Case-control 168 cases 264 controls	Spain Occupational pesticide exposure	Pancreatic Cancer Arsenical pesticides Other pesticides	OR 3.4 (0.9-12.0) 3.17 (1.1-9.2)	2000 Alguacil
73 Cases 73 Controls	1995-1996 Woodland Hills California	Breast Cancer DDT breast fat DDE breast fat DDT+DDE+DDD breast fat Mean breast fat tissue levels ng/g lipid DDT DDE DDD DDT+DDE+DDD	OR 1.052 (0.93-1.9) 1.126 (0.79-1.6) 0.904 (0.71-1.15) Cases Controls 261.6 267.3 ns 800.0 709.1 p=.006 9.8 24.0 1071.4 1000.4 p =.04	2000 Bagga
1018 Cases 1020 controls	British Columbia	Breast Cancer Crop farming ¹⁶ Fruit, vegetable production	OR Increased sig Increased sig	2000 Band
Cancer mortality ¹⁷	1975-1994 22 US states 1968 DDE fat levels	Increase with increased DDE levels Liver cancer: men, wom. - whites Decrease with increased DDE levels Beast cancer: white & black wom. Uterine cancer - whites Pancreatic cancer Multiple myeloma Uterine cancer - blacks Non-Hodgkin lymphoma Liver cancer men, wom - blacks	SMR Sig - whites only Sig Sig No association No association No association No association No association	2000 Cocco
Case-control 862 cases 790 controls	1993-1996 North Carolina Farm women	Breast cancer 1-10 years of farming 11-17 years of farming 18-23 years of farming More than 23 years of farming Applied pesticide in the fields Appl. pesticides - no protec. cloth. Appl. pesticides with protec.cloth.	OR 1.2 (0.8-1.7) 0.8 (0.5-1.2) 0.7 (0.5-1.1) 0.6 (0.4-0.9) 1.8 (1.1-2.8) 2.0 (1.0-4.3) 0.8 (0.4-1.8)	2000 Duell
932 Cases 932 Controls	Egypt Pesticide Exposure	Chronic lymphocytic leukemia Male farm workers	RR 2.1 not sig.	2000 El-Sadek

Case-control 108 cases 82 controls	1996-1998 San Francisco Bay Area	Pancreatic cancer Highest level DDE Median levels in ng/g lipid DDE Trans-nonachlor	OR 2.1 (0.9-4.7) Cases Controls Sig. 1290 1030 p=.05 54 28 p=.003	2000 Hoppin
195 Cases	Denmark 1976-78, 1981-83	Breast Cancer Dieldrin adverse effect on survival	RR 2.61 (0.97-7) trend p= .01	2000 Hoyer
1469 cases 5073 controls	1994-1997 Canada 8 Provinces	Non-Hodgkin lymphoma Herbicide exposure Pesticide exposure	OR 1.3 (1-1.6) trend σ sig 1.3 (1-1.6)	2000 Mao
292 Black cases 270 controls 456 white cases 389 controls	US North Carolina	Breast Cancer DDE highest vs lowest third - blacks DDE highest vs lowest third - whites DDE leanest blacks BMI <25 DDE lived /worked on a farm DDE farm women pesticide exposed	OR 1.41 (0.87-2.29) 0.98 (0.67-1.43) 3.84 (0.98-15.08) No associations No associations	2000 Millikan
135 cases 1,909 controls	U.S. Chlorophenol factory workers	Nasopharyngeal cancer ¹⁸ Med/hi chlorophenol exposure High exposure 10 yrs or more	OR 1.94 (1.03-3.50) 9.07 (1.41-42.9)	2000 Mirabelli
120 Cases 126 Controls	1990-1995 Mexico City	Breast Cancer DDE serum 1 st vs 2 nd quartile DDE serum 2 nd vs 3 rd quartile DDE serum 1 st vs 4 th quartile Test for trend significant DDE post-menop. 1 st vs 4 th quartile Test for trend significant DDT serum levels DDE serum ug/g lipid - cases DDE serum ug/g lipid - controls	OR 1.24 (0.50-3.06) 2.31 (0.92-5.86) 3.81 (1.14-12.8) p = 0.02 5.26 (0.80-34.30) p = 0.03 No Association 3.84 \pm 5.98 2.51 \pm 1.97	2000 Romieu
Cancer mortality	1980-1989 Minnesota, North Dakota, South Dakota, Montana Wheat growing areas	Men Esophagus, stomach, rectum, pancreas, larynx, prostate, kidney/ureter, brain, thyroid, bone, all cancers Women Oral cavity/tongue, esophagus, stomach, liver and gall bladder/ bile ducts, pancreas, cervix, ovary, bladder/other urinary Men and Women Cancer of the nose and eye	SMR Positive trends of increasing mortality Positive trends of increasing mortality Increased mortality	2000 Schreine- machers
Mortality 261 cases 250 controls	1958-94 Sweden Lumberjacks Penoxy herb. exp. ¹⁹	All malignancies Highly exposed group of foremen Non-Hodgkin's lymphoma	SIR 2.74 (1.00-5.96) 3 cases - 2 high expos.	2000 Thorn
150 Cases and controls	1973-1991 Norway Serum Bank storage specimens	Breast Cancer β -HCH, heptachlor epoxide Oxychlorthane, trans-nonachlor p'p'-DDE, Dieldrin	OR No associations No trends increasing risk	2000 Ward

154 Cases 205 Controls	Sweden Population based	Endometrial Cancer DDE Hexachlorobenzene beta-Hexachlorocyclohexane Oxychlorane Transnonachlor	OR Highest v lowest quartile 1.0 (0.6-2.0) 1.0 0.9 1.4 not sig 1.2 not sig	2000 Weiderpass
148 Cases 295 Controls	1987-1992 New York City Serum Bank	Breast Cancer DDE serum (6 months prior to diag.) DDE geom. mean lipid-adj. - cases DDE geom. mean lipid-adj. - controls	OR No associations 6.95 ng/ml 7.27 ng/ml diff. not sig.	2000 Wolff
175 Cases 355 Controls	New York City	Breast Cancer Serum DDE, DDT, trans-nonachlor	OR No associations	2000 Wolff
475 Cases 502 Controls	1995-1997 Connecticut	Breast Cancer DDE lowest vs 3 rd tertile DDE and estrogen receptor status DDE serum g mean lipid-adj.-cases DDE serum g mean lipid-adj.-cntrls	OR 0.96 (0.67-1.36) No associations 460.1 ppb 456.2 ppb	2000 Zheng
304 Cases 186 controls	1994 -1997 Connecticut	Breast Cancer Oxychlorane fat 4 th vs 1 st quartile Trans-nonachlor fat 4 th vs 1 st quartile ER, menopausal status Oxychlorane breast fat -cases/cntrls Trans-nonachlor brst fat -cases/cntrls	OR 0.7 (0.4-1.3) 1.1 (0.6-1.9) No associations 36.4 / 38 ppb g mean 55.5 / 58.1 ppb g mean	2000 Zheng
Mortality 1,441 applicators 1,045 instructors	1965-1988 U.S. Aerial pesticide applicators and instructors	Applicators Leukemia Pancreatic cancer All malignant neoplasms Colon cancer Multiple myeloma	RR 3.35 sig 2.71 sig 1.18 sig 0.51 0.23	1999 Cantor
12,980 cases ♀ 51,920 controls	1984-1992 4 US States	Central Nervous System Insecticide/fungicide exposure ♀	OR 1.2 sig	1999 Cocco
105 Cancer cases 210 controls	1977-1987 US Columbia, Missouri	Breast Cancer HCB ³⁵ 2 nd -3 rd quartiles ²⁰ DDT/organochlorine pesticides	OR 2.0 No dose response No associations	1999 Dorgan
Case-control 567 cases 1,165 controls	Sweden 1989 - 1995	Stomach cancer Herbicide exposure Phenoxy herbicide exposure	OR 1.56 (1.13-2.15) 1.70 (1.16-2.48)	1999 Ekstrom
Cohort Mortality 1874 deaths	1975 - 1993 Florida. Licensed pesticide applicators	Type of cancer Prostate cancer Soft tissue sarcoma Non-Hodgkin lymphoma	SMR 2.38 (1.83- 3.04) No cases No increase	1999 Fleming
Cohort Mortality 1266	1975 - 1993 Florida. Licensed pesticide applicators	Type of cancer Prostate cancer Testicular cancer Cervical cancer Breast cancer	SIR 1.91 (1.72-2.13) 2.48 (1.57-3.72) 3.69 (1.84-6.61) Decreased sig.	1999 Fleming

995 Cases 1,783 controls	1984-1988 US Chlorophenol	Non-Hodgkin lymphoma (Registry) ≥ 8 years substantial exposure	OR 1.51 (0.88-2.59)	1999 Garabedian
275 cases Aus. 36 cases Scot.	1987-1993 Australia/ Scotland	Melanoma (soles and palms) Heavy expos. agric. chemicals	RR 3.6 (1.5-8.3)	1999 Green
Case-control 404 cases 741 controls (all males)	Sweden	Non-Hodgkin's lymphoma Fungicides Herbicides (includes glyphosate) Phenoxyacetic acid herbicides Phenoxy herbicide MCPA ²¹ Insecticide exposure	OR 3.7 (1.1-13.0) 1.6 (1.0- 2.5) 1.5 (0.9-2.4) 2.7 (1.0-6.9) No associations	1999 Hardell
Case-control 295 cases ²² 1,908 controls	1984 - 1988 US Selected Cancer Study ²³	Soft tissue sarcoma Chlorophenol exposure, hi ≥10 yrs Chlorophenol exposure, high Self-reported herbicide use	OR 7.78 (2.46-24.65) 1.79 (1.1-3) ²⁴ trend sig 2.9 (1.1-7.3) ²⁵	1999 1998 Hoppin
63,097 cases 252,386 controls	1984-1993 24 U.S. States Occupational exposures	Pancreatic cancer Formaldehyde exposure Probability of exposure Intensity of exposure	OR Low Medium High 1.2 1.2 1.4 1.2 1.2 1.1	1999 Kernan
177 Cases 350 Hospital visitor controls	1995-1996 Rio de Janeiro Brazil	Breast Cancer DDE serum 1 st vs 5 th quintile DDE serum 1 st vs 5 th quintile adjusted DDE serum in ng/ml - cases DDE serum in ng/ml - controls	OR 0.90 (0.47-1.73) 0.79 (0.39-1.60) 3.1 median, 5.1 mean 3.1 median, 4.8 mean	1999 Mendonca
811 Incident cases in 1,177 cancer-free men	9 year follow-up Iowa farmers	Prostate cancer Farmer usual occupation Excluding well-diff, local tumors Confined to older (age 70+yrs No effect younger farmers	RR 1.7 (1.0-2.7) 2.0 (1.1-3.6) 2.2 (1.1-4.3) 1.0 (0.4-2.1)	1999 Parker
Case-control 51 cases 26 controls	Barcelona Spain	Pancreatic cancer Serum p,p'DDE higher in cases with K-ras mutation	OR 8.7 (1.6-48.5) Trend p = 0.005	1999 Porta
Mortality (whites)	1980-1989 Minnesota Agricultural areas compared to urban	Type of Cancer Lip- men ²⁶ Nasopharynx - women ²⁰ Non-Hodgkin lymph. - women ²⁷ Prostate ²⁸ Thyroid - men ²² Bone - men ²² Eye - women ²²	SRR 2.70 (1.08-6.71) 3.35 (1.20-9.31) 1.35 (1.09-1.66) 1.12 (1.0-1.26) 2.95 (1.35-6.44) 2.09 (1.0-4.34) 5.77 (1.9-17.5)	1999 Schreine- machers
Mortality 2978 farmers 2586 wives	Italy 1971-1973 Males licensed to use pesticides	Non- Hodgkin's lymphoma Wives Male farmers All leukemia Wives Male farmers Myeloid leukemia Wives Male farmers	SMR 2.29 (0.62-5.86) 0.90 (0.24-2.30) 2.41 (1.04-4.76) 1.44 (0.69- 2.64) 3.14 (1.02-7.33) 2.43 (0.98-5.00)	1999 Sperati

Cohort mortality 1,896	U.S. 1940-1988 Ethylene oxide manuf. workers ²⁹	Type of Cancer All cancer types Leukemia Non-Hodgkin lymphoma Brain cancer Pancreatic cancer Stomach cancer	SMR 0.86 (0.71-1.04) 1.06 Increase (inconclusive) No increase No increase No increase	1999 1993 Teta
Ecological study Mortality	1981-1993 Costa Rica 3 urban/11 rural Paraquat, lead arsenate use	Heavy pesticide use Lung cancer Female hormone-related cancers Coffee growing areas Lip, melanoma, non-melanocytic skin, penile cancer	RR 2.0 men 2.6 women 1.3 to 1.8 Increased	1999 Wesseling
304 Cases (62 in situ) 186 Controls	1994-1997 Connecticut	Breast Cancer DDE breast fat 1 st vs 4 th quartile DDT breast fat 1 st vs 4 th quartile β -BHC breast fat 1 st vs 4 th quartile β -BHC high levels parous women β -BHC high levels nulliparous (few) DDE / DDT geom. mean - cases DDE / DDT geom. mean - controls	OR 0.9 (0.5-1.5) 0.8 (0.5-1.5) Decrease not sig. Decrease not sig. Increase not sig. 736.5 ppb / 51.8 ppb 784.1 ppb / 55.6 ppb	1999 Zheng
304 Cases (62 in situ) 186 Controls	1994-1997 Connecticut	Breast Cancer HCB ³⁵ breast fat 1 st vs 4 th quartile HCB parous who ever breast fed HCB parous who never breast fed HCB nulliparous 3 rd vs lowest tertile HCB geom. mean - cases HCB geom. mean - controls	OR No association 0.5 (0.2-1.4) 0.7 (0.3-1.7) 2.1 (0.5-8.8) 21.0 ppb 19.2 ppb	1999 Zheng
High cancer rates	Israel 2 Negev kibbutzim	Leukemia and lymphoma Orchard/field work before 1960	OR Increased p < .08	1998 Avnon
Case-control 993 farmers 2,918 controls	1980 - 1986 Nebraska, Iowa, Minnesota, Kansas	Non-Hodgkin lymphoma Used DDT Handled DDT DDT use \geq 5 days /yr (Neb.) ³⁰	OR 1.5 (1.1-2.1) 1.6 (1.1-2.3) 2.6 (1.1- 5.9)	1998 Baris
987 cases 2,895 white males	Kansas, Neb. Iowa, Minn. farmers exposed Lindane	Non-Hodgkin lymphoma Lindane use 5 days or more / yr 1 st use 20 years prior to diagnosis Use less than five days / yr Any use of lindane	OR 2.0 ns 1.7 ns 1.6 ns 1.5 ns ³¹	1998 Blair
Ecological ³²	1971-1994 US DDT workers	Prostate cancer Black workers 1981-1985	Multivar. Analy. Sig > 0.05	1998 Cocco
178 cases 1041 controls	1986 U.S.	Breast Cancer in Males Occup. exposure herb/pesticides	OR No associations	1998 Cocco
1,056 cases ♂ 5,280 controls	1984-1992 24 U.S. States	Stomach Cancer Occup. pesticide exposure - males	OR No associations	1998 Cocco

Case-control 153 pairs	Bogotá Colombia	Breast Cancer Highest mean DDE levels Test for trend	OR 1.95 (1.10-3.52) p = 0.09 ns	1998 Desi
Mortality 401 deaths (20,025)	1965-1976 Sweden Agric. pesticide applicators	Prostate cancer Entire cohort Born 1935 or later Born earlier than 1935	SIR 1.13 (1.02-1.24) 2.03 (0.82-4.19) 1.12 (1.01-1.24)	1998 Dich
Case-control	1985-1993 Northern Italy	Non- Hodgkin's lymphoma Rice weeders - women	OR 1.9 (0.6-6.0)	1998 Fontana
45 Cases 20 Controls	Hesse Germany	Breast Cancer p,p'-DDT breast fat p,p'-DDE mean breast fat - cases p,p'-DDE mean breast fat - controls beta-HCH breast fat	OR Increased p = 0.017 805 ug/kg 496 ug/kg Decreased not sig.	1998 Guttes
148 cases 314 controls 101 seminoma 47 embryonal	Sweden	Testicular cancer Insect repellents with Deet Farming (embryonal) Contact farm anim. (embryonal)	OR 1.7 (1.03 - 2.8) ³³ 3.1 (1.0 - 3-9.1) 3.3 (1.00 -10.9)	1998 Hardell
55 cases, males 220 live,100 dead controls	Sweden Occupational exposure	Soft tissue sarcoma Phenoxyacetic acid exposure Chlorophenol exposure	OR 3.0 No association	1998 Hardell
346 Cases and controls	1974,1989 U.S. Blood donations	Breast Cancer DDE highest 1974 concentrations DDE highest 1989 concentrations Median serum concentrations DDE 1974 DDE 1989	OR 0.50 (.27-.89) trend p=.02 0.53 (.24- 1.2) trend p=.08 11.7% lower cases p=.06 8.6% lower cases p =0.41	1998 Helzlsouer
Cohort mortality (males)	Netherlands Workers exposed to phenoxy herbicides	Type of Cancer All malignancies Respiratory cancer Non-Hodgkin lymphoma	RR ³⁴ 4.1 (1.8-9.0) 7.5 (1.0-56.1) 1.7 (0.2-16.5)	1998 Hooiveld
268 Cases 477 Controls	1996-97 Denmark Copenhagen 1976 serum bank	Breast Cancer Dieldrin beta-Hexachlorocyclohexane p,p'-DDE	OR 2.15 (1.2-2.6) trend p=.01 Inc. not sig. trend p=0.24 No association	1998 Hoyer
Meta-analysis 33 studies	1981-1996	Brain cancer and farming All studies Female farmers only Farmers central US only	RR 1.30 (1.09-1.56) 1.04 (0.84-1.29) 1.25 (1.09-1.44)	1998 Khuder
Meta-analysis 36 studies	1982-1997 Farming	Non-Hodgkin lymphoma All the studies Female farmers only Case-referent studies combined Farmers central US only	RR 1.10 (1.03-1.19) 0.93 (0.82-1.06) 1.19 (1.06-1.33) 1.26 (1.15-1.37)	1998 Khuder
479 blk/502 w 594 blk/721 w	Atlanta, Detroit, New Jersey	Prostate cancer Farming (short-term crop workers)	OR 2.17 (1.18-3.98)	1998 Krstev

