

Mortality Studies

“Summary of Summaries”

Dow has posted a number of mortality studies on its *Dioxin Data* website. Due to the difficulty of understanding epidemiology studies, it's reasonable to assume that many of the *Dioxin Data* visitors may have only read the abstracts at the beginning of each article.

This is the era of news being delivered in 20 second segments. Perhaps with this in mind, Dow also provided *Overview of Dow Worker Studies*. “Overview” is basically a summary of the summaries of the various Dow mortality studies. I thought that it was very nice of Dow to provide this summary. Rather than having to read the summaries of 22 scientific papers, a website visitor just has to read a single summary. “Overview” can be read very quickly, surely convincing the reader that “all is well” in Midland and along the Tittabawassee River.

I really do dislike being critical of my previous employer, but a few words of explanation are warranted.

1. Of the 22 “scientific papers” that Dow posted on its website, 11 (50%) are not really what I would consider to be “scientific papers”. Three of the “papers” are letters to the editors of scientific journals disagreeing with published studies that offer conclusions that are in disagreement with Dow. One of the “papers” is a single page letter to a journal correcting an error in a Dow study.
2. One “scientific paper” was Dow’s response to the EPA and the National Cancer Institute on mortality data that Dow questioned.
3. Two of the “scientific papers” were actually questionnaire surveys of the wives of Dow employees exposed to dioxins. Surveys are notorious for being prone to interviewer-bias. Dow assumed that neither the men nor the women of the control group were ever exposed to dioxins which, based on dioxin levels in the community,

might be an invalid assumption. Dow failed to determine the dioxin body burden levels in any of the interviewees.

4. Four of the “scientific papers” were articles highlighting Dow’s efforts in notifying employees and the community about dioxin related issues, and putting data associated with dioxin exposure and soft tissue sarcoma’s into perspective. One of the “scientific papers” was named “Dioxin: Comparing Apples and Oranges”.

Perhaps the best approach is to present some of Dow’s statements from “Summary of Summaries” and provide comment based on data contained in the relevant study and in other associated studies. Please notice the extent of the information not contained in Dow’s “Summary of Summaries”

- A. *A Mortality Analysis of Employees Engaged in the Manufacture of 2,4,5-Trichlorophenoxyacetic Acid*, MG Ott, 1980¹.

Link to *Dioxin Data Health Study*: http://129.33.46.234/pdfs/health/mortality_analysis.pdf

Dow Summary: “This study examined the mortality experience of 204 people exposed to 2,4,5-T during its manufacture from 1950 – 1971. Within the scope of this survey, no adverse effects were observed with respect to occupational exposure to 2,4,5-T.”

DioxinSpin.com Comments: I thought that we would start off with this study, just in case that are some readers that seem to believe that I disagree with everything in a Dow mortality study. I agree with the conclusions of this study.

However, since the study was presented in Dow’s *Dioxin Data* website, it’s expected that the study was being presented to provide some insight into dioxin exposure. Dow analytical testing of the 2,4,5-T plant confirmed that the plant was TCDD-free and none of the 2,4,5-T workers were ever exposed to TCDD.

Based on this study, it can be concluded that employees, not exposed to TCDD, do not have a higher risk of death from diseases associated with TCDD. *That’s a relief.*

B. Cancer Mortality in Workers Exposed to 2,3,7,8-Tetrachlorodibenzo-p-dioxin, MA Fingerhut, 1991² **Link to Dioxin Data Study:**

http://129.33.46.234/pdfs/health/cancer_mortality_in_workers.pdf

Dow Summary: “An article published in *The New England Journal of Medicine* concluded that the study of mortality among workers with occupational exposure to TCDD does not confirm the high relative risks reported for many cancers in previous studies. It showed that cancers of the respiratory tract and soft tissue sarcoma might result from exposure to TCDD, however, other potential causes could not be ruled out.”

DioxinSpin.com Comments: This study is the NIOSH study conducted by non-Dow epidemiologists on 5,172 workers at twelve plants in the United States that produced chemicals contaminated with TCDD. Dow workers totaled approximately 2,192 employees of the entire cohort. This is an excellent, high quality mortality study. The NIOSH study reported the following:

A. “Mortality from all cancers combined ... was 15 percent higher than expected in the overall cohort. The subcohort with 1 year or more of [TCDD] exposure and 20 years or more of latency had a 46 percent increase in all cancers combined... and a 42 percent increase... in cancers of the respiratory tract. Although the study could not completely exclude the possible contribution of other occupational carcinogens or smoking, the increased mortality, especially in the subcohort with one year or more of exposure [and 20 years or more of latency] is consistent with the status of TCDD as a carcinogen.”

