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June 17, 2002  
RR-02-003

Attn: TSCA Section 8(e) Coordinator  
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**Subject: 8EHQ-0781-0406**

Dear Sir or Madam:

With this letter, CNA Holdings, Inc. (formerly known as Hoechst Celanese Corporation) is providing additional epidemiology information for glycerol polyglycidyl ether (GPE), CAS no. 25038-04-4.

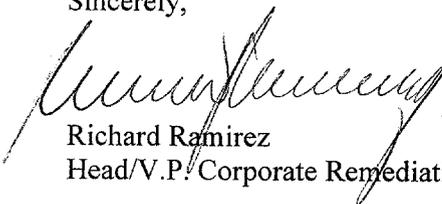
This information refers to an update of the mortality experience of a cohort of 8,878 employees who worked between November 1, 1965 and December 31, 1988 at a synthetic fiber manufacturing facility with potential exposure to glycerol polyglycidyl ether (T55) and followed through December 31, 1998. A copy of the summary report is attached.

Please be advised that CNA Holdings, Inc. has not processed this chemical since December 1993.

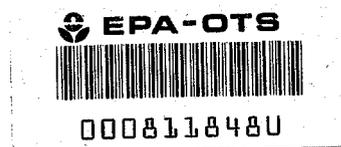
This submission contains no confidential business information.

If any further information is required, please do not hesitate to contact me at (704) 554-2711.

Sincerely,

  
Richard Ramirez  
Head/V.P. Corporate Remediation

Attachment



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## An Historical Cohort Mortality Study of Synthetic Fiber Workers Potentially Exposed to Glycerol Polyglycidyl Ether

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### Abstract

We report an update of the mortality experience of a cohort of 8,878 employees who worked between November 1, 1965 and December 31, 1988 at a synthetic fiber manufacturing facility with potential exposure to glycerol polyglycidyl ether (T55) and followed through December 31, 1998.

The mortality experience of the race/gender groups within the cohort is strikingly similar, with both the all causes of death and all cancer causes of death below unity on both national and local standards. For white males, there were no statistically significant increases for any cause of death with the exception of benign neoplasms.

Thirty four (34) percent of the cohort worked at the plant for less than one year. SMRs were compiled for those

with less than one year of employment and for those with one year or more of employment. Exclusion of those cohort members who worked less than one year had little impact on the SMRs.

Glycidyl ethers are synthetic compounds that are used as a basic component of epoxy resins in a number of industrial applications. In the late 1970s, the National Institute for Occupational Safety and Health (NIOSH) published a criteria document on glycidyl ethers reporting that animal research findings indicated that "some of the glycidyl ethers may be capable of producing testicular atrophy and hemopoietic abnormalities in various species of laboratory animals."<sup>1,2</sup> To date, epidemiologic investigation of workers potentially exposed to glycidyl ethers is limited.<sup>3</sup>

The Division of Occupational Health Studies, Georgetown University Medical Center, in collaboration with Epidemiology Associates of Princeton, undertook a follow up study of the mortality experience of workers at a synthetic fiber manufacturing facility in Salisbury, North Carolina. From 1969 until the early 1990s, the plant sprayed a finishing agent containing glycerol polyglycidyl ether (T55) onto polyester fiber in the filament spindraw section of the manufacturing process. While the primary route of exposure was inhalation, dermal contact was also possible.

#### METHODS

The study cohort, initially compiled by Lanes, et al, identified 8,878 employees who had worked at the Salisbury, NC plant between November 1, 1965 and December 31, 1988 and originally followed through December 31, 1988.<sup>3</sup> The current vital status follow up was carried out for all persons without regard to race or gender and for all causes of death and extends the follow up through December 31, 1998.

The following data were provided for each employee: name, Social Security number, date of birth, gender, race (where known), dates of hire and termination, payroll

status, marital status and date of death (if known). Tracing for vital status was conducted through company records, the Social Security Administration mortality files and the National Death Index. Race was unknown for 1,986 persons in the total cohort (22%) of which 1,576 were males (25%). The majority of those of known race were white (81% of the total cohort and 83% were males) although the proportion varies by year of hire. For the 1,986 cohort members whose race was unknown, race was assigned randomly based on the proportion of those of known race and gender by year of hire. The distribution of the cohort by race, gender and vital status is given in Table 1.

When not available from company records, death certificates were obtained from state vital statistics offices. Death certificates could not be located for 33 white males, 9 white females, 2 black females and 4 black males. In cause of death analyses, deaths listed as "cause unknown" (no death certificate) are included in the number of total deaths but not in cause specific mortality analyses. Death certificates were coded by a qualified nosologist according to the International Classification of Diseases revision in effect at the time of death.

Results for the cohort follow up are presented as standardized mortality ratios (SMRs) computed using OCMAP/PC and tested for significance at the 0.05 level.<sup>5,6</sup> Mortality at the Salisbury plant is compared with (1) mortality (specific for race and gender) for the entire United States (national standard) and (2) mortality (specific for race and gender) for Rowan county North Carolina (local standard), the county in which the plant is located.

## RESULTS

## White Males

There were a total of 834 deaths among white males for follow up through December 31, 1998. SMRs based on the national standard for selected causes of death are presented in Table 2. Results of SMRs based on the county standard are discussed but not presented.

SMRs are below one for the all causes and all cancers on both the national and local standards, with the all causes on the local standard significantly in deficit (observed = 834; expected = 945.71; SMR = 88.2). The only cancer cause of death SMR that is statistically significant is a deficit for cancer of digestive organs and peritoneum on the national standard (observed = 35; expected = 52.63; SMR = 66.5). The lung cancer SMR on the national standard is slightly above unity (SMR = 100.9) but falls below one on the local standard (SMR = 91.2). Other cancer causes of death with elevated but not statistically significant SMRs on both standards are: kidney cancer (observed = 9) with SMRs of 142.5 (national) and 130.7 (local); melanoma (observed = 10) SMR of 183.9 (national) and 165.6 (local); and central nervous system (observed = 13) with SMRs of 158.5 (national) and 134.4 (local).

The SMR for benign neoplasms (seven brain tumors and one other lymphatic and hematopoietic tissue) is significantly elevated on both the national (observed = 8; expected = 2.65; SMR = 301.8) and local standard (observed = 8; expected = 1.91; SMR = 419.3).

Among noncancer causes there are significant deficits in the SMR