43 Cases 35 Controls	Sweden	Breast cancer DDE adipose levels HCB ³⁵ >40 ng/g post menopausal HCB ³⁵ post-menopausal and ER+	OR No associations 1.9 (0.4-7.2) 7.1 (1.1-45)	1998 Liljegen
Ecological study cancer incidence	1993 California Pesticide Use	Hispanic males Leukemia and atrazine Leukemia and 2,4-D Leukemia and captan Atrazine and brain cancer Atrazine and testicular cancer Black males Atrazine and prostate cancer Captan and prostate cancer	Correl. coefficients r = .40 r = .41 r = .46 r = .54 r = .41 r = .67 r = .49	1998 Mills
154 Cases 192 Controls	US New York Buffalo	Breast Cancer (post-menopausal) DDE serum in ng/g Hexachlorobenzene serum in ng/g Mirex serum in ng/g Mirex -parous never lactated	OR 1.34 (0.71-2.55) 0.81 (0.43-1.53) 1.37 (0.78-2.39) 2.42 (0.98-4.32)	1998 Moysich
Case-control 46 cases (20 women) 230 controls	1987 - 1990 Italy Forli Province Agricultural workers	Multiple myeloma Apple/pear production Chlorinated chemical exposure DDT exposure Fungicide exposure Herbicide exposure Arsenate exposure Fumigant exposure	OR 1.75 (1.05-2.91) 1.6 (1.1-2.4) 2.6 (0.9-7.8) 2.6 (0.7-9.3) 1.9 (0.5-7.6) 1.9 (0.1-30.0) 1.7 (0.6-4.3)	1998 Nanni
Case-control 121cases (males) 484 controls	Sweden Farmers	Hairy cell leukemia ² Fungicides Herbicides Farm animals Insecticides Organic solvents Exhaust fumes	OR 3.8 (1.4-9.9) 2.9 (1.4-5.9) 2.0 (1.2-3.2) 2.0 (1.1-3.5) 2.1 (1.3-3.3). 1.5 (0.99-2.3)	1998 Nordstrom
Cancer mortality 178 families	1965-1993 Italy Flower greenhouse	Adult children of owners Ovarian cancer (2 cases) Leukemia Owners and spouses	SMR Increased Increased Decreased	1998 Settimi
109 Cases, no healthy ctrls ³⁶	1975-1994 Mayo Clinic Study	Primary CNS lymphoma (Brain) Farming	OR No associations	1998 Schiff
90 Cases 90 Controls	U.S. 5 Regions	Endometrial Cancer p,p'-DDE 4 th vs 1 st quartile	RR 0.7 (0.2-2.0)	1998 Sturgeon
Mortality 35-74 yrs males	1984-1986 France Farmers/farm wkrs	Brain cancer Farmers Pesticide exposure	RR 1.25 p < .001 1.10 (1.03-1.18)	1998 Viel

Case-control 31 cases 119 controls	1987-1989 Italy Pesticide users	Leukemia Farmer Animal breeder Farmer Animal breeder	OR 4.9 (1.1-2) 4.8 (1.3-18) Logistic Model 5.38 (1.3-22) ³⁷ 1.2 (0.7-2) ³¹	1997 Assennato
Cohort morality 1,043 deaths	1956- 1992 Sardinia, Italy Malaria sprayers ³⁸	Type of cancer Liver/biliary ³⁹ direct DDT expos. Liver/biliary no direct DDT exp. Multiple myeloma direct DDT exp Myeloid leukemia direct DDT exp. Myeloid leuk. no direct DDT exp.	PMR 2.28 (1.43-3.45) 2.10 (1.17-3.46) 3.41 (1.10-7.95) 1.89 (0.38-5.52) 1.70 0.(19-6.14)	1997 Cocco
Cohort Mort. 118 deaths (570)	1954-1970 Netherlands Aldrin/dieldrin	Type of Cancer Liver cancer Rectal cancer (inverse to dose)	OR No increase Increase	1997 DeJong
66 Cases 131 controls	Southeastern Michigan (18 counties)	Pancreatic cancer Self-reported exposure ethylan Self-reported exposure DDT Self-reported exposure OCI ⁴⁰	OR Increased sig Increased not sig Increased not sig	1997 Fryzek
Cancer mortality 1,493 males	1957-1992 Italy Rice growers	Types of Cancer All cancers Oral cavity Esophagus Pleura Intestines Liver Bladder Soft tissue sarcoma Non-Hodgkin lymphoma	SMR 0.92 (0.81-1.05) 1.32 (0.64-2.44) 1.11 (0.44-2.28) 2.21 (0.25-7.93) 1.07 (0.71-1.56) 1.28 (0.51-2.64) 1.03 (0.53-1.8) 3.93 (0.5-22.3) 1.27 (0.34-3.25)	1997 Gambini
Cohort study 26,000 workers 4,710 deaths	1950 - 1990 British Columbia 11 sawmills using chlorophenate wood preservatives	Non-Hodgkin Lymphoma Less than 120 hours exposure 120 to 999 hours of exposure 1,000 to 3,999 hours exposure 4,000 to 9,999 hours exposure 10,000 or more hours exposure	SIR 0.68 0.59 1.04 1.02 1.30	1997 Hertzman
Case-control 236 pairs	US 1989-1990 Blood samples	Breast cancer diagnosis 1992 DDE serum 5 th vs 1 st quintile Serum DDE cases / controls	OR 0.72 (0.37-1.40) 4.71 ppb / 5.35 ppb	1997 Hunter
Meta-analysis Published articles	1983-1984	Prostate cancer and farming All studies Retrospective studies only SMR studies only	Positive assoc. Positive assoc. No association	1997 Keller-B
Meta-analysis 6 studies	Central US	Non-Hodgkin's lymphoma Farmers	RR 1.34 (1.17-1.55)	1997 Keller-B
Ecological study	1990 Kentucky	Breast Cancer Triazine herbicides high exposure Triazine herbicides med. exposure	OR 1.14 p <0.0001 1.2 p <0.0001	1997 Kettles

Meta-analysis 32 studies	1981-1996	Multiple myeloma and farming All studies Female farmers only Farmers central US only	RR 1.23 (1.14-1.32) 1.23 (1.17-1.29) 1.38 (1.27-1.51)	1997 Khuder
Mortality 710 cancer deaths (21,863) men and women	1939 - 1992 12 Countries ⁴¹ Phenoxy herbicide manufacturing workers	Type of Cancer Respiratory (not lung) Kidney All malignant neoplasms Breast (male) Breast (female) Soft-tissue sarcoma Non-Hodgkin lymphoma Multiple myeloma Lung	SMR 3.2 (1.46-6.08) 1.60 (1.05- 2.35) 1.12 (1.04-1.21) 2.56 (0.31-9.26) 2.16 (0.99-4.10) 2.03 (0.75-4.43) 1.39 (0.89-2.06) 1.21 (0.55-2.29) 1.12 (0.98-1.28)	1997 Kogevinas
Cases 680 ♂ 250 ♀ 3,136 controls	Europe Seven Countries	Sinonasal cancer Orchard worker ≥ 10 years, men Orchard worker ≥ 10 years, women	OR 3.72 sig. 1.69 sig.	1997 Leclerc
21 Cases 21 Benign	1994 Hanoi, Vietnam	Breast Cancer p,p'-DDT/p,p'-DDE levels	RR No Association	1997 Schechter
265 Cases 341 Controls	Germany, Spain Netherlands Northern Ireland Switzerland	Breast Cancer (post-menopausal) DDE buttocks fat 1 st vs 4 th quartile DDE buttocks fat 1 st vs 4 th quar. adj. DDE mean fat concentration - cases	OR 0.73 (.44-1.2) 0.48 (.25-.95) trend p=.02 9.2% lower than controls	1997 Van'tVeer
Cohort mortality N=32,600	U.S. Employees of a lawn care company	Type of Cancer All cancer 45 obs. 59.6 expected Non-Hodgkin lymph. (4 deaths) ⁴² NHL - lawn applicators only NHL - 2 employed 3 yrs or more	SMR 0.76 (0.55- 1.01) 1.14 (0.31- 2.91) 1.63 (0.33-4.44) 7.10 (1.8-28.4)	1997 Zahm
Cancer mortal. Cancer incid. 24 deaths 954 males 245 females ⁴³	1968-1993 Muscatine, Iowa Monsanto pesticide plant (Alachlor)	Type of cancer Non-Hodgkin lymphoma. Melanoma Chronic myeloid leukemia Colorectal >15 ys since 1 st expos. Testicular cancer	SIR 18.6 (2.3-67.2) 3.9 (0.5-14.2) 2.4 (0.3-8.8) 1.9 (0.4-5.6) 1.9 (0.2-6.7)	1996 Acquavella
Case-control 1050 cases ⁴⁴ 1371 cntrols ⁴⁵	1983-1986 Upper Cape Cod area Massachusetts	Ever live ≤ 2600 ft cranberry bog All brain cancer Astrocytoma Breast cancer	OR 2.0 (0.8- 4.9) 6.7 (1.6- 27.8) No association	1996 Aschengrau
Mortality 484 deaths 2,479 workers	1972-1992 West Germany Four herbicide plants	Type of cancer ⁴⁶ Non-Hodgkin lymph. 20 yr 1 st exp. Non-Hodgkin lymph. entire cohort Buccal cavity /pharynx Respiratory cancer	SMR 4.25 (1.15-10.88) 3.26 (1.19-7.10) 2.95 (1.35-5.60) 1.54 (1.15-2.02)	1996 Becher
Cohort mortality	1942-1987 Diatomaceous earth workers	Lung cancer Cryst. silica no asbestos exposure Cryst. silica and asbestos expos.	SMR 1.41 8.31	1996 Checkoway

Case-control 226 men, 425 hospital controls	1990-1992 France Farming agricultural employment	Hairy cell leukemia ² Forage growing Farmed at least six months Pesticide use Organophosphates (nonsmokers)	OR 2.8 (1.6-4.9) 2.3 (1.3-3.9) 1.5 (1.0-2.2) 7.5 (0.9-61.5)	1996 Clavel
Cancer Incidence 20,025	1970-1991 Sweden Agricultural workers	Testicular cancer Born before 1934 Entire cohort Born 1935 or later	SIR 1.42 (0.61-2.80) 1.09 (0.68-1.67) 1.02 (0.54-1.74)	1996 Dich
Population based cohort 55-69 yrs old	1986-1992 Iowa Farm Women	Type of Cancer Non-Hodgkin lymph. (node sites) Non-Hodgkin lymphoma (all sites) All cancers Lung cancer Bladder cancer	RR 1.89 (1.13-3.18) 1.52 (0.96-2.39) 0.84 (0.76-0.92) 0.32 (0.20-0.50) 0.33 (0.12-0.92)	1996 Folsom
Case-control	Quebec, Canada Occupational. Exposure	Non-Hodgkin Lymphoma Pesticide exposure Employment in agriculture	OR No increased risk No increased risk	1996 Fritschi
22 cases on chemotherapy	US	Breast Cancer DDE pre vs post chemotherapy	Mean Diff. Lipid-Adj. .05 ug/g (-.04-.13) p=.10	1996 Gammon
61 Cases 33 Controls	Minnesota Pesticide applicers	Excess rearrangement and breaks Fumigant applicers vs. controls Herbicide applicers vs. controls	Chromosome Band 14q32 ⁴⁷ 18q21 ⁴¹	1996 Garry
Cancer cluster investigation	Israel Kibbutzim Orchard workers	Lymphoproliferative Kibbutz A (site of cluster) Kibbutz C (control site)	Observed v Expected 17 1.7 9 8.9	1996 Goldsmith
Case-control 221 white ♂	1978-1987 11 US States ⁴⁸ Chemical wrkrs exposed to pesticides	Intraocular melanoma Pesticide exp. (ever/never) Carbon tetrachloride exp. Formaldehyde ⁴⁹ Agricultural occupations	OR 2.3 (1.4-4.7) 2.3 (1.3-4.1) 2.9 (1.2-7.0) 1.2 (0.74-1.9)	1996 Holly
495 cases 974 controls	Ontario Canada	Testicular cancer Farmers	OR 0.89	1996 Knight
Mortality	1979-1990 England/Wales	Prostate Cancer Farmers	PMR 1.12 sig	1996 Inskip
106 cases and controls	Nish, Serbia	Female breast cancer Occupational exp. pesticides	RR 4.25 (1.4-12) p=0.007	1996 Kocic

<p>Cancer Incidence 3,333 ♂ 2,145 ♀ (136,463♂ 109,641 ♀</p>	<p>1969-1989 Norway Farmers Agricultural workers</p>	<p>Acute leukemia Dairy cattle -males Dairy cattle -entire cohort Orchard /greenhouse-females Orchard /greenhouse-males Dairy cattle -females Hodgkin disease Orchard /greenhouse-males Pesticide purchases-female Non-Hodgkin lymphoma Pesticide purchases-females Forestry -females Grain farming-females <i>continued below</i></p>	<p>RR 1.76 (1.02-3.05) 1.76 (1.02-3.05) 1.69 (0.38-7.52) 1.51 (0.68-3.35) 1.22 (0.44-3.37) 1.85 (0.91-3.77) 1.43 (0.38-5.35) 1.12 (0.66-1.91) 1.12 (0.67-1.86) 1.01 (0.62-1.66) <i>continued below</i></p>	<p>1996 Kristensen</p>
		<p><i>continued from above</i> Multiple myeloma Orchards/greenhouse-females Potato+pest.-entire cohort Potato cult.- entire cohort Pesticide purchase-females Soft tissue sarcoma Orchard/greenhouse-females Cattle - females Brain tumor Grain farming-entire cohort Pesticide purchase-females Testicular - Orchard/greenhouse Prostate- Orchard/greenhouse Malig. melanoma- pest. purchase</p>	<p><i>continued from above</i> 2.61 (0.88-7.76) 2.46 (1.03-5.85) 1.65 (0.92-2.95) 1.49 (0.59-3.77) 3.9 (1.05-14.47) 2.14 (0.68-6.71) 1.51 (0.98-2.30) 1.17 (0.56-2.44) 1.63 (1.01-2.62) 1.45 (1.01-2.09) 1.37 (1.03-1.82)</p>	
<p>Mortality 686 white males</p>	<p>1970-1992 50 U.S. States Golf course superintendents</p>	<p>Type of cancer Prostate Non-Hodgkin lymphoma Brain Colon All cancers Bone, connective tissue Leukemia Liver Pancreas Lung⁵⁰</p>	<p>PMR 2.93 (1.87-4.60) 2.37 (1.37-4.10) 2.34 (1.21-4.54) 1.75 (1.25-2.45) 1.36 (1.21-1.52) 2.59 (.84-7.93) 1.62 (83-3.16) 1.50 (.49-6.92) 1.28 (.70-2.36) 1.17 (.93-1.48)</p>	<p>1996 Kross</p>
<p>Cancer Incidence 18 cancer deaths (943)</p>	<p>1968-1990 Muscatine, Iowa Monsanto Plant Alachlor workers</p>	<p>Colorectal cancer All levels exposure Alachlor High exposure All other levels of exposure ≥ 5 years first exposure Chronic myeloid leukemia All levels of exposure High exposure Lymphatic/hematopoietic All levels of exposure High exposure</p>	<p>SIR 4.3 (1.2-10.9) 3.4 (1.2-8.6) 3.4 (0.7-10.0) 5.2 (1.1-15.1) 25.0 (3.0-90.3) 28.6 (3.5-103.2) 3.6 (1.2-9.5) 3.3 (0.9-8.3)</p>	<p>1996 Leet</p>