B. “An unexpected finding was the small but significant increase in mortality from All Cancers Combined. The observed increase is consistent with a carcinogenic effect of TCDD.... Moreover, a significantly increased SMR for All Cancers Combined is unusual in occupational studies of chemical workers.”

The NIOSH study found elevated levels of mortality in 26 disease categories including 23 categories of cancer. Dow mortality studies have also found elevated mortalities of similar diseases.

B. *Cohort Mortality Study of Chemical Workers With Potential Exposure to the Higher Chlorinated Dioxins*, Ott, 1987³

Link to Dioxin Data study: http://129.33.46.234/pdfs/health/cohort_mortality_study.pdf

Dow Summary: “This study of 2,192 employees potentially exposed to chlorinated dioxins showed that relative to the United States white male mortality experience, there were no significant deviations from the expected categories of cancer. The study does not support a causal association between chronic human disease as measured by mortality and exposures to the higher chlorinated phenols, derivative products, or their unwanted contaminants, chlorinated dioxins. [1982]”

DioxinSpin.com Comments: The Ott, 1987 study presented information that strongly suggested that there is a causal relationship between TCDD exposure and specific cancers. The study indicated that the 1,319 workers that were only exposed to TCDD (none of the other dioxins) had an elevated level of All Cancers Combined (Obs. 45, Exp. 39.1 SMR 115). The study reported the following mortality ratio's for the 1,319 TCDD exposed workers: (1) stomach cancer (SMR 222), (2) liver cancer (SMR 167), (3) connective and other soft tissue cancers (SMR 500), (4) lymphatic and hematopoietic tissue cancer (SMR 166), (5) Non-Hodgkin's lymphoma (SMR 286) and (6) Other and Unspecified cancers (SMR 260). The study did not provide information on the 95% Confidence Interval for this sub-cohort so it is not possible to determine if these results are statistically significant.

The Ott, 1987 study did report that mortality from Other and Unspecified Cancers was significantly elevated (Obs. 12, Exp, 4.6 SMR 261, 95% CI 135-456). The Ott, 1987 report stated, “Among other cancer sites, there was a significant increase in deaths due to Other and Unspecified malignant neoplasms (12 observed v. 4.6 expected) [SMR 261]. Review of the death certificates and other available information did not provide additional insights as to the origin of the tumors. Nor did the internal analyses identify

any significant work area or dioxin-related associations. Aside from noting that mortality for the category tends to run somewhat higher at this plant location [Midland] than for the United States population, we can offer no explanation for the finding”.^b

The NIOSH, 1991² study also reported, “Mortality was significantly higher than expected in the category of Unspecified sites, which included those of rare sites not included in a category of the life-table analysis...”

C. Evaluation of Mortality Patterns Among Chemical Workers with Chloracne, GG Bond, 1987⁴

Link to Dioxin Data Study: http://129.33.46.234/pdfs/health/eval_pattern.pdf

Dow Comments: “The mortality experience of 322 men with chloracne was evaluated for the time period of 1940 to 1982. There was no indication that they experienced increased overall mortality or an excessive number of deaths from cancer. Among those specific cancers of special interest, no deaths were observed.”

DioxinSpin.com Comments: The study indicated that approximately 15% of the employees exposed to TCDD contracted chloracne. While the information on the 322 workers with chloracne is useful, the information of the 1,865 Dow workers that were exposed to TCDD but did not contract chloracne is even more fascinating. Based on age and longer work history, the 1,865 employees may have had a higher TCDD exposure level and more latency that did the workers with chloracne.

This study indicated that the mortality from All Malignant Neoplasms for the 1,865 non-chloracne workers (SMR 106) increased by 56% from that of the chloracne workers (SMR 68). Although the larger non-chloracne cohort had elevated mortality from (1) stomach cancer (SMR 108), (2) lymphatic and hematopoietic tissue cancer (SMR 117), (3) leukemia and aleukemia (SMR 171), (4) lymphosarcoma and reticulosarcoma (SMR 231), (5) Hodgkin’s disease (SMR 111), (6) other lymphatic tissue cancers (SMR 200) and (7) Other and Unspecified cancers (SMR 192), the study indicated that these specific cancers were not “statistically significant.”