Case-control 347 males	Canada Occupational pesticide exposure	Multiple myeloma Pesticide exposure >10 h / y Occup. with pot. pest. exp.	OR 1.18 (0.88-1.58) 0.87 (0.68-1.11)	1996 McLaughlin
Case-Control 187 cases 977 controls	Italy Farming and animal breeding workers	Leukemia (CLL), lo grade NHL Insecticides in general Carbamates, and Organophosphates	OR 2.46 (1.07-5.63) 3.08 (1.05-9.00) 2.97 (1.28-6.91)	1996 Nanni
Mortality cohort of 243 men ⁵¹	1953 - 1992 Michigan Dow chemical Co. Dioxin exposure	Type of Cancer All cancers Respiratory cancer Current smokers high dose expos. Current smokers low dose expos.	SMR 1.97 (1.05-3.36) 3.06 (1.12-6.66) 3.42 (1.77-5.97) 1.29 (0.52-2.66)	1996 Ott
Mortality 50 cancer deaths (770)	1940-1989 Michigan Dow Pentachlorophenol workers	PCP - highest exposure group Kidney cancer Pancreatic cancer All cancers Stomach can (low to mod. expos) 15 yrs or more since first exposure Kidney cancer Stomach cancer Other lymphoma Lymphopoietic cancers	RR 4.16 (1.43-12.09) 1.25 (0.31-5.04) 1.08 (0.77-1.51) 3.63 (1.24-10.64) SMR 3.00 (0.62-8.77) 1.61 (0.52-3.76) 1.76 (0.36-5.16) 1.32 (0.42-3.07)	1996 Ramlow
Mortality (♂) 2,683 prob. 2,234 poss.	1960 - 1986 Alabama Triazine manuf.	Definite/prob. vs possible exposure All cancer Non-Hodgkin lymphoma ⁵²	SMR 0.85 (0.46-1.42) 3.85 (0.79-11.24)	1996 Sathiakumar
Cancer Incidence 192 cases 394 controls	1987-1990 Uppsala, Sweden Pesticide exposure	Brain cancer (glioma) Pest expos. self-reported - women Pest expos. self-reported - men Agricultural occup.- women Agricultural occup - men	RR 2.2 (0.5-10.5) 1.8 (0.6- 5.1) 1.4 (0.7-2.9) 1.2 (0.7-2.4)	1996 Rodvall
Case-control 316	Canada Farmers	Hodgkin disease Ever worked on a farm Occup. with potential pest. expos. Pesticide exposure >10 h / y	OR 1.03 (0.67-1.58) 0.96 (0.74-1.26) 0.85 (0.62-1.16)	1996 Spinelli
Mortality 65 cancer deaths (1485 males)	1984 England and Wales Pest control officers	Type of Cancer Soft tissue sarcoma Bladder Stomach	OR 3.18 (0.08-17.7) 2.4 (0.97-4.95) 1.29 (0.47-2.4)	1996 Thomas
Cancer incidence 7016 male and female adult s	1959-1987 Tecumseh, Michigan ⁵³ 1972, 1982-1987 Agricultural chemical use/acre	All cancer sites combined Females only Males only NHL, Hodgkin, CLL ent.cohort Areas high vs low agric. chem use ⁵⁴ All sites combined Females only Males only Non-Hodgkin lymphoma Females only Males only	SIR 0.95 (0.86-1.05) 0.91 (0.81-1.01) 1.40 (1.03-1.86) OR 1.01 (0.89-1.14) 0.88 (0.77-1.00) 1.90 (1.07-3.1) trend ↑ 3.81 (1.49-9.79)	1996 Waterhouse

Mortality 292 men 76 women	Costa Rica Banana plantation workers	Type of Cancer Leukemia - women Melanoma - men Penile All sites - women	SIR 2.74 (0.86-6.39) 1.97 (0.94-3.62) 1.49 (0.55-3.24) 1.16 (0.90-1.42)	1996 Wesseling
Incidence	Iceland 1993 Pesticide Users	Type of Cancer Lymphatic/hematopoetic -females Rectal cancer (all users) Rectal (licensed users)	SIR 5.56 (1.12-16.23) 2.94 (1.07-6.40) 4.63 (1.49-10.80)	1996 Zhong
Case-control 164 NHL 23 CLL	1988-1990 Italy - animal breeding wrkrs	Type of Cancer Non-Hodgkin Lymphoma Chronic lymphocytic leukemia	OR 1.79 (1.22 - 2.63)	1995 Amadori
Mortality 465	1952-90 Colorado Pest. manufact ⁵⁵	Hepatobiliary cancer Biliary duct/gall bladder ⁵⁶	SMR 2.49 (0.81-5.81)	1995 Amoateng-
Mortality 8,045 white ♂ 121 white ♀ 2,718 nonw ♂ 807 nonw ♀	1984-1988 Alabama Farmers Farm operators	White females Leukemia All lymphopoietic Respiratory Nonwhite females Bladder Leukemia	PMR 2.25 not sig 1.74 not sig 1.43 not sig 1.19 not sig 1.12 not sig	1995 Austin S
739 Cases 3,750 controls	1980 Michigan	Stomach cancer Agric. workers - white males	OR 2.6 sig	1995 Burns
Case-control 229 men 62 women 541 controls	1990-1992 France Farmers Agricultural occupations	Hairy cell leukemia ² Farmer or agricultural worker Farmer Use farm pesticide - men Agric./forestry worker Use farm pesticides - women Breed bovine cattle - men Breed bovine cattle - women	OR 2.7 (1.1-6.7) 2.3 (1.3-3.9) 2.0 (1.3-3.1) 1.7 (1.1-2.4) 2.7 (0.8-8.7) 1.9 (1.1-3.1) 2.0 (0.6-6.0)	1995 Clavel
Mortality 23,890 ♂, ♀ 119,450 non- cancer controls	1984 - 1989 24 US States ⁵⁷ Farmers	Non-Hodgkin lymphoma Farm managers Farm laborers (white males) Farm laborers (black males) Farmers	SMR 6.3 (1.8-22.4) 0.7 (0.5-0.9) 0.3 (0.1-0.8) 0.5 (0.3-0.8)	1995 Figgs
Mortality 190 deaths (1,189 males)	1952-1992 Germany Herb. manufact.	All cancer Highest exposure group Highest TCDD decile, blood	RR 3.30 (2.05-5.31) 2.43 (1.80-3.29)	1995 Flesch-Jany s
Case-control 98 cases 81 hospital, 72 neighbor controls	1985-1988 France Agriculture animal husband. forestry	Aplastic anemia Exposure all types pesticides Exposure insecticides Exposure herbicides Exposure fungicides	OR 1.6 (0.6-4.1) ns 1.6 (0.8-3.0) ns 1.7 (0.8-3.6) ns 1.8 (0.9-3.7) ns	1995 Guiguet

Mortality Cohort of 2,170 workers	1970 - 1990 Sweden 2 Plants manuf. ethylene oxide	Type of Cancer All lymphohaematopoietic Leukaemia entire cohort Leukemia \geq 10 yrs latency ⁵⁸	SIR 1.78 (0.65-3.88) 2.44 (0.3-8.8) 7.14 (0.87-25.8)	1995 Hagmar
Mortality 276 ♀	1980-1984 Shanghai farmers	Brain cancer Grain farmers Pesticide exposed	SIR 6.5 (1.3-19.1) 3.6 (1.2-8.5)	1995 Heineman
595 Cases 1,622 controls	1984-87 Finland Occup. exposure	Pancreatic cancer Pesticide exposure	OR 1.7 (0.8-3.4)	1995 Kauppinen
Nested Case-control 43	1991 International Registry Production use phenoxy herb.	Soft tissue sarcoma ⁵⁹ Exposure any Phenoxy. herb. Exposure any PDCC/furan Exposure 2,3,7,8-TCDD Non-Hodgkin lymphoma ⁶⁰ Exposure any Phenoxy. herb. Exposure. any PDCC/furan Exposure.2,3,7,8-TCDD	OR 10.32 (1.18-90.6) 5.56 (1.12-27.7) 5.19 (0.85-31.9) 1.25 (0.54-2.9) 1.84 (0.80-4.26) 1.93 (0.74-5.07)	1995 Kogevinas
Cancer incid. Cohort of 1,132, 82% ♀ 28 cancers ⁶¹	1974-1980 New York Ethylene oxide exposed workers	Breast cancer Regular employees Temporary employees Both regular and temporary	SMR 2.55 (1.31-4.98) 1.70 (0.89-3.23) 2.40 (1.32-4.37)	1995 Norman
Mortality 68 males (548)	1957-1989 Midland Michigan Dow chemical workers	DBCP exposed only Lung All cancers Entire cohort Prostate Lymphatic/hematopoietic	OR 3.3 (1.1-9.6) 1.5 (0.6-4.0) 1.4 (0.5-5.5) 1.1 (0.3-4.4)	1995 Olsen
Case-control 595 cases 1,700 controls	1984-1987 Finland	Pancreas Gardeners - males Pesticide exposure	OR 6.7 1.7 (0.8-3.4)	1995, 1994 Partanen
Mortality 78 females 48 males (1,225)	1938-1990 Wenatchee, Washington Apple orchard workers ⁶²	Males Digestive Pancreas All cancers Females Digestive All cancers Breast cancer	OR 2.23 (0.52-9.52) 1.42 (0.17-11.6) 1.20 (0.59-2.44) 3.09 (0.52-18.8) 1.31 (0.48-3.6) 0.75 ns	1995 Tollestrup
Case-control 323 cases 340 controls	1960-1970 Netherlands Pesticide exposure	Prostate Cancer Farm laborers Agric. machinery maintenance	OR Increased sig Increased ns	VanDerGul. 1995
Mortality 35-74 yrs males (837,413)	1984-1986 France Farmers/laborers	Bladder cancer Vineyard workers Pesticide exposure ⁶³ Pesticide exposure ⁶⁴	SMR 0.96 (0.85-1.0) 1.17 (1.1-1.24) 1.14 (1.7-1.22)	1995 Viel

Mortality 15,040 males (140,208)	1971-1987 Sweden Farmers	Type of Cancer Lip Multiple myeloma ⁶⁵ Malignant melanoma ⁶⁶ Lymphoma ⁶⁷	SIR Increased sig. Increased sig. Slight increase not sig Slight increase not sig	1995 Wiklund
Cohort 1,909 384 deaths - 77 cancer	1955-1971 Finland Phenoxy herbicide sprayers	18 year follow-up All cancer deaths Incident cancer cases Non-Hodgkin lymphoma	SMR 0.83 (0.65-1.0) 0.81 (0.67-0.97) (SIR) 1 case (2.4 expected)	1994 Asp
Case-control 10	Italy Farmers	Non-Hodgkin lymphoma Triazine expos. more than 18 yrs Triazine exposure Maize cultivation Exposure more than 18 yrs	OR 9.3 (0.9-97.7) 3.7 (0.7-19.0) 2.8 (0.6-12.9) 1.1 (0.1-14.7)	1994 Betta
Cancer Incidence 2,531	1961-1979 Sweden Farmers	Colon cancer Males Females	SIR 0.8 sig 0.9 ns	1994 Chow
Cancer Incidence 13,940 ♂ 4,892 ♀	1961-1979 Sweden Farmers	Stomach cancer Agriculture (occup. code) Farmer Farm worker/gardener	SIR 1.1 p <.05 1.1 p <.01 1.1 P <.01	1994 Chow
Case-control 640 ♂ cases 959 controls	1985 - 1987 Italy Farmers	Stomach cancer Forestry worker > 21 yrs Farm laborer - ever worked	OR 4.3 (0.9-20.6) 1.3 (0.9-1.8)	1994 Cocco
Mortality 54 ♂ (1,323)	1960-1989 Ireland Agricultural research institute workers	Type of cancer Bladder Brain Hodgkin Disease All cancers	OR 9.31 (1.9-27.2) 4.69 (1.2-11.4) 2.37 p=.09 1.24 (0.8-1.9)	1994 Daly
Mortality 773 ♂ 565 ♀	1971-1987 Ireland ⁶⁸ Agricultural workers	Type of cancer Brain Hodgkin's disease Multiple myeloma Leukemia	OR Increased ns Increased ns Increased ns Increased ns	1994 Dean
20 Cancer cases 17 Benign	US	Breast Cancer Estrogen receptor + DDE fat concentrations vs controls	Median and Mean Substantially higher	1994 Dewailly
5 cancer cases 5 controls		Breast adipose tissue p, p-DDE cases p, p-DDE controls	Mean Levels in ppb 379 ± 286 160 ± 149	1994 Djordjevic
Case-control black farmers	1984 to 1991 24 US states NOMS ⁶⁹	Prostate cancer Farmers in NC, SC, GA Farmers in other 21 states Attributable risk NC, SC, GA Attributable risk other 21 states	OR 1.40 sig 1.39 sig 5.0 1.3	1994 Dosemeci
Case report cohort 1,000	Minnesota Pest. applicers	Hairy cell leukemia ² 2 cases - incidence of 1 per 500	Incidence in Minn. 0.67 per 100,000	1994 Garry

Cancer mortality 2,531 males 2,472 females 129 deaths (74 men, 55 women)	1984-1991 Catalonia, Spain village with a factory manuf. hexachlorobenze (HCB) ⁷⁰	Males Thyroid cancer Soft-tissue sarcoma Brain cancer Bladder cancer Rectal cancer Females Soft-tissue sarcoma Breast cancer Lung cancer Bladder cancer	SIR 6.7 (1.6-28) 5.5 (1.7-17.5). 2.7 (0.99-7.2) 1.3 (0.75-2.3) 1.3 (0.6-3.0) 2.2 (0.3-16) 1.3 (0.84-2.1) 1.6 (0.39-1.7) 1.1 (0.28-4.6)	1994 Grimalt
105 Cases 335 Controls	Sweden Occupational exposures	Non-Hodgkin lymphoma 2,4-D, 2,4,5-T exposure Penta/other chlorophenols DDT exposure	OR 5.5 (2.7-11) 4.8 (2.7-8.8) No associations.	1994 Hardell
Case-control 97♂, 19♀	1984-1986 Lyon, France	Bladder Agricultural workers	OR 4.6 (2.0-10.6)	1994 Hours
Series of Case-control studies 21,186	1954-1982 Illinois Farmers	Type of cancer Eye Leukemia ⁷¹ Prostate ⁷² Brain Multiple myeloma Melanoma Muscle/connective tissue Hodgkin disease Non-Hodgkin lymphoma	OR 6.49 (1.78-23.7) 1.51 (1.01-2.25) 1.15 (0.99-1.35) 1.39 (0.86-2.24) 1.30 (0.74-2.26) 1.29 (0.77-2.14) 1.28 (0.59-2.76) 1.21 (0.42-3.48) 1.09 (0.77-1.54)	1994 Keller
Prospective 150 cases 150 controls	1990 US San Francisco Blood samples from late 1960s	Breast Cancer DDE entire cohort vs controls DDE black case vs black controls DDE blacks vs white controls ⁷³ DDE Asians vs white controls ⁷³	Serum Mean Diff. ppb 0.2 (-6.7-7.2) ns 5.7 (-3.3-14.8) ns 11.0 (4.3-17.6) sig 12.6 (6.0-19.2) sig	1994 Kreiger
Cancer Incidence 3250 women	1961-1979 Sweden Farming, forestry	Type of Cancer Non-Hodg. lymph.- animal breeders Mult. myeloma - forestry workers Leukemia Farmers (ANLL) Gardeners (CML) Other agricultural (CML)	SIR 5.3 sig 3.6 sig 5.0 sig 4.0 sig 1.9 sig	1994 Linnet
Review of studies	Women in farming pesticide exposure	Women with handling of pesticides No fam. hist. hematopoietic can. Fam. history hematopoietic can.	OR 0.6 5.8	1994 McDuffie

Case-control 226 males 142 females	1989-1992 Denmark. Occupational pesticide exposure	Kidney (renal-cell) - males ≥20 y work insecticide./herb. Occ exp. insecticides Occ. exp. herbicides >20 y work insecticide/herb. Kidney (renal-cell) - females Occ. exp. insecticides Occ. exp. herbicides ≥ 20 y work insect./herb.	OR 3.9 (1.0-15) 2.2 (0.8-6.3) 1.7 (0.7-4.3) 1.3 (0.4-4.1) 5.7 (0.6-58) 5.7 (0.6-58) 2.3 (crude)	1994 Mellemg.
Cancer mortality	1971-1985 Western Canada Farmers	Non-Hodgkin lymphoma ≥ 380 acres spraying herbicides ≥ 900C\$ on fuel and oil	RR 2.11 (1.13-3.93) 1.56 (1.06-1.39)	1994 Morrison
Mortality Case-Control 65 (294)	1977-1982 Florida Exterminators	Lung cancer Licensed before age 40 Licensed for 10 to 19 years	OR 2.4 (1.0-5.90) 2.1 (0.8-5.5)	1994 Pesatori
Mortality males (155,547)	1971-1987 Western Canada Farmers	Leukemia ≥ 130 chickens/turkeys Test for trend Insecticide/herbicide use	RR 1.32 (0.99-1.77) χ^2 4.24, p=.03 No association	1994 Semenciw
Mortality 23,401	1970-1986 Southern Piedmont Italy Farmers licensed to use pesticides	Type of Cancer Eye tumors Connective soft tissue Other lymphoma Melanoma, skin Prostate Hodgkin disease Lymphatic/hematopoietic	SMR 2.38 (0.65-6.09) 1.91 (0.26-6.89) 1.36 (0.68-2.43) 1.21 (0.55-2.29) 1.15 (0.82-1.58) 1.02 (0.38-2.23) 1.01 (0.71-1.38)	1994 Torchio
Mortality 4,474 females (50,682)	1971-1987 Sweden Agricultural occupations	Type of Cancer All sites combined Soft tissue sarcoma Non-Hodgkin lymphoma Breast cancer Colon Rectum Kidney Urinary organs Lung Cervix uteri	SIR 0.85 (0.82-0.87) 0.62 (0.39-0.95) 0.78 (0.63-0.96) 0.83 (0.78-0.88) 0.90 (0.81-1.0) 0.86 (0.74-1.0) 0.81 (0.68-0.97) 0.57 (0.45-0.72) 0.46 (0.37-0.57) 0.40 (0.31-0.50)	1994 Wiklund
Mortality Cohort of 1,971 (76 deaths)	1940-1984 Italy Ethylene oxide workers	Type of Cancer All sites combined Lympho/reticulosarcoma ¹¹⁰ All haematopoietic cancers	SMR 1.30 (0.94-1.75) 6.82 (1.86-17.45) 2.50 (0.91-5.44)	1993 Bisanti

Mortality White 119,648 ♂ 2,400 ♀	1984-1988 23 U.S. States ⁵⁰ Farmers	White Males Leukemia Lymphatic/hematopoietic Non-Hodgkin lymphoma Prostate Multiple myeloma Pancreas Brain Kidney White Females Multiple myeloma Leukemia Lymphatic/hematopoietic Melanoma Soft tissue sarcoma	PCMR 1.27 (1.20-1.35) 1.22 (1.18-1.27) 1.21 (1.13-1.30) 1.18 (1.14-1.22) 1.15 (1.04-1.27) 1.13 (1.07-1.20) 1.15 (1.05-1.26) 1.10 (1.01-1.19) 1.78 (0.97-2.99) 1.45 (0.93-2.16) 1.33 (1.00-1.72) 1.14 (0.37-2.66) 1.19 (0.24-3.48)	1993 Blair
Mortality Nonwhite 11,446 ♂ 2,066 ♀	1984-1988 23 U.S. States ⁵⁰ Farmers	Nonwhite Males ⁷⁴ Pancreas Prostate Breast Testicular cancer Melanoma Nonwhite Females Stomach Kidney Melanoma Multiple myeloma	PCMR 1.20 (1.0-1.43) 1.14 (1.05-1.24) 1.72 (0.46-4.41) 1.32 (0.48-2.88) 1.22 (0.39-2.86) 1.88 (1.19-2.82) 1.44 (0.52-3.13) 1.18 (0.02-6.56) 1.10 (0.55-1.97)	1993 Blair
Case-control 622 white ♂	1980-1983 Iowa, Minn.	Non-Hodgkin lymphoma Agricultural production	OR 2.3 (0.9-5.8)	1993 Blair
878 exposed 36,804 contrls	1945-1983 US 2,4-D cohort	Type of cancer Non-Hodgkin lymphoma	SMR 1.96 (0.24-7.08)	1993 Bloemen
173 cases 650 controls	Iowa Farmers	Multiple myeloma Farmers	OR 1.2 (0.8-1.7)	1993 Brown L
Case-control 429 women	1986-1991 Missouri	Lung cancer ⁷⁵ Pesticide exposure ever Entire cohort	OR 2.4 (1.1-5.6) 2.4 (0.8-7.0)	1993 Brownson
963 Exposed 1,111 Nonexp. IARC Registry	1955-1985 Plant 1 1965-1986 Plant 2 The Netherlands Phenoxy herbicide manufact. workers	Entire Cohort Total mortality Cancer mortality Non-Hodgkin lymph. - 2 deaths Soft-tissue sarcoma Workers prob. exposed dioxin ⁷⁶ Total mortality Cancer mortality Exposed workers vs nonexposed Total mortality All cancers Respiratory cancer	SMR 1.01 (0.82-1.24) 1.07 (0.73-1.52) 2.99 (0.36-10.8) No cases found 1.11 (0.72-1.63) 1.37 (0.66-2.52) RR 1.28 (0.89-1.82) 1.7 (0.9-3.4) 1.7 (0.5-6.3)	1993 BuenoDe Mesquita
86 Cases 264 controls	Italy	Acute Myeloid Leukemia ⁷⁷ Women exposed to pesticides	OR 4.4 (1.7-11.5)	1993 Ciccone

Case-control 692	1977-1981 4 US States ⁷⁸ Agricultural workers Farm laborers	Multiple Myeloma 10 yrs or more & exp. pesticides Self-reported pesticide exposure Currently employed forestry 10 yrs or more employed Employed in agriculture Entire cohort	OR 7.9 (2.4-4.6) 5.2 (1.6-21.1) 2.5 (1.1-12) 1.8 (1.0-4.0) 1.6 (1.2-2.6) 1.3 (0.8-2.8)	1993 Demers
Mortality 1,701 ♂ 426 ♀	1972 - 1988 Italy Farm workers	Type of Cancer Kidney (renal) < 65 yrs Kidney (renal) - entire cohort Leukemia	SMR 3.27 ns 2.12 ns 1.54 ns	1993 Faustini
Mortality 207 (2310)	1973-1988 Italy Rome Pest control workers	Type of cancer Brain cancer Lung cancer	SMR 2.70 (1.09-5.57) 0.57 (0.35-0.80)	1993 Figa- Talamanca.
Mortality 63 (168)	1946-1987 Italy-Exterminators	Type of cancer Liver and bile ducts	SMR 5.71 (1.54-14.63)	1993 Figa-T
Case-control 480 ♀ (1,674)	1980-1986 Central Italy Vitebro Province Farmers licensed pesticide users in 1970-1971	Farmer for more than 10 yrs Stomach Colorectal Kidney Prostate Brain Leukemia Pesticide license for more than 10 yrs Stomach Rectum Pancreas (vs. non-licensed) Pancreas (vs. entire cohort) Prostate	OR 1.38 (1.03-1.87) 1.45 (0.82-2.59) 2.00 (1.03-3.94) 1.25 (0.83-1.89) 1.04 (0.43-2.44) 1.29 (0.74-2.27) 2.62 (1.11-6.30) 4.22 (1.08-1.47) 5.18 (1.55-16.7) 3.78 (1.24-1.10) 2.68 (0.81-8.23)	1993 Forastiere
Case-control 2476 cases (1508 males) 2676 controls (1508 males)	1985-1991 Giulia region of northeastern Italy Farmers	Farming - males Oral cavity and pharynx Pancreatic cancer Hodgkin's disease Colorectal Bladder cancer Farming - females Multiple myeloma	RR 1.8 sig. 1.5 ns 1.6 ns 0.6 0.6 2.4 sig.	1993 Franceschi
Cancer Incidence 29 deaths 701 women	1991 Internat. Registry dioxin workers	Type of cancer All sites, dioxin exposed All cancers Breast	SIR 2.22 (1.02-4.22) ⁷⁹ 0.96 (0.64-1.37) No excess seen	1993 Kogevinas
Cancer Incidence 4,496	1961-1979 Sweden Dairy farmers	Non-Hodgkin lymphoma Dairy workers Dairy farmers	SIR 1.8 p<.05 1.6 p<.05	1993 Linnet
Mortality cohort of 940 workers	1943-1987 Denmark 2 plants phenoxy herbicide manuf.	Type of Cancer Soft tissue sarcoma 10 yr latency Soft tissue sarcoma All cancers Non-Hodgkin lymphoma	SIR 6.4 (1.3-18.7) 2.3 (0.6-5.8) 1.0 (0.8-1.3) 1.3 (0.4-3.3)	1993 Lyngø

Mortality 1,148	1971-1987 Canada farmers	Prostate cancer Age 45-69 spray \geq 250 acres	RR 2.23 (1.3-3.8) trend sig.	1993 Morrison
N=54 cases (35 men, 19 women) N=106 cases (157 men, 118 women)	Sweden Occupational exposure pesticides	Hodgkin disease Creosote exposure Phenoxy acid expos. DDT exposure Other pesticides exposure Non-Hodgkin lymphoma Phenoxy acid exposure Cresosote exposure	OR 10.7 (1.1-103) 3.8 (0.7-21) 7.5 (0.8-70) 2.0 (0.3-12) 4.9 (1.3-18) 9.4 (1.2-69)	1993 Persson
Mortality males (155,547)	1971-1987 Canada Alberta, Manitoba Saskatchewan Farmers	Multiple myeloma Fuel/oil expend. $>$ \$900 Test for trend $>$ 250 acres herbicide treatment. Test for trend $>$ 250 acres fertilizer treatment. Test for trend	RR 1.69 (1.108-2.65) χ^2 4.27, p=.04 1.32 (0.83-2.11) Not sig. 1.56 (0.96-2.53) χ^2 2.92, p=.08	1993 Semenciw
Mortality	1984-1986 France Farmers	Type of Cancer Multiple myeloma Leukemia ⁸⁰ Lymphoma	SMR 1.59 (1.32-1.89) 1.33 (1.19-1.49) 1.09 (0.94-1.26)	1993 Viel
Case-control 104	Philippines	Nasopharyngeal ⁸¹ Formaldehyde 1st exp. \geq 25 years Daily burning mosquito coil Pesticide exposure Less than 35 yrs 1st exposure 35+ yrs since 1st exposure	OR 4.0 (1.3-12.3) 7.8 (2.7-22.8) 1.4 ns 1.7 ns	1993 West
58 Cases 171 Controls	1985 -1991 New York City Serum Bank	Breast Cancer DDE 2.0 ng/mL 10 th percentile to 19.1 ng/mL 90 th percentile	RR 4.0 p = .031	1993 Wolff
Cohort mortality 18,728 men and women 1353 deaths	1988 US National 14 Ethylene oxide (ETO) production plants ⁸²	Type of Cancer All cancers Stomach Leukemia, pancreas, brain Non-Hodgkin's lymphoma Men Women	SIR Decreased sig. Decreased sig Decreased not sig Increased sig Decreased	1993 Wong
Case-control 993 white males	1979-1986 Kansas, Iowa, Minnesota, Nebraska Farmers	Non-Hodgkin lymphoma Atrazine exposure Adjust other pest. use ⁸³ (Kan.) Adjust other pest. use ⁷⁵ (Iowa) Adjust other pest. use ⁷⁵ (Min.) Adjust other pest. use ⁷⁵ (Neb.)	OR 1.4 (1.1-1.8) 1.9 (0.8-4.5) 1.6 (0.9-2.9) 1.3 (0.8-4.5) 0.7 (0.3-1.3)	1993 Zahm
Case-control women	Nebraska	Non-Hodgkin lymphoma Personally handled OPs Pest. use on dairy cattle Use organochlorine insecticides	OR 4.5 sig. 3.0 sig. 1.6 sig.	1993 Zahm

197 cases 394 controls	1984-1987 6 New England States	Uveal melanoma Agricultural occupation. Self-reported insecticide exposure	OR 2.18 (0.63-7.55) 1.36 (0.58)-3.19)	1992 Ajani
Mortality 337 deaths 650 white ♂	1964-1987 U.S. Organochlorine manufacturing workers ⁸⁴ Plant 1 N=64 Plant 2 N=159 Plant 3 N=337 Plant 4 N=90	Liver/biliary Plant 3 Plant 4 Bladder Plant 2 Stomach Plant 4 Plant 2 Plant 1	SMR 3.9 (1.27-2.9) 3.3 (1.1-8.7) 7.1 (1.5-20.8) 3.6 (0.7-10.6) 2.8 (0.3-10.3) 2.1 (0.6-5.4)	1992 Brown D
Cancer Incidence 305 ♂ 65 ♀	1970-1984 Sweden Farmers	Multiple myeloma Farmers (males) Farmers (females) Horticulture (males) Horticulture (females)	SIR 1.3 sig 1.4 sig 1.4 ns 1.1 ns	1992 Eriksson
New diagnosis AML	Italy Occupational Pesticide Exposure	Acute Myeloid Leukemia Myelodysplasia - cell lineages CD34 stem cell marker Chemotherapy response Median survival Chromosomal aberrations (classic AML-specific trans- locations. t[15;17]; t[8;21]) Detected only in unexposed)	Pest. exposed Unexp. Multiple cells Minority 85% 22%. 5.2%. 48.3% 2 months 9 months Type and Number 5q and/or 7q 40%exp. 17p-/trisomy 11q/ trans location 16q 6p 7p 11p	1992 Fagioli
20 Case 20 Controls	1987 US Connecticut	Breast Cancer DDE /total DDT tissue levels HCB ³⁵ , oxychlordan, transnonachlor	OR 1.5 sig Increased not sig	1992 Falck
Case-control 1,130 farmers 3,563 controls	1983 - 1988 Canada Alberta Province Farmers	Type of cancer Lip Prostate Esophagus Pancreas Stomach	OR 3.22 (2.14- 4.84) 1.31 (1.11- 1.55) 1.17 (0.52-2.63) 1.16 (0.54-2.48) 1.12 (0.75-1.67)	1992 Fincham
Case-control 28 (5,886)	1987 Philadelphia Rohm & Haas chemical workers	Pancreatic cancer Nitrofen (TOK) exposure DDT mean exposure 47 months DDT ever vs. never exposed Ethylan exposure Nitrophenol exposure DDD exposure Carbon tetrachloride exposure Dinocap exposure Dicofol exposure DDE exposure	RR 12.0 (1.2-115.3) 7.4 4.8 (1.3-17.6) 5.0 (1.4-18.2) 4.5 (1.4-14.4) 4.3 (1.5-12.4) 4.1 (1.1-15.6) 4.1 (1.2-13.6) 3.0 (0.7-13.4) No association	1992 Garabrant

18 cases 26 controls	Minnesota Pesticide applicators	*Phosphine exposed workers G band chrom. rearrangements No exposure at least 8 mon. prior Metaphase breaks - exposed Metaphase breaks - unexposed Bands 1q32, 3p14, 7p15, 14q11 3 of 4 bands 4 of 4 bands Bands 1p13, 2p23, 14q32, 21q12 Breaks in 4 of 4 bands ⁸⁵ No breaks any bands	Exposed vs Unexposed Sig. increase No sig. increase 196 / 3605 5.4% 102 / 2,533 4.0% Sig. excess ent. cohort Sig. excess exposed Sig. excess unexposed Exposed Unexposed	1992 Garry
Cancer Incidence 3,156♂ 859 ♀	1975-1984 Denmark Gardeners exposed to pesticides	Males Soft tissue sarcoma Chronic lymph. leukemia Non-Hodgkin lymphoma Lymphatic/hematopoietic Other leukemias Genital organs All cancers Females Non-Hodgkin lymphoma Lymphatic/hematopoietic Breast All cancers	SMbR 5.29 (1.09-15.38) sig 2.75 (1.01-5.99) sig 1.73 (0.63-3.76) ns 1.44 (0.80-2.37) ns 1.44 (3.0-4.19) ns 1.15 (0.7-1.78) ns 1.07 (0.92-1.24) ns 3.64 (0.44-13.14) ns 1.37 (0.17-4.95) ns 1.04 (0.50-2.05) ns 1.04 (0.91-1.20) ns	1992 Hansen
Case-report	1974-80 Sweden Hospital nurse	Malignant fibrous histiocytoma Hexachlorophene exposed 34 yr ♀	—	1992 Hardell
Cohort cancer morbidity 922 men	1950-1975 Sweden, Norway creosote exposed workers 13 plants	Type of Cancer Skin cancer Lip cancer Malignant lymphoma All malignancies	SIR 2.37 (1.08-4.50) 2.50 (0.81-5.83) 1.9 (0.83-3.78) 0.94	1992 Karlehagen
Cancer incidence and case-control	Finland (Jarvela) chlorophenol contaminated water	Contaminated area vs control Soft-tissue sarcoma Non-Hodgkin's lymphoma	RR 8.9 (1.8-4.4) 2.8 (1.4-5.6)	1992 Lampi
Case-control 167 males 40 females	1986-1988 France Farm workers	Sinonasal (squamous cell) Farm workers - males Farm workers - females	OR 2.2 (1.1-4.4) 4.9 (1.0-24.9)	1992 Luce
Mortality 156,242	1971-1987 Canada Farmers	Brain (glioblastoma) Highest quartile fuel/oil exp.	RR 2.11 (0.89-5) trend sig.	1992 Morrison
Cancer incidence 49 workers	1965 - 1976 Denmark, Germ manuf. chlordimeform	Bladder cancer Germany (GDR) Denmark Saarland	SIR 89.7 (35.6-168.6) 35.0 (13.9-65.7) 53.8 (21.3- 101)	1992 Popp
Case-control 1,010 cases 4,040 controls	1970-1984 Denmark	Multiple myeloma - females Employment in agriculture Pesticide exposure	OR 1.5 (0.8-2.8) Increased - not sig	1992 Pottern