The issue of what is “statistically significant” and what is “not” in an interesting issue. Let’s examine Cancers from Other and Unspecified Sites. Three Dow studies studied the same cohort of 2,100+ Dow employees that had been exposed to TCDD and the other dioxins. All three studies reported the mortality for this category and all three studies provided the 95% Confidence Interval information. Two of the studies indicated that the elevated mortality for this category of cancers was statistically significant, the third study indicated that the increased mortality for this category was statistically insignificant. The results from these three studies are summarized below. The NIOSH, 1991 study is provided as additional information.

Table 1
Rare Cancers of Other and Unspecified Sites
(Dow Dioxin Exposed Chemical Workers)

<u>Study</u>	<u>Obs.</u>	<u>Exp.</u>	<u>SMR</u>	<u>95% CI</u>
Dow: Cook, 1986 ⁵	9	3.7	243	<u>111-462</u>
Dow: Ott, 1987 ³	12	4.6	261	<u>135-456</u>
Dow: Bond, 1987 ⁴	8	4.2	192	<u>82-375</u>
NIOSH, 1991 ²	18	9	201	<u>118-316</u>

As the reader already knows, a lower 95% CL greater than 100 indicates that the finding of elevated mortality is statistically significant.

Two Dow researchers co-authored all three studies. It’s also interesting to note that both Ott, 1987 and Bond, 1987 examined the mortality of the same numbers of workers that had been exposed to dioxins from 1940 to 1982. Ott, 1987 found 12 deaths from these rare cancers while Bond, 1987 found only 8 deaths.

I’m confused... there must be a simple answer that is eluding me. Perhaps, Dow can offer some explanation on these discrepancies.

D. Mortality Experience of Employees Exposed to 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), RR Cook, 1980⁶

Link to Dioxin Data Study: http://129.33.46.234/pdfs/health/mortality_experience.pdf

Dow Comments: “The study describes the mortality experience of a cohort of 62 males involved in a 1965 chloracne accident. 49 of these trichlorophenol production workers developed a skin condition. The analysis of the mortality experience of 61 males indicates that within the limitations posed by cohort size and length of follow-up, 2,3,7,8-TCDD, even at levels to produce chloracne does not increase the overall mortality, and does not appear to increase the risk of cardiovascular death.”

DioxinSpin.com Comments: This study actually uses the word “incident” and not “accident”. An “accident” implies a one time occurrence. What actually occurred is that (1) Dow may not have anticipated the production of TCDD at such high levels in the new process and (2) the operating procedures and operating practices in the new plant were inadequate to protect the workers from high levels of TCDD exposure. Information on the specific reasons for the “accident” or “incident” has never been divulged by Dow. More information on this Chlorance “Incident” can be found in the website section of the same name.

At the time that the report was written (1980), it may not have been known that a minimum of 20 years of latency is generally needed before the carcinogenic effects of TCDD exposure can be determined. This study only allowed 16 years of latency. The significance of a “few years” between exposure and premature death can be seen in the table below. The information is taken from Ott, 1987³.

Table 2
Total Malignant Neoplasms Following TCDD Exposure

<u>Years After First Exposure</u>	<u>Observed Deaths</u>	<u>Expected Deaths</u>	<u>SMR</u>
0 – 10	7	11.5	61
10 – 19	16	22.1	71
> 20	58	45.7	122
Total	81	79.3	102

A number of the Dow studies contained in the “Summary of Summaries” had latencies of less than 15 year. One study, Ott 1987³ provided some information on the mortality of employees with a latency of more than 15 years. For the Dow employees with more than 15 years between TCDD exposure and eventual deaths, the SMR was 106 (higher than expected).

The Dow employees described in the 1964 chloracne “incident” had a 80% (49/61) chloracne occurrence rate. This is the highest occurrence rate that Dow has ever reported. In addition, these 61 employees may have had the highest known TCDD exposure of any Dow employee. The report concluded, “Continued surveillance of this group’s mortality experience should provide additional information pertaining to the chemical’s [TCDD] potential as a weak carcinogen for humans.”

Unfortunately, I have not been able to locate any published study on the promised “continued surveillance” of the 61 employees. It is surprising that Dow has not updated this study since, if the mortality from cancer remained low, it would be strong evidence that TCDD is not harmful to human health.