Case-control 185 males and females 510 controls	1984-1988 France Pesticide exposed workers	Leukemia ⁸⁶ >10 yrs expos. herbicides >10 yrs expos. insecticides High/med expos. herbicides Any exposure insecticides Hi/med expos. insect. Expos. all types pesticides Any exposure to herbicides	OR 6.0 (1.5-25.0) 4.0 (1.2-13.2) 3.5 (1.1-10.8) 7.2 (1.0-3.1) 2.1 (0.8-5.4) 1.6 (0.9-2.8) 1.5 (0.8-2.8)	1992 Richardson
Cancer Incidence males and females	Italy Farmers Farm employees	Type of Cancer Hodgkin disease Kidney Non-Hodgkin lymphoma Pancreas Stomach Bladder Nasal Melanoma (skin) Lung Leukemia Multiple myeloma Gallbladder	OR Males Females 2.91 sig 1.87 ns 1.46 sig 4.23 sig 1.59 sig 3.28 ns 1.42 sig - 1.25 sig 1.26 ns - 5.12 ns 4.15 ns - 1.43 ns 2.31 ns - 2.12 ns - 1.71 ns - 1.71 ns - 1.37 ns	1992 Ronco
Cancer Incidence males and females	Denmark Farmers Farm employees	Type of Cancer Lip Multiple myeloma Gallbladder Leukemia Bone Thyroid Soft tissue sarcoma Nasal Breast Eye Esophageal Non-Hodgkin lymph Hodgkin disease Salivary gland Small intestine Stomach Pancreas Melanoma (skin)	SIR Males Females 1.2, 2.1 sig 1.57 sig 3.3 sig 1.32 ns ⁸⁷ - 2.66 sig - 2.22 sig - 6.25 sig 1.13 ns 1.67 sig 1.21 ns 2.38 ns 1.27 ns 3.45 ns 1.37 ns - 1.34 ns 1.87 ns - 1.35 ns - 1.29 ns - 1.22 ns - 1.10 3.3 ns ⁸² - 1.10 ns - 1.66 ns - 1.27 ns - 1.51 ns	1992 Ronco
Cohort mortality 4,323 men	1960 - 1986 Alabama Agricultural chemical plant workers	Whites ⁸⁸ Buccal cavity and pharynx Esophageal cancer ⁷⁸ Lung cancer ⁷⁸ Soft tissue sarcoma	SMR 3.88 (1.25- 9.05) 4.17 (112-10.67) 1.50 4.84 (p = .05)	1992 Sathiakumar
Case-control 53 ♂ 40 ♀ 721 controls	Northern Italy	Soft-tissue sarcoma Agriculture empl. > 10 yrs Pesticide/ herbicide exposure	OR 0.8 (0.4-1.5) 0.4 (0.1-1.2)	1992 Serraino

Case-control 82 cases 164 controls	1982-1988 Victoria, Australia phenoxy herbicide chlorophenol exposure	Definite/prob exposure at least 1 day Soft tissue sarcoma Malignant lymphoma Defin/prob exposure more than 30 days Soft tissue sarcoma Malignant lymphoma	RR 1.0 (0.3-3.1) 1.5 (0.6-3.7) 2.0 (0.5-8.0) 2.7 (0.7-9.6)	1992 Smith J
Mortality 63 deaths (1,341)	1980-1988 Netherlands Licensed herbicide applicators	Type of Cancer Multiple myeloma Hodgkin disease Brain Colon Pancreas Prostate Kidney	SMR 8.15 (1.64-23.82) 3.34 (0.04-18.61) 3.18 (0.64-9.30) 2.55 (0.69-6.54) 2.18 (0.44-6.37) 1.31 (0.02-7.31) 1.14 (0.02-6.32)	1992 Swaen
Case-control 109	1958-1968 Netherlands Farmers	Prostate Farming longest occupation Farmer 1958-1968	OR 1.53 (0.72-3.26) 1.49 (0.68-3.28)	1992 VanDerGul den
Mortality 535 male farmers	1974 - 1987 Italy - farmers licen. pest. users	Brain Cancer Compared to national population Compared to regional population	SMR 1.69 ns 1.39 ns	1991 Alberghini
Mortality 699 applicators 454 instructors	1965-1979 U.S. Aerial pesticide applicators and instructors	Applicators ⁸⁹ Leukemia Pancreas Prostate Kidney Stomach ⁹⁰ Instructors Lymphosarcoma	SMR 1.71 (0.73-3.36) 1.34 (0.58-2.65) 1.36 (0.44-3.17) 1.26 (0.34-3.23) 0.68 (0.14-2.00) 1.31 (0.26-3.82)	1991 Cantor
Mortality 152 ♂ (2,239)	1950s-1970s. England 4 Pesticide plants	Type of cancer Non-Hodgkin lymphoma Lung	SMR 2.29 (.028-8.27) 1.34 (.081-2.10)	1991 Coggon
152 cases 613 controls	Northeast Italy Pordenone province	Hodgkin Disease Agriculture occup. > 10 years Livestock/meat processing occup Herbicides/ pesticide exposure	OR 2.2 (1.3-3.7) 3.4 (1.7-6.6) 3.2 (1.6-6.5)	1991 Franceschi
Mortality Case-control	1976-1985 Quebec - agric. area	Lymphatic cancer Women	RR 1.91 (1.14- 3.18)	1991 Godon
Mortality Cohort of 2,170 workers	1970 - 1985 Sweden 2 Plants manuf. ethylene oxide	Type of Cancer All malignancies Respiratory tract Hematopoietic/ lymphatic ⁹¹	SMR 0.78 (0.49-1.21) 1.75 (0.21-6.34) ns 1.54 (0.32-4.5) ns	1991 Hagmar
Case-control 5,147 males (615,834)	1985-1987 16 US States ⁹² Farming	Leukemia Farming, agriculture White farmers Black farmers	OR 1.0 (0.9-1.1) 1.1 (1.0-1.2) 0.7 (0.5-1.0)	1991 Loomis

Cohort Cancer Mortality 93 ♂ (1184) 20 ♀ (399)	1952-1984 Germany Exposure phenoxy herbicides and dioxins ⁹³	All cancers -males Entire cohort ≥ 20 y employment Entry ≤1954 & ≥20 y emp. Ent. ≤1954 & ≥20 y dioxin All cancers - females Breast -females	SMR 1.24 (1.00-1.52) 1.87 (1.11-2.95) 2.21 (1.29-3.53) 3.50 (1.51-6.90) 0.94 (0.58-1.45) 2.15 (0.98-4.09)	1991 Manz
338 Cases and controls	1977-1978 Finland	Kidney (renal) cell adenocarcinoma Male farmers	OR Decreased	1991 Partanen
Historical cohort 18,910 workers	10 Countries Phenoxy herbicide exposed production workers and sprayers	Soft tissue sarcoma ⁹⁴ Entire cohort 10-19 y first expos. Sprayers only Testes, thyroid, nose/nasal cancer Epithelial cancers / lymphomas	SMR 1.96 (.53-5.02) 6.06 (1.65-15.52) 8.82 (1.82-25.79) Increased not sig No increase	1991 Saracci
Case-control 332 white males	1977-1984 Washington Farming	Testicular cancer Farm manager (ever) Farm worker/gardener	RR 1.9 (0.6-5.4) 0.6 (0.3-1.3)	1991 VanDenE.
Mortality 377 males	1968-1978 France - farmers	Leukemia Depending on pesticide exposure	SMR 0 - 321	1991 Viel
Ecological incidence study 235 cancers	1985-1988 Northern Italy Rice growing provinces Phenoxy herbicide use since 1950s	Non-Hodgkin lymphoma Entire area - men Area A ⁹⁵ - men Area B ⁹⁶ - men Entire area - women Area A ⁸⁹ - women Area B ⁹⁰ - women Hodgkin disease Entire area - men Entire area - women Soft-tissue sarcoma Entire area - men Entire area - women	Incidence/100K 8.8 (7.4-10.4) 11.7 (5.0-19.3) 18.2 (11.1-28.0) 5.8 (4.7-7.0) 6.2 (8-11.8) 7.4 (3.5-13.6) 3.3 (2.4-4.4) 1.5 (0.9-2.3) 1.8 (1.2-2.6) 0.9 (0.5-1.4)	1991 Vineis
Mortality 1,914 (22,938)	1955-1985 US. Flour workers ⁹⁷ (at 57 mills)	Follow-up ≥ 20 years Non-Hodgkin lymphoma Leukemia (10-19 years) Pancreas Follow-up ≥ 25 years Non-Hodgkin lymphoma Pancreas Leukemia	SMR 2.31 (1.19-4.04) 1.94 (1.03-3.32) 1.92 (1.14-3.04) OR 9.4 (1.4-61.5) 2.2 (1.4-4.3) 1.8 (0.8-3.9)	1990 Alavanja
Case-control	1981-1984 Iowa and Minnesota	Leukemia Use OP ⁹⁸ insecticides on animals Ever handle crotoxyphos Ever handle dichlorvos Ever handle pyrethrins DDT use on animals >10d/y	OR 2.2 (1.3-3.7) 11.1 (2.2-55.0) 2.0 (1.2-3.4) 3.7 (1.3-10.6) 2.1 (1.1-3.9)	1990 Brown L
Case control 312 males	1984-1988 Missouri	Brain cancer Agricultural production	OR 1.5 (1.0-2.4)	1990 Brownson

Incidence Registry Data	Sweden 1961-1979	Thyroid cancer Horticultural workers	SIR Decreased risk	1990 Carstensen
Cohort Mortality Study	1964-1976 Vesicol Chemical Company	Type of Cancer Exposure category ⁹⁹ All cancers Respiratory cancer	SMR Grp1 Grp2 Grp3 Grp4 .91 .95 1.0 1.1 1.22 1.28 1.33 1.46	1990 DiTraglia
Case-control 218 males	1978-1986 Sweden Phenoxy herbicides (PH) chlorophenol, dioxin exposed workers ¹⁰⁰	Soft-tissue sarcoma High exposure chlorophenols High expos. pentachlorophenol Exposure 2,4,5-T in 1950s High exposure PH, dioxins Exposure PH in 1950s High expos. phenoxy herb.	RR 5.25 (1.69-16.3) 3.85 (1.20-12.8) 2.94 (1.08-7.98) 2.43 (1.30-4.54) 2.36 (1.02-5.44) 1.80 (1.02-3.18)	1990 Eriksson
Cancer Incidence 198 ♂	1979-1983 Louisiana Farmers	Pancreas Non-Cajun sugar cane ≥10 yrs Non-Cajun pest./herb. expos. Non-Cajun farmer ≥ 10 yrs Pest./herb. expos (entire cohort) Sugar cane ≥10 y (entire cohort) Cajun pesticide/herb. exposure Cajun farmer ≥ 10 yrs	OR ¹⁰¹ 3.84 1.82 1.45 1.39 1.24 1.26 1.05	1990 Falk
Survey 52 cases 52 controls	US Pesticide / Solvent exposure	Exposed versus unexposed Myelodysplasia syndrome Leukemia (ANL) abnl karyotype	OR No difference No difference	1990 Goldberg
Cohort mortal. 2,174 exposed 26,965 unexp	1940-1978 US - Ethylene oxide workers	Type of cancer ¹⁰² Leukemia (x 6) Pancreatic cancer (x 6)	Obs v Expected 7 3.0 7 4.1	1990 Greenberg
Cancer Incidence 17,164 ♂ 6,835 ♀	1979-1987 Japan Agricultural workers	Males Bone and soft tissue Prostate Liver Esophagus Females Stomach Breast Corpus uteri	SPR 1.62 p <.05 1.22 p <.05 0.64 p <.05 0.60 p <.05 1.37 p <.01 0.73 p <.01 0.51 p <.01	1990 Kato
Cohort mortality 2658 men 68 cancer deaths	1928-1981 Germany (FR) 8 ethylene oxide manuf. plants	Type of Cancer All malignancies Leukemia Esophageal Stomach	SMR 0.97 0.85 2.0 ns 1.38 ns	1990 Kiesselbach
44 Cases 33 Controls	1985-1986 Helsinki, Finland	Breast Cancer beta-HCH > 0.1 mg/kg fat DDE, hexachlorobenzene	OR 10.5 (2.0-55.36) Increased not sig.	1990 Mussalo-R

Case-control 201 white males	1983-1985 Eastern Nebraska Pesticide exposure	Non-Hodgkin lymphoma Organophosphate use Carbamate use Personal exp. 2,4-D >20 d/yr 2,4-D use Atrazine use Chlorinated hydrocarbon use	OR 1.9 (1.1-3.1) 1.8 (1.1-3.1) 3.3 (0.5-22.1) 1.5 (0.9- 2.4) 1.4 (0.8-2.2) 1.4 (0.8-2.3)	1990 Weisen- burger
Mortality males > 35 yrs (69,513)	1971-1985 Saskatchewan Canada Farm operators	Non-Hodgkin lymphoma ≤ 99 acres sprayed herbicides ¹⁰³ 100 to 249 acres sprayed ≥ 250 acres sprayed Test for trend ≤ \$599 spent for fuel \$600 to \$899 spent fuel ≥ \$900 spent for fuel Test for trend	RR 1.31 (0.7-2.4) 1.92 (1.18-3.18) 2.14 (1.05-4.24) χ^2 8.32, p<.002 1.18 (0.66-2.13) 1.45 (0.81-2.55) 1.83 (1.03-3.25) χ^2 5.78, p=.008	1990 Wigle
Case-control 200 cases 750 controls	Southeast Sweden	Soft tissue sarcoma Potential phenoxy expos. Gardeners Farmers Forestry workers	OR 1.6 4.1 5.1 1.9	1990 Wingren
Case-control 201 white men 725 controls.	1983-1986 Eastern Nebraska 66 counties 2,4-D exposure	Non-Hodgkin's lymphoma Mixed or applied 2,4-D Exposed 2,4-D ≥20 days per year Adjusted for organophosphate use Adjusted for fungicide use Adjusted for OPs/fungicides	OR 1.5 (0.9- 2.5) 3.0 trend p=.051 1.8 4.5 3.1	1990 Zahm
Mortality 1,411 white males (9,555)	1970-1979 U.S. Soil Conservationists Department of Agriculture	Type of Cancer Non-Hodgkin lymphoma Lymphatic/hematopoietic Colon Prostate Kidney All cancers 15 yrs or more emp. forest convs. Non-Hodgkin lymphoma ¹⁰⁴ Kidney ¹⁰⁵ Colon ¹⁰⁶ Prostate	PMR 2.4 (1.5-3.6) 1.8 (1.3-2.4) 1.5 (1.1-2.0) 1.6 (1.1-2.2) 2.1 (1.2-3.3) 1.1 (1.0-1.2) OR Trend 11.2 p< .01 9.0 p< .01 1.9 p< .05 2.1 p< .07	1989 Alavanja
Mortality 209 deaths (as of 1985)	1974-1985 South Carolina residents exposed to DDT late 1940s	Blood collected 1974-75 Total cohort Males vs females Blacks vs whites Cancer deaths All cancers Respiratory cancer Gastrointestinal cancer	Serum DDT/DDE Mean 48 ±36 ppb ¹⁰⁷ 6% higher 14% higher SMR 104 (79-134) 124 (77-189) Slight inverse assoc.	1989 Austin H
Case-control 282 cases 328 controls	US Nationwide study	Multiple myeloma Employment as farmer Pest./herb. exp. with farming	OR 2.7 ¹⁰⁸ 4.3 ¹⁰⁹	1989 Boffetta

Case-control 1,720 ♂	1984-1988 Missouri Farmers	Type of Cancer Non-Hodgkin lymphoma Prostate Bone Nasal Multiple myeloma Malignant melanoma Rectum Kidney Liver Leukemia Bladder	OR 1.40 (1.04-1.85) 1.33 (1.18-1.51) 2.02 (0.66-5.81) 1.66 (0.54-4.70) 1.40 (0.87-2.24) 1.26 (0.63-2.45) 1.21 (0.95-1.53) 1.21 (0.89-1.65) 1.19 (0.58-2.37) 1.12 (0.81-1.44) 1.09 (0.89-1.34)	1989 Brownson
Case-control 631 licensees (25,945)	1976-1983 Italy Farmers (licensed applicators)	Entire cohort Nervous system Skin Lymphatic Hematopoietic Birth cohort born before 1913 Skin Hematopoietic Lymphatic	SIR 2.1 (1.0-4.0) 1.4 (1.0-1.8) 1.4 (1.0-1.9) 1.1 (0.8-1.5) 1.6 (1.0-2.4) 1.6 (0.9-2.2) 1.5 (0.8-2.7)	1989 Corrao
Case-control 65 ♀	1980-1985 Italy Agricultural areas with high use of Atrazine/Simazine	Ovarian cancer Definite triazine exposure (all) Definite triazine exposure (occup) Possibly exposed to triazines Less than 10 yrs exposure 10 yrs or more exposure	RR (CI 90%) 2.7 (1.0-6.9) 3.1 (0.9-10.7) 1.8 (0.9-3.5) 1.4 (0.9-6-3.4) 2.0 (0.8-5.0)	1989 Donna
208 cases 401 controls	Northeast Italy	Non-Hodgkin's lymphoma Agricultural pesticides	OR No increased risk	1989 Franceschi
Mortality 2876 men and women	England/Wales Ethylene oxide exposed workers	Type of Cancer Leukemia Stomach cancer	Observed vs Expected 3 20.9 5 5.95	1989 Gardner
Case-control 69 Hodgkin 153 NHL 110 myeloma	1983-1988 Italy Occupational exposures	Agriculture/ food processing Multiple myeloma Non-Hodgkin lymphoma Hodgkin disease Herbicide exposure Multiple myeloma Non-Hodgkin lymphoma Hodgkin disease	RR 2.0 (1.1-3.5) 1.9 (1.2-3.0) 2.1 (1.0-3.8) 1-10 yrs >10 yrs 1.8 1.8 2.6 5.2 trend sig. 1.4 8.7 trend sig.	1989 LaVecchia
Case-control 452 males	1980-1984 New Zealand Farmers Agricultural workers	Brain cancer All farmers Livestock farmers Dairy Farmers Orchard/vineyard workers Other farm workers	OR 1.38 (1.08-1.77) 2.59 (1.41-4.75) 1.61 (0.82-3.17) 1.45 (0.46-4.58) 1.29 (0.57-2.91)	1989 Reif
Case-control 1,742 cases	1969-1980 Texas	Liver cancer Farm workers Farmers	OR 1.4 (0.8-2.2) 1.0 (0.8-1.2)	1989 Suarez

Mortality Case-control	1982-1983 Quebec 34 agricultural drainage basins (Pesticide exposure based on sales)	Lymphatic cancer Females - hi pesticide expos. Females - intermed pest. expos. Females 35-64 y hi pest. expos Females 34-64 y intermed. expos. Females age 35-64, ≥ 65, all ages Males age 34-64 Brain cancer Females age 35-64 Males age 1-14, 15-34 Leukemia Females age 35-64, ≥ 65, all ages Males age 1-14	RR 1.62 (1.16- 2.25) 1.63 (1.08-2.45) 3.15 (1.67-5.93) 3.73 (1.54-9.01) Significant assoc. Significant assoc. Significant assoc. Significant assoc. Significant assoc	1989 Godon
Cohort cancer mortality 20,245 (99% males) 558 cancers	1965-1982 Sweden Pesticide applicators ¹¹⁰	Type of Cancer Testicular cancer Nervous system tumors Hodgkin disease Endocrine gland tumors All malignancies Kidney Pancreas Lung Liver	SIR 1.55 (0.92-2.45) Inc risk Inc risk Inc risks 0.86 (0.79-0.93) 0.53 (0.32-0.84) 0.50 (0.26-0.87) 0.50 (0.35-0.68) 0.45 (0.18-0.93)	1989 Wiklund
Case-control (Ecological)	1975-1985 Fresno, California	DBCP contaminated well-water ¹¹¹ Stomach cancer (N=263) Leukemia (N=293)	OR No association ¹¹² No association ¹⁰⁶	1989 Wong
Case-control 133 cases 948 controls	1976-1982 Kansas Nonagricultural occupations	Soft-tissue sarcoma Chloramphenicol use Chewing tobacco or snuff Smokeless tobacco use Upper gastrointestinal tract Lung, pleura, and thorax Head, neck, and face region Cholesterol-lowering drug use Employment woodworking ¹¹³ 1 st ° relative history of cancer ¹¹⁴	OR 5.4 (1.2-23.9) 1.8 (1.1-2.9) 3.3 3.1 2.4 1.7 ns 1.7 (0.9-3.2) Increased risk.	1989 Zahm
Mortality and Case-control 1,495 white males	1970-1979 US. Agricultural extension agents	Type of Cancer Lymph. leuk., agent ≥15 y Myeloid leuk., agent ≥15 y Hodgkin disease Non-Hodgkin lymphoma Lymphatic/hematopoietic Brain Kidney Multiple myeloma Agent 15 yrs or more Leukemia all ¹¹⁵ Agent 15 yrs or more Prostate Colon	PMR 5.4 p=.025 4.02 p=.005 2.72 (1.17-6.3) 2.32 (1.72-2.97) 2.16 (1.67-2.77) 2.08 (1.18-3.65) 2.00 (1.2-3.3) 1.9 (1.3-2) 2.6 p = 0.15 1.8 (1.2-2.8) 1.9 (1.04-3) OR 2.9 1.50 (1.13-1.99) 1.46 (1.09-1.95)	1988 Alavanja

Mortality 111 white ♂	1945-1982 Michigan Dow chemical workers (2,4-D)	2,4-D plant All lymphopoietic Ill defined sites 15 yrs or more since entry Hodgkin disease Testicular cancer Leukemia Colon Rectum Lymphatic/hematopoietic Entire follow-up period Other, unspecified sites Lympho/reticulosarcoma ¹¹⁶	SMR 3.12 p = .05 3.88 p = .05 6.76 (0.09-37.64) 4.62 (0.06-25.69) 3.64 (0.41-13.15) 2.76 (0.74-7.08) 2.31 (0.03-12.48) 1.95 (0.39-5.70) 3.06 (1.01-7.29) 3.91 (0.44-14.11)	1988 Bond
Case-control 1,239 white ♂	1984-1986 Missouri Frmers/farmwrkrs	Prostate cancer Entire cohort Agriculture, crops	RR 1.4 (1.3-1.5) 1.4 (1.1-1.6)	1988 Brownson
Case-control 475 ♂	1984-1985 Missouri Farmers	All farmers Reticulosarcoma ¹¹⁰ Chronic myeloid leukemia Hodgkin Disease Non-Hodgkin lymphoma Farmers ≥ 65 Reticulosarcoma ¹¹⁰ Acute lymphocytic leukemia Hodgkin disease Non-Hodgkin lymphoma Lymphosarcoma	OR 1.99 (0.92-4.25) 1.53 (0.43-5.42) 1.30 (0.38-4.47) 1.11 (0.70-1.77) 2.78 (1.09-7.07) 2.84 (0.67-12.1) 1.92 (0.39-9.51) 1.41 (0.81-2.44) 1.18 (0.53-2.65)	1988 Brownson
125 cases ♂ 238 controls	1975-1984 Paris, France	Malignant glioma Exposure to wood preservatives	OR 1.6 p < 0.10	1988 Cordier
399 cases 399 controls	England	Multiple myeloma Agriculture/food processing	RR 1.8 p = 0.002	1988 Cuzick
Case-control 61 deaths	1958-1983 Ohio Hancock County	Non-Hodgkin lymphoma All farmers Farmers died 1958-73 Farmers died 1960-79	OR 1.6 (0.8-3.4) 2.1 (0.9-4.8) 2.0 (0.8-4.6)	1988 Dubrow
Case-control 71 ♂ 40 ♀	1964-1984 Sweden Farmers	Chronic lymph. leukemia DDT exposure Farmers	RR 6.1 (1.9-19.0) 1.8 (1.0-3.1)	1988 Flodin
733 males 672 females	Shanghai, China 10 urban districts	Lung cancer ¹¹⁷ Agricultural employment Farmers	OR 1.6 (1.0-2.6) 1.6 (1.0-2.5)	1988 Levin
Mortality 1,082 white males (16,124)	1967-1976 U.S. Pesticide applicators (exterminators)	Type of Cancer Lung Skin Bladder All cancers	SMR 1.35 sig 1.26 ns 1.23 ns 1.11 ns	1988 MacMahon

Case-control 165 males 165 male sibs	1979-1983 Canada Saskatchewan Farmers	Lung can. (farmers compared to sibs) Greater exposure to chemicals Greater exposure to herbicides Greater exposure to grains Greater exposure to diesel fuel	Significance p = .005 p = .05 p = .015 p = .005	1988 McDuffie
Cancer Incidence 808 males (3,067)	1961-1979 Sweden Farmers	Multiple myeloma Farm workers Farm and animal workers Farmers/foresters Gardeners	SIR 1.4 p <.01 1.3 p <.01 1.2 p <.01 1.1 ns	1988 McLaughlin
392 Cases	1970-1984 Denmark	Sinonasal cancer Farming occupation, women	SPIR 7.35	1988 Olsen
Mortality	Hungary High pesticide use village	Stomach Cancer Men compared to low use area Men, compared to entire country	RR 1.65 (0.96-2.83) 3.20 (1.91-5.36)	1988 Paldy
Case-control 501 cases ♂ whites, blacks	1968-1970, 1975- 1977, 1980-1982 North Carolina	Non-Hodgkin lymphoma Farming Agricultural occupation High pesticide use counties	OR No association No association No increased risk	1988 Schumacher
Mortality 214 (611)	1940-1982 Michigan Dow arsenic workers	Type of Cancer All cancers Respiratory system Lymphatic/hematopoietic	SMR 138 (106-176) 225 (156-312) 148 (40-379)	1988 Sobel
Cancer mortality, Case- control 155 cases 465 controls	1950-1971 1968-1980 Washington State orchardists	Respiratory cancer Orchardists Other farmers Respiratory cancer Orchardists - lead arsenate use Orchardists - DDT use Orchardists smokers v nonsmokers	PMR 133 81 OR No association No association 4.6	1988 1983 Wiklund
Mortality (20,245)	1971-1984 Sweden	Soft tissue sarcoma ¹¹⁸ Pesticide applicators ¹¹⁹	RR 0.9 (0.4-1.9)	1988 Wiklund
Cancer mort. 1657 persons	1965-1976 Sweden	Licensed for seed disinfection ¹²⁰ Nervous system tumors	SIR 0.80	1988 Wiklund
Cohort cancer mortality 254,417 males 1450 cases	1961-1979 Sweden Farmers	Respiratory cancer All sites combined Nasal/sinuses squamous cell 1961 to 1966 1974 to 1979	RR 0.38 (0.36-0.40) 0.42 (0.20-0.80) 2.06 (1.22-3.50)	1988 Wiklund
Cohort Incidence	1965-1982 Sweden Agricultural pesticide applicators	Type of Cancer Testicular cancer All cancer, born 1935 or later Liver cancer Pancreatic cancer Lung cancer Kidney cancer	SIR 1.55 (0.92-2.45) 1.07 (0.82-1.37) 0.45 (0.18-0.93) 0.50 (0.26-0.87) 0.50 (0.35-0.68) 0.53 (0.32-0.84)	1988 Wiklund

Case-control 254 ♂	1976-1982 Kansas Farmers	Soft-tissue sarcoma Mix/apply insecticides No protective equipment Insecticide. use on animals Took some precautions Insecticide use on crops Year first use 1945 Year first use 1946-1955 Year first use 1956-1965 Year first use 1966 ¹²¹ (Test for trend)	OR 1.9 (1.1-3.3) 1.7 (1.0-2.9) 1.6 (0.9-2.5) 1.2 (0.4-3.1) 0.8 (0.4-1.6) 1.8 (1.0-3.4) 1.5 (0.7-3.4) 0.7 (0.2-2.4) 0.9 (0.2-3.3) χ^2 2.25, p=.012	1988 Zahm
Case-control 2,649 white ♂	1961-1979 Sweden Grain millers	Type of Cancer Liver Multiple myeloma Non-Hodgkin lymphoma	SIR 2.38 (1.14-4.38) 1.39 (0.56-2.87) 1.37 (0.71-1.52)	1987 Alavanja
Mortality 403 white ♂ (1,114)	1968-1983 U.S. Grain millers	Type of Cancer Other lymphoma Lymphatic/hematopoietic Pancreas Lymphosarcoma	PMR PCMR 2.72 sig 2.49 sig 2.02 2.18 sig 1.91 sig 1.71 ns 2.16 ns 1.91 ns	1987 Alavanja
Case-control 60 ♂ 26 ♀	Alabama, Duke Miami, Harvard Penn. Farmers laborers	Liver ¹²² Ever expos. pesticides Ever livestock farming Farmer	RR 2.4 (0.9-6.5) 1.5 (0.4-5.6) 1.4 (0.7-2.9)	1987 Austin H
Mortality Men & women	1972-1981 England/Wales	Soft tissue sarcoma Farm and forestry workers	SMR No increase	1987 Kilpatrick
Mortality	Philippines 1961-1984	Leukemia Rural rice growing areas - men	1961-71 vs 1972-84 SMR 4.8	1987 Loevisohn
617 Cases and controls	1979 New Zealand	Prostate Cancer Farming and farm management.	OR Slight increase	1987 Pearce
202 Cases 338 Controls	1977-1981 New Zealand	Non-Hodgkin Lymphoma Orchard workers Phenoxy herbicide exposure Chlorophenol exposure Exposure to farm animals	OR (90% CI) 3.7 (1.1-12.1) 1.0 (0.7-1.5) 1.4 (0.8-2.3) No association	1987 Pearce
Mortality 35,972 white males	1968-1976 Wisconsin Farmers	Type of Cancer Eye Hodgkin disease Stomach Lymphosarcoma Other lymph. (% mult. myeloma) Lymphopoietic Prostate Pancreas Leukemia Brain Bone Kidney Testicular	PMR PCMR 3.75 sig 3.43 sig 1.55 sig 1.26 ns 1.24 sig 1.13 sig 1.25 sig 1.10 ns 1.23 sig 1.10 ns 1.23 sig 1.10 sig 1.22 sig 1.41 sig 1.20 sig 1.09 ns 1.10 sig .98 sig 1.10 ns 1.05 ns 1.06 ns 1.03 ns	1987 Saftlas

Mortality 18,811 males	1973-1979 New York State Farm Bureau members	Brain cancer Age 40--49 Age 70+ Age 50-59 Entire cohort Prostate cancer Age 60-69 Entire cohort Leukemia Age 60-69 Entire cohort	SMR 2.86 ns 1.77 ns 1.11 ns 1.03 ns 1.11 ns 0.92 ns 1.27 ns 0.90 ns	1987 Stark
Prevalence study 228 males	Taiwan Workers in 28 Paraquat plants	Pre-malignant skin lesions Hyperpigmented macules All workers Bipyridine centrifugation Hyperkeratosis. All workers Bipyridine crystallization	Prevalence 30% 80% 7.5% 67%	1987 Wang
Mortality 32 cases (20,245)	Sweden Pesticide applicators	Type of Cancer Hodgkin disease ¹²³ Non-Hodgkin lymphoma ¹²⁴	RR 1.20 (0.60-2.16) 1.01 (0.63-1.54)	1987 Wiklund
Case-control 704 males	1981-1984 Washington Farmer/forestry	Non-Hodgkin lymphoma: Forest herbicide applicators ≥15 yrs phenoxy herbicide use Farmers - entire cohort DDT occupational exposure Chlordane exposure Lead arsenate exposure	OR 4.80 (1.2-19.4) 1.71 (1.04-2.8) 1.33 (1.03-1.7) 1.82 (1.04-3.2) 1.61 ns 1.60 ns	1987 Woods
Cancer incidence 190 cases and 369 controls	US Chemical workers	Bladder cancer Ever work chemical industry Ever work organic chems - men Work organic chems. ≥20 years Agricultural chemicals - men Pesticides subdivision - men	OR 1.0 (0.8-1.2) 1.3 (0.8-2.1) 2.4 trend sig. 3.3 2.3 (0.6- 8.2)	1987 Zahm
78 Cases 197 clinical 92 pop. controls	1980 - 1981 Sweden Living near a farm	Brain cancer (astrocytoma) Herbicide/insecticide exposure ¹²⁵ Herbicide/insecticide exposure ¹²⁶	OR 2.4 (0.9-6.5) 1.3 (0.5-3.5)	1986 Ahlbom

Mortality 297	1947-1975 England Manufacture/spray MCPA, other pesticides ¹²⁷	Type of cancer Nasal Non-melanoma skin Digestive system Non-bladder genitourinary Testicular cancer Leukemia Thyroid Multiple myeloma Small intestine Prostate Brain Gallbladder Lung All cancer Soft-tissue sarcoma	SMR 4.93 (1.02-14.40) 3.06 (0.63-8.95) 2.73 (0.33-9.85) 2.27 (0.61-2.66) 2.23 (0.61-5.72) 1.77 (0.97-2.97) 1.70 (0.04-9.49) 1.62 (0.53-3.78) 1.59 (0.04-8.84) 1.32 (0.78-2.08) 1.24 (.062-2.22) 1.19 (0.14-1.32) 1.15 (0.95-1.38) 1.07 (0.96-1.20) 1.04 (0.03-5.81)	1986 Coggon
Case-control 442 white ♂	1976-1982 Kansas Farmers	Non-Hodgkin lymphoma Mix and apply herbicides Herb. exposure >20 days/yr Herbicide use Soft-tissue sarcoma Hodgkin disease	OR 8.0 (2.3-27.9) 6.0 (1.9-19.5) 1.6 (0.9-2.6) No associations No associations	1986 Hoar
Mortality 57 males	1944-65 Finland Wood workers ¹²⁸	Respiratory cancer Exposure to pesticides	SMR Increased p <.05	1986 Kauppinen
Case-control 2,434	1971-1980 England/Wales Farmers/managers farm workers	Testicular cancer Farmers/farm managers Entire cohort Farm workers	OR 1.85 (1.10-3.11) 1.42 (0.94-2.14) 0.9 (0.25-3.23)	1986 McDowall
Case-control 698	1977-1981 4 U.S. States ¹²⁹	Multiple myeloma Pesticide exposed farmers	RR 2.6 (1.5-4.6)	1986 Morris
Case-control 249	1975-1984 Australia	Multiple myeloma Farmers	OR 1.44 (0.81-2.55)	1986 Nandakumar
Case-control 83 males	1977-1981 New Zealand	Non-Hodgkin lymphoma Farmers	OR 1.4 ns	1986 Pearce
546 Cases ♂ 4 controls each	1979-1983 New Zealand	All Leukemias Agriculture/forestry occupation Livestock farmers Livestock farmers 65 yrs or older All leukemias Acute myeloid leukemia Acute monocytic leuk. (5 cases)	OR 1.24 (0.95-1.61) 3.00 (1.23-7.32) 1.29 (0.94-1.78) 1.55 (0.90-2.67) 10.38 (1.99-54.29)	1986 Pearce
Case-control 81 deaths	1966-1984 New Mexico Farm/ranch	Testicular cancer Farming/ranching 24-65 yrs Ranching only Farming only	OR 1.37 (0.002-5.8) 1.23 (0.28-5.37) 0.56 (0.21-1.47)	1986 Sewell
Mortality 181 deaths	1946-1985 Illinois	Velsicol pesticide plant workers ¹³⁰ Lung cancer	SMR 86 sig.	1986 Shindell

Case-control 37 males 31 female 158 controls	1981-1983 Northern Italy Rice weeders	Soft-tissue sarcoma Agricultural work, men Agricultural work, women Women exposed phenoxy herbicides Men exposed phenoxy herbicides	OR 1.33 1.58 2.71 (0.51-14.17) 0.91	1986 Vineis
Cancer Incidence ♂ 20-69 yrs (254,417)	1961-1979 Sweden Agricultural employees	Type of Cancer Malignant melanoma Multiple myeloma Stomach	SMR 1.39 (1.11-1.75) 1.20 (1.09-1.33) 1.07 (1.02-1.11)	1986 Wiklund
Cancer mortal. All agriculture (254,417) Applicators (20,245)	Sweden 1961-79 Agric./forestry 1965-1982 Pesticide applicators	Testicular cancer Agric. employee 1961-66 (37 cases) Agric. employee 1967-73 (42 cases) Agric. employee 1974-79 (38 cases) Pesticide applicators (18 cases)	SMR 0.83 (0.59-1.18) 0.94 (0.67-1.32) 1.35 (0.94-1.9) trend ns 1.55 (0.92-2.45)	1986 Wiklund
Case-control 331 Cases	1961-79 Sweden Agric./forestry	Soft tissue sarcoma Phenoxy herbicide exposure	OR 0.9 (0.8-1.0)	1986 Wiklund
Mortality 1,214 ♂	1945-1980 East Germany Pest control workers	Type of cancer All malignant tumors Melanoma (skin) Esophagus Stomach ¹³¹	SMR 1.33 sig 5.88 ns 4.30 ns 1.80 ns	1985 Barthel
Case-control 578 white ♂	1980-1983 Iowa Minn. Farmer/pest.	Leukemia ¹³² DDVP use on animals Corn production (CLL)	OR 1.8 (1.1-3.0) 1.4 (1.0-1.8)	1985 Blair
Case-control 1,084 white ♂	1957-1974 Nebraska Farmers	High vs low pest./fertil. use counties Acute lymphatic leukemia Acute myeloid leukemia Chronic myeloid leukemia Acute unspecified leukemia.	Increased risk Increased risk Increased risk Increased risk	1985 Blair
Case-control 622 cases 1,245 controls	1980-1983 Iowa and Minnesota farmers	Non-Hodgkin lymphoma - small cell High pestic. use ≥ 20 yrs prior Nicotine use Lindane use 2,4,5-T use Glyphosate (Roundup) use Atrazine use Cyanazine use Non-Hodgkin lymphoma - all types DDT use Chloramben use Carbofuran use	OR 1.25 2.0 ns 1.9 ns 1.9 ns 1.9 ns 1.6 ns 1.6 ns 1.5 p < .05 2.2, p < .05 1.6 ns	1985 Cantor

Mortality 9,245 whites 3,508 nonwh. (94% black)	1976-1978 North Carolina Farmers	Whites Non-melanoma skin Melanoma (skin) Prostate Nonwhites Melanoma (skin) Leukemia Brain Other lymphoma	PMR 1.80 sig 1.20 ns 1.10 ns 6.30 sig 1.90 sig 2.30 ns 1.20 ns	1985 Delzell
Case-control 1,200	1980-1983 Iowa, Minnesota Pesticide exposed workers	Leukemia Exposure to herbicides Exposure to insecticides Non-Hodgkin lymphoma Exposure to methyl bromide Exposure to herbicides Exposure to insecticides Exp. to pentachlorophenol	OR 1.86 p <.05 1.50 p <.05 2.82 p <.01 2.06 p <.01 1.90 p <.01 1.86 p <.05	1985 Everett
Mortality 4,066 males	1950-1978 British Columbia Farmers	Type of cancer Liver Stomach Leukemia Pancreas	PCMR 1.73 (1.08-2.62) 1.36 (1.14-1.63) 1.31 (0.97-1.77) 1.21 (0.95-1.04)	1985 Gallagher
36 Cases 74 controls	1975-1980 Georgia	Malignant melanoma - whites Non-occup. pesticide expos.	OR 3.56 (0.87-14) p = .059	1985 Hicks
Case-control 734 white males	1977-1981 New Zealand Agricultural occupation	Non-Hodgkin lymphoma Farmers diag. prior age 65 Multiple myeloma Farmers diag. prior age 65 Non-Hodgkin lymph./mult. myeloma Orchard farming Farmers -entire cohort	OR 1.76 (1.03-3.02) 2.22 (1.31-3.75) 5.51 (1.45-20.9) 1.25 (1.00-1.56)	1985 Pearce
Case-control 228 white males	1967-1982 Utah Farmers	Non-Hodgkin lymphoma Diagnosed 1952-65 Diagnosed 1966-71 Age at diagnosis 45-54 Age at diagnosis 55-64 Age at diagnosis 35-44 Rural vs. urban residence 1952 to 1966 1966 to 1971 1972 to 1977	OR 6.6 (1.2-35.7) 3.1 (1.2-8.1) 4.0 (1.1-14.7) 2.3 (0.8-6.4) 1.4 (0.1-15.0) 3.3 (0.3-36.7) 3.4 (0.9-1.3) 2.4 (0.6-9.1)	1985 Schumacher
Case-control	The National Cancer Register farmers, agricultural .and forestry workers	Soft tissue sarcoma Entire group Farmers/market gardeners Agricultural workers Gardeners and groundsmen Foresters and woodmen	RR 1.15 (0.83-1.59) 1.7 (1.00-2.88) 1.0 0.7 1.0	1984 Balarajan

Case-control 271	1976-1981 US Farmers	Testicular cancer Farmers who grew up in the South Never employed farming/agric Ever employed farming/agric Current employment farming/agric	OR 1.4 ¹³³ ns 1.0 0.9 0.6	1984 Brown L
71 white males 1,733 controls	8 year period Winnebago County Illinois farmers	Type of Cancer Non-Hodgkin lymphoma Prostate cancer Leukemia Lung cancer	SMR 2.65 sig 1.95 sig 2.0 sig 0.82	1984 Buesching
Case-control 411 white ♂	1968-1976 Wisconsin Farmers	Multiple myeloma If ≥65 years old If died between 1968-70 High insecticide use county Hi insecticide county/born >1905	OR 1.5 (1.1-2.0) 1.9 (1.1-3.3) 1.9 (1.1-3.5) 2.8 (1.1-7.3)	1984 Cantor
Case-control	Italy	Ovarian Cancer Herbicide exposure	RR 4.28	1984 Donna
Mortality 28,032 ♂	1950-1978 British Columbia Farmers	Type of cancer Leukemia Stomach Prostate Nasal Aplastic anemia Pancreas Multiple myeloma Nasal Aplastic anemia Pancreas	PCMR 1.22 sig 1.19 sig 1.13 sig 1.78 ns 1.78 ns 1.05 ns 1.03 ns PMR 1.86 sig 1.86 sig 1.12 sig	1984 Gallagher
Mortality 2,328 ♂	1950-1978 British Columbia Farm workers	Type of cancer Stomach Pancreas Prostate	PCMR 1.26 (0.94-1.68) 1.24 (0.81-1.83) 1.09 (0.80-1.49)	1984 Gallagher
Case report 2 fireman	California Tank-truck spill	Malignant lymphoma 1,3-Dichloropropene cleanup	Diagnosed 6 years later a few months apart	1984 Markovitz
Mortality	1968-1981 Australia Sugar cane areas	Leukemias and lymphomas Women Men 60 yrs or	SMR 1.54 p< .001 0.49 p< .001	1984 McCabe
Case-control 1,384 deaths	1973-75 1975-80 England & Wales	Testicular cancer Farming as last occupation Farmer owner/manager	OR 1.57 (0.94-2.64) 1.89 (0.99-13.60)	1984 McDowall
Case-control 347 ¹³⁴	1977-1980 Texas Agricultural work	Testicular cancer Total farming Farm workers-except horticulture Total agriculture	OR 6.27 (1.83-21.49) 5.1 (1.11-23.5) 4.18 (1.55-11.3)	1984 Mills

82 cases 92 controls	New Zealand Phenoxy / chloro- phenol workers	Soft Tissue Sarcoma Phenoxy herbicide exposure ¹³⁵ Chlorophenol exposure	RR 1.3 (0.6-2.5) 1.5 (0.5-4.5)	1984 Smith A
Mortality 14,908	1978-1979 California Farm workers	Farm workers ¹³⁶ Stomach Brain Bone Liver and gallbladder Lung Other lymphoma Prostate Rectum	PCMR White Nonwhite 1.34 sig 1.01 ns - 1.55 sig 1.59 ns - 1.45 ns 1.51 ns 1.08 ns - 1.07 ns 1.14 ns 1.01 ns - - 1.90 ns	1984 Stubbs
Mortality 14,908	1978-1979 California Farm owners/ managers	Farm owners/managers Other lymphoma Prostate Liver Stomach Rectum Lymphopoietic Kidney Esophagus Colon	PCMR White Nonwhite 15.0 sig 1.27 ns 1.22 sig - 1.37 ns 1.50 ns 1.09 ns 2.02 sig 1.09 ns 2.24 sig 1.05 ns 1.08 ns 1.02 ns - - 1.27 ns - 1.07 ns	1984 Stubbs
32 cases ¹³⁷ 56 controls ¹³⁷	Denmark	Breast Cancer DDT - breast fat	OR No significant differences	1984 Unger
Mortality 541 (3,579)	1935-1976 Michigan Arkansas Dow chemical workers ¹³⁸	Entire Cohort Testicular cancer Testicular ¹³⁹ Bladder Leukemia Prostate Kidney Brain Lung Liver Lymphatic All cancers DBCP Exposed All cancers Testis Rectum Bladder Lung Prostate Stomach Pancreas	SMR 1.93 (.22-6.97) 17.99 p<.05 1.88 (.19-2.70) 1.87 (.85-3.54) 1.64 (.82-2.93) 1.45 (.39-3.70) 1.32 (.43-3.09) 1.31 (.95-1.78) 1.24 (.25-3.63) 1.11 (.59-1.90) 1.02 (.84-1.22) SMR 1.25 (.75-1.95) 5.91 (.8-32.90) 4.19 (.47-15.13) 2.60 (.3-14.45) 1.47 (.59-3.02) 1.42 (.2-7.88) 1.27 (.2-7.06) 1.22 (.2-6.80)	1984 Wong

Case-control 265	1975-1979 New Jersey Farmers agricultural workers	Liver cancer Agricultural production Farm laborer Horticulture Farm owner/manager	RR 2.08 (1.33-3.23) 1.89 (1.19-3.00) 1.83 (0.57-5.87) 1.23 (0.51-2.96)	1983 Stemhagen
Case-control 8,290 cases ¹⁴⁰ white ♂	1964-1978 Iowa Farmers	Type of Cancer Multiple myeloma Non-Hodgkin lymphoma Stomach Prostate	OR 1.5 sig 1.3 sig 1.3 sig 1.2 sig	1982 Burmeister
Case-control 1,675 white ♂	1964-1968 Iowa Farmers	All leukemias Farmers (entire cohort) Farmer born 1890-1900 Farmer born 1901-1947 Chronic lymphatic leukemia Farmers (entire cohort) High soybean acreage High herbicides counties Farmer born 1890-1900 Farmer born after 1900	OR 1.24 (1.09-1.42) 1.36 (1.10-1.68) 1.39 (1.11-1.73) 1.70 (1.22-2.38) 2.21 (1.33-3.66) 1.89 (1.16-3.08) 2.03 (1.24-3.10) 1.80 (1.09-2.97)	1982 Burmeister
Case-control 774 deaths	1968-1976 Wisconsin Farmers	Non-Hodgkin lymphoma Farmers Farmers < 65 Reticulum cell sarcoma < 65 General agriculture Insecticides/small grains Wheat	OR 1.22 (0.98-5.51) 1.67 (1.14-2.5) 3.2 (1.17-8.5) 6.6 (2.8-15.6) 4.4 (1.83-10.6)	1982 Cantor
Case-control 24 ♂, 18 ♀	1979-1980 Milan, Italy	Brain (glioma) Agricultural work after 1960	OR 5.0 (p=.043)	1982 Musicco
Mortality 144 (1,926)	1955-1971 Finland Pesticide sprayers 2,4-D / 2.4.5-T	Type of Cancer Multiple myeloma Prostate Esophagus/stomach Lung	SMR 5.00 ns 1.82 ns 1.08 ns 1.08 ns	1982 Riihimaki
Mortality 169 (1,658)	1948-1978 East Germany Agricultural pesticide sprayers ¹⁴¹	Type of Cancer Lung Other genitourinary Pancreas Bladder	PCMR 1.80 sig 1.86 ns 1.46 ns 1.18 ns	1981 Barthel

Mortality 6,402	1971-1978 Iowa Farmers	Type of cancer Lip Multiple myeloma Prostate Hodgkin disease Leukemia Stomach Skin Other lymphoma Pancreas Colon Kidney Bladder Bone Brain	SMR 2.06 sig 1.47 sig 1.41 sig 1.37 sig 1.36 sig 1.35 sig 1.31 sig 1.29 sig 1.23 sig 1.22 sig 1.22 sig 1.14 sig 1.26 ns 1.11 ns	1981 Burmeister
Case-control 110- 38 deaths	1974-1978 Sweden	Soft tissue sarcoma Phenoxy herbicide expos. wrkrs	RR 6.8 (2.6-17.3)	1981 Eriksson
Mortality 197 ♂ 43 ♀ Cohort of 1050 ♂ 343 ♀	1946-1977 Baltimore Maryland Pesticide manufacturing workers ¹⁴²	Males Lung Lung predom. arsenical All cancers Esophagus Esophagus employed ≥ 25 yrs Lymphopietic Lymphatic employed 5-24 yrs Stomach Skin Females Colorectal Lung	SMR 2.65 p<.05 3.36 p<.05 1.68 p<.05 4.51 ns 14.9 p <.05 2.09 ns 8.53 p <.05 1.72 ns 1.62 ns 6.67 ns 1.51 ns	1980 Mabuchi
Case report	1980 Kobe, Japan	Multiple myeloma Husband and wife agric. wrkrs	30 years exposure BHC (lindane)	1980 Nakaama
Cohort Mortality	U.S. Ethylene dibromide factory	Malignant neoplasms Unit 1 - 1942 to 1969 deaths Unit 2 - 1920s - 1976 deaths	Observed Expected 2 3.6 5 2.2	1980 Ott
Case-control 1,084 white ♂	1957-1974 Nebraska Farmers	Leukemia Entire cohort Born after 1900 High insecticide use county	OR 1.25 sig 1.64 sig 1.95 sig	1979 Blair

Case-control 110 cases 219 controls	Sweden Phenoxy herbicide / chlorophenol, other pesticide workers	Soft Tissue Sarcoma Herbicide/chlorophenol exposure Frequencies of exposure Pesticides in general Amitrole Bromophos DDT Dinoseb Fenitrothion Organomercurial seed-dressing Lindane Sodium chlorate Other pesticides	5.1 2.0 1.8 2.0 1.3 3.0 1.8 1.8 1.0 2.0	RR OR	1979 Eriksson
Mortality 47 cancer deaths (16,126)	1967-1976 40 U.S. States Pesticide applicators ¹⁴³	Type of Cancer Bladder Skin Lung	2.77 (1.01-7.61) 1.73 (.63-4.73) 1.15 (.77-1.70)	SMR	1979 Wang
Mortality 3,844 ¹⁴⁴	1959-1961 Calif.- Agriculture	Type of Cancer All sites combined	1.13 ns	RR	1978 Carlson
Mortality	Washington State	Mortality from all causes Orchard workers exp. lead arsenate Infrequently exposed persons General population	0.65 0.78 0.74	SMR	1973 Finklea
Case-control 4,444	1968 Ore/Wash Farmers	Multiple myeloma Leukemia	Increased risk sig Increased risk sig		1971 Milham
Mortality 8,118 males 4,070 females	1959-1961 California farm residents	Type of cancer Leukemia (males and females) Hodgkin disease (males) Multiple myeloma (females)	1.14 ns 1.08 ns 1.02 ns	SMR	1968 Fasal

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Footnotes

1. Increase in risk as a function of exposure duration was not found.
2. A rare subtype of non-Hodgkin lymphoma.
3. Univariate analysis. In multivariate analyses significantl increased risk found only for category of 'other herbicides'.
4. Based on public water measurements, acres of corn planted, and pounds of atrazine sold.
5. 195 adenocarcinomas (169 ♂, 26 ♀), 432 squamous cell carcinomas (330 ♂, 102 ♀), 3136 controls (2349 ♂, 787 ♀).
6. Most freq. male cancers: lung, lymphoma, leukemia, bladder, prostate, brain, colon, stomach, liver. No female correlations.
7. 8-hydroxy-2'-deoxyguanosine (8-OHdG), a biomarker of oxidative DNA damage.
8. 26,148 subjects :14,631 white men, 7,299 non-white men, 1,081 white women, 3,137 non-white women identified on death certificates as farmworkers.
9. All of whom worked for at least 10 years in greenhouses for more than 4 hours daily.
10. Fibroadenoma, ductal hyperplasia, sclerotic adenosis, fibrohyperplastic disease, cystic disease, inflammatory m astitis
11. Diagnosed within 26 months of each other., father age 71, son 39. Metaphase cells from peripheral blood leukocytes bore specific marker chromosomes (father, 44XY,-14,-17,-18,-22,+2mar; son, 46XY,-17,+1mar).
12. Calculations used California Hispanics for comparisons. Evaluated time since first joined union, subtypes/stage at diagnosis.
13. Sites: lip, oral/pharynx, esophagus, stomach, colorectal, lung, melanoma, skin, prostate, bladder, kidney, non-Hodgkin lymphoma.
14. Blood levels of pesticides did not show significant differences in either carcinoma or cholelithiasis.
15. After adjustment for other pesticide exposures.
16. In the combined group of pre- and post-menopausal women.
17. For multiple myeloma, non-Hodgkin lymphoma, cancer of the breast, corpus uteri, liver, and pancreas.
18. 43 nasal carcinoma, 92 nasopharyngeal carcinoma.
19. Number of days of exposure to phenoxy herbicides determined from pay slips.
20. Limited to women whose blood was collected close to the time of diagnosis.
21. The risk was highest with first exposure 10 to 20 years prior to diagnosis.
22. 251 living sarcoma cases (48 dermatofibrosarcoma protuberans, 32 malignant fibrohistiocytic sarcoma, 67 leiomyosarcoma, 53 liposarcoma, and 51 skeletal sarcoma).
23. 295 males 32 to 60 with soft tissue sarcoma from 8 cancer registries (Connecticut, Kansas, Iowa, Florida (Miami), Michigan (Detroit), California (San Francisco), Washington (Seattle), Georgia (Atlanta), and 1,908 male controls.
24. Trend significant $p < 0.001$.
25. Associated with malignant fibrohistiocytic sarcoma type.
26. Region 1 - South-central (corn, soybeans).
27. Region 2 - West-central (wheat, corn, soybeans).
28. Region 3 - Northwest (wheat, sugar beets, potatoes).
29. Mean duration of exposure more than 5 years; mean follow up 27 years; all subjects 10 years or more since first exposure.
30. Additional adjustment for other pesticide use reduced the risk:: atrazine OR=1.9, malathion OR= 1.6, lindane OR=1.1, organophosphates OR=1.0, phenoxyacetic acids OR=0.9.
31. Adjustment for use of 2,4-D reduced risk to OR=1.2; for use of diazinon to OR=1.3.
32. Comparisons and analysis using fat DDE levels and DDT levels in tree bark.
33. With dose response.
34. Exposed vs nonexposed. In general, RRs highest for highest exposures, i.e. increase risk with increased TCDD level.
35. Hexachlorobenzene.
36. 101 were patients with other cancer, and 109 patients with a different neurologic disease.
37. Independent variables: age, sex, information directly from the subject or relatives and smoking habit.
38. Estimated DDT exposure 170-600 mg/m³ for indoor operations, 24-86 mg/m³ for outdoor operations.
39. Liver /biliary cancer PMRs elevated in workers without direct occupational contact with DDT; nor was there any increase in either PMR by number of days in exposed jobs.
40. Organochlorine insecticides (includes DDT, aldrin, dieldrin, chlordane, lindane, heptachlor, toxaphene, etc.).
41. Australia, Austria, Canada, Denmark, Finland, Germany, Italy, Netherlands, New Zealand, Sweden, UK, US.
42. Three were male lawn applicators (SMR 1.63 (0.3- 4.8)), 2 of whom employed 3 years or more.
43. 75% of the cohort less than 40 years old.
44. Incident cancers of: lung (n = 252), breast (n = 265), colon-rectum (n = 326), bladder (n = 63), kidney (n = 35), pancreas (n = 37), brain (n = 37), leukemia (n = 35).
45. Randomly selected telephone subscribers (n = 184), Medicare beneficiaries (n = 464), deceased individuals (n = 723).
46. All neoplasms increased with latency and were highest in the largest plant where highest TCDD blood levels found.
47. Translocations linking 14q32 and 18q21 are the most common rearrangements in non-Hodgkin lymphoma patients.
48. Washington, Oregon, California, Idaho, Nevada, Utah, Arizona, Montana, Wyoming, Colorado, New Mexico.
49. Increased eye melanoma found in embalmers exposed to formaldehyde. Cluster of eye melanoma at a DuPont plant in West Virginia .thought to be chemical related (*Am J Ophth* 89:323, 1980).
50. Smoking related disease accounted for 52% of total deaths. Significant excess mortality observed for: arteriosclerotic heart disease PMR 140 (127-155); all respiratory disease PMR 176 (135-230), emphysema PMR 186 (101-342), esophageal cancer PMR 139 (58,330), and disease of the nervous system, PMR 202 (123- 333).
51. Levels of 2,3,7,8-TCDD in blood lipids estimated for 135 men ≥ 0.1 mcg/kg bwt; for 69 men ≥ 1 mcg/kg bwt .
52. Of the three observed cases of NHL (vs 0.78 expected), two had worked less than 2 years in triazine-related jobs.
53. Tecumseh Community Health Study: a prospective study set up in 1959 by the University of Michigan School of Public Health.
54. Tecumseh in rural Lenawee County (40% acres treated). Compared to urban Wayne-Oakland- Macomb (8% treated).
55. Plant produced aldrin, azodrin, vapona (dichlorvos), and other pesticides.
56. Limited to white men in hourly jobs but no particular production unit; increases did not show duration-response trends.

57. Northeast: Maine, New Hampshire, New Jersey, Rhode Island, Vermont. South: Georgia, Kentucky, North Carolina, South Carolina, Tennessee, West Virginia. Central: Indiana, Kansas, Missouri, Nebraska, Ohio, Oklahoma, Wisconsin. West: Colorado, Idaho, Nevada, New Mexico, Utah, Washington.
58. With the exclusion of those with cumulative exposures to ETO below the median value (0.13 ppm-years).
59. 11 cases of soft tissue sarcoma: Australia (1), Denmark (5), New Zealand (2), United Kingdom (3).
60. 32 cases non-Hodgkin lymphoma: Australia (2), Denmark (11), New Zealand (1), United Kingdom (9), Finland (1), Germany (5), Netherlands (2), Sweden (1).
61. Of 28 cancer deaths, 12 were female breast cancer. No deaths from leukemia, or cancer of the pancreas, brain, or stomach.
62. From 1890 to 1940 lead arsenate was the major pesticide used in apple orchards. The Wenatchee area of Washington State used it for longer periods and in larger quantities than any other area in the U.S.
63. Univariate analysis with variable Pesticide Exposure Index.
64. Multivariate analysis with variable Pesticide Exposure Index.
65. Multiple myeloma SIR significantly increased in parts of Sweden where pesticide use less frequent and in lower amounts.
66. For malignant lymphomas the SIR increased over time, though not significantly, and was highest among younger farmers.
67. Non-Hodgkin lymphoma SIR lowest in the north, supports association with pesticides/agricultural chemical exposure.
68. Farmers at risk, but comparisons based on socio-economic groups, assuming lower SEGs comprised farmers. Brain cancer doubled 1978-87 compared to 1968-72. 1972, but rates not reported.
69. From 24 states in National Occupational Mortality Surveillance (NOMS) – a death certificate based surveillance system with industry and occupation of the decedents in the database.
70. Village atmospheric mean 35 $\mu\text{g}/\text{m}^3$ compared to 0.3 $\mu\text{g}/\text{m}^3$ in control community. Village mean serum HCB 26 $\mu\text{g}/\text{l}$ (7.5-69), compared to 0.3 $\mu\text{g}/\text{l}$ (0.25-0.4) in reference community.
71. Wheat and soybean production were found to be positively associated with leukemia.
72. Hay and beef production were found to be positively associated with prostate cancer.
73. But no increase in breast cancer with increasing levels (quartiles) of DDE.
74. Non-white men at decreased risk (not sig.) for non-Hodgkin lymphoma (0.71), multiple myeloma (0.92), and leukemia (0.90).
75. 294 of cases were lifetime nonsmokers and 135 were exsmokers for 15 years or more or had smoked less than one pack /year.
76. Exposure during a 1963 2,4,5-trichlorophenol production accident or the subsequent clean-up operations.
77. 50 acute myeloid leukemias, 17 chronic myeloid leukemias, 19 myelodysplastic syndrome.
78. Washington, Utah, and selected areas of metropolitan Detroit, Michigan, and Atlanta, Georgia (SEER area).
79. Nine workers, risk highest the first 10 years after exposure.
80. Using Poisson regression, leukemia mortality significantly linked to the pesticide exposure index, $p=0.04$.
81. 4.4 fold excess risk dust/exhaust exposure ≥ 35 years, and 3.5 fold excess if first exposed $<$ age 20. Ever users of herbal medicine had a 2.5 fold excess risk of disease.
82. Potentially exposed to ethylene oxide (ETO) for at least 90 days.
83. Herbicide 2,4-D, and organophosphate insecticides. Concludes little evidence atrazine related to non-Hodgkin lymphoma.
84. Plant 1: chlordane; Plant 2: heptachlor, endrin; Plant 3: aldrin, dieldrin, endrin; Plant 4: DDT.
85. In applicators with mixed exposure to phosphine and other pesticides. Rearrangements and/or deletions in these bands are associated with non-Hodgkin lymphoma.
86. Of the 16 pesticide-associated leukemia cases, 10 were acute myelogenous type, 6 acute lymphoblastic.
87. In working farm wives.
88. Primarily short-term employees. No increased mortality from BCP, esophageal or lung cancer in blacks.
89. Almost all excess mortality of applicators from crashes (311 of 699 deaths). Crash deaths also excessive among instructors.
90. All three gastric cancer deaths occurred in applicators with the most flight-hours (more than 1,280).
91. One non-Hodgkin's lymphoma, one myeloma, one polycythemia vera
92. Colorado, Georgia, Kansas, Kentucky, Maine, Missouri, Nebraska, Nevada, New Hampshire, Ohio, Oklahoma, Rhode Island, South Carolina, Tennessee, Utah, Wisconsin.
93. 2,3,7,8-TCDD contamination with a serious outbreak of chloracne in 1954. Seven percent of women compared to 9.7% of men worked in high TCDD exposure areas .
94. Based on 4 observed deaths.
95. Area A: 2,4-D or 2,4,5-trichlorophenol detected at least once in water.
96. Area B: 70-460 ppb of 2,4-D and 110-190 ppb of 2,4,5-trichlorophenol in water, highest levels of contamination.
97. 31% flour millers applied pesticides. There was a significant deficit of lung cancer, SMR 78, $p<0.05$.
98. Organophosphates.
99. Group 1 employed at least 6 months, Group 2 6-12 months, Group 3 12-36 months, Group 4 more than 36 months.
100. High exposure ≥ 1 week continually at least 1 month total. An exposure of 1 day was required for classification as exposed.
101. Odds ratios adjusted for age, race, cigarette use, income, pork and fruit intake, and residence.
102. 4 of 7 who died from leukemia and 6 of 7 who died from pancreatic cancer were assigned to the chlorohydrin dept (low ETO exposure). Excluding chlorohydrin workers, no association of ETO with pancreatic cancer or leukemia.
103. In 1960s 2,4-D comprised 90%, and in the 1970s, 75% by weight of active ingredient herbicides used in agriculture in Saskatchewan.
104. For last year of employment before 1960; for ≥ 1960 OR=2.1, trend not sig. $p=0.06$.
105. For last year of employment before 1960; for ≥ 1960 OR=1.1, trend not sig. $p=0.41$.
106. For last year of employment ≥ 1960 ; if before 1960 OR=0.9, trend not sig. $p=0.14$.
107. 6% of study sample had serum DDT levels exceeding 92 ppb.
108. Linear trend with duration of exposure.
109. Exposure alone did not increase risk.
110. 70% agricultural employment; most not full time with pesticides. Herbicide use 20%(1950s), 51% (1960s), 68%(1970s) - MCPA most common. Insecticide use 15% (1950s), 34% (1960s), 46% (1970s) - DDT most common (1950s, 1960s), fenitrothion (1970s). Fungicide use 7% (1950s), 16% (1960s), 31% (1970s) - maneb (1950s/ 60s), triadimefon (1970s).
111. Mean concentrations ranged from 0.0041 to 5.75 ppb with varying amounts of nitrates and arsenic as well.

112. Increase in stomach cancer found in Hispanics and leukemia in farm workers not associated with DBCP levels.
113. Risk increased with increasing duration of employment.
114. Hodgkin's disease, lymphoma, cancer of the pancreas, prostate, brain, or skin.
115. Test for trend significant with increasing number of years as an extension agent, $p=0.004$.
116. Reticulosarcoma is an obsolete term for histiocytic lymphoma.
117. Adjusted for smoking.
118. Based on 7 cases.
119. Mean follow up time was 13.9 years; most did not work full time as pesticide applicators.
120. Mercury compounds used for over 60 years as seed disinfectants. Use diminished in the mid 1960s.
121. Increased risk by yr of 1st use primarily fibrous/ myomatous. Little association for lipomatous/other soft tissue neoplasms.
122. No consistent trend between years of farming and risk for liver cancer.
123. Relative risk rose (not significant) with increased time since licensed for both diagnoses.
124. Compared to general population controls.
125. Compared to population controls.
126. Compared to clinical controls.
127. Additional potential exposures: DNOC, copper oxychloride, organophosphates, 2,4,5-T, chlortrizaie herbicides.
128. The workers were in the particle board, ply-wood, sawmill, formaldehyde glue industries.
129. Minnesota, North Dakota, South Dakota, Montana.
130. Cancer (number cases): lung (12), colorectal (4), stomach (3), pancreas (3), renal (3), different types (9), unknown (5).
131. Stomach cancer mortality rising trend by years licensed - SMR: <10 yrs=118, 10-19 yrs=160, >19 yrs=260).
132. Pesticides use > by cases: ethoprop (OR 1.9), nicotine (OR 1.6), methoxychlor (OR 1.5), DDT (OR 1.4), none significant.
133. Only for current farmers who grew up in the south. ORs < 1 for other farming/agricultural experiences.
134. 79% controls had pesticide related cancers: 16% melanoma, 18% Hodgkin/or leukemia, 12 bone/ soft or connective tissue.
135. For more than one day not in the five years before cancer registration.
136. Includes Hispanics.
137. Cases were 14 living and 18 autopsy breast cancer patients; controls 21 living and 35 autopsy non-cancer controls.
138. Other potential exposures all 3 plants (2 in Michigan, 1 in Arkansas): DBCP, methyl bromide, ethyl bromide, bromochlorobenzene, chlorobromomethane, sodium/potassium bromide, PCBs, PBBs, Tris, DDT, among others.
139. Based on 2 cases in workers whose only common exposure was to methyl bromide.
140. 4,827 prostate, 1,812 stomach, 1,101 non-Hodgkin lymphoma, 550 multiple myeloma.
141. Potential exposures: Zineb, Maneb, atrazine, simazine, amitrole, arsenic, DDT, lindane, methyl parathion, DNOC, toxaphene, 2,4- D, 2,4,5-T, others.
142. Other potential exposures: lead/calcium arsenate, sodium/zinc/magnesium arsenite, copper acetoarsenite (Paris green), DDT, aldrin, toxaphene, chlordecone, OPs, carbamates, 2,4-D, monuron-TCA. DDT production began 1945, peaked 1960-62.
143. Potential exposures: chlordane, heptachlor, fumigants, botanicals, carbamates, OPs, other chlorinated hydrocarbons.
144. 2,938 farm workers (laborers) and 906 farmers (operators/managers).