Perhaps, I have not looked hard enough for an updated study. If such a study is available, I am certain that Dow would be more than pleased to provide a copy.

E. Evaluation of the Mortality Experience of Workers Exposed to the Chlorinated Dioxins, RR Cook, 1986⁵

Link to Dioxin Data study: http://129.33.46.234/pdfs/health/eval_experience.pdf

Dow Comments: “Mortality patterns were analyzed for the time period 1940 through 1979 of 2,189 men with potential occupational exposure to chlorinated dibenzo-p-dioxins. Special attention was directed toward 2,3,7,8-TCDD and deaths due to soft-tissue sarcoma, non-Hodgkin’s lymphoma, Hodgkin’s disease, liver cancer, stomach cancer and nasal or nasopharyngeal cancer. Among the malignancy categories of interest, none demonstrated a significant deviation from expected, nor were any significant trends noted for any specific cause of death category when analyzed by estimated cumulative exposure.”

DioxinSpin.com Comments: There were at least three studies that reported on the mortality of 2,187 to 2,292 employees exposed to dioxins. Let's ignore for a moment that the three studies did not agree on the total number of employees exposed to dioxins. The three studies reported slightly different number of deaths for stomach cancer and cancers from Other and Unspecified Sites. Two Dow researchers co-authored all three reports; one Dow researcher co-authored two of the three reports in question. You would think that one of the three researchers might have noticed the few more or few less dead folks. Evidently not.

Table 3
Mortality Experience of Dow Employees Exposed to Dioxins

	Cook, 1986⁵		Ott, 1987³		Bond, 1987⁴	
	<u>Obs/Exp</u>	<u>SMR</u>	<u>Obs/Exp</u>	<u>SMR</u>	<u>Obs/Exp</u>	<u>SMR</u>
Years:	1940-1979		1940-1982		1940-1982	
No. Employees	2189		2192		2187	
Soft Tissue Sarcoma	1/nr	nr	1/0.4	250	1/0.4	250
Non-Hodgkin's Lymphoma	5/2.1	238	5/2.6	192	nr	nr
Hodgkin's Disease	1/nr	nr	1/1.1	91	1/1	100
Liver Cancer	1/nr	nr	1/1.3	53	1/1.3	77
Stomach Cancer	5/3.2	156	6/3.8	158	3/3.2	94
Cancer – Other/Unspecified	9/3.7	243	12/4.6	261	8/4.9	163

Perhaps, I'm just being too critical, but if these errors are real, you have to wonder if there are other errors in any of the studies that form the basis for Dow's assurances that dioxins are not a risk to human health.

There two additional studies that Dow included in its "Summary of Summaries". The studies evaluated the mortality of more than 35,000 Dow workers that were employed at the Midland and Bay City sites. Although these two studies do not address dioxin exposure directly, the information is so significant that these two studies warrant their own section in the website. See "Mortality Studies – B".

References:

1. **MG Ott**, BB Holder, RD Olson, A Mortality Analysis of Employees Engaged in the Manufacture of 2,4,5-Trichlorophenoxyacetic Acid, *Joun Occup Med*, **22**: 1 47-50 (1980)
2. **MA Fingerhut**, WE Halperin, DA Marlow, LA Piacitelli, PA Honchar, MH Sweeney, AL Greife, PA Dill, K Steenland, AJ Suruda, *Cancer Mortality In Workers Exposed To 2,3,7,8-Tetrachlorodibnzo-p-Dioxin*, *NE Joun Med*, **324**, No. 4, 212-218 (1991)
3. **GM Ott**, RA Olson, RR Cook, GG Bond, Cohort Mortality Study of Chemical Workers With Potential Exposure to the Higher Chlorinated Dioxins, *Joun Occup Med*, Vol **29**, No. 5, 422-429 (1987)
4. **GG Bond**, EA McLaren, JB Cartmill, KT Wymer, W Sobel, TE Lipps, RR Cook, Cancer-Specific Mortality Among Male Chemical Workers, *Am Jour Indus Med*, **12**:353-383 (1987)
5. **RR Cook**, GG Bond, RA Olson, MG Ott, MR Gondek, Evaluation of the Mortality Experience of Workers Exposed to Chlorinated Dioxins, *Chemosphere* **15**, Nos. 9-12, 1769-1776 (1986)
6. **RR Cook**, Mortality Experience of Employees Exposed to 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), *Joun Occup Med*, **22**: No. 8, 530-532, (1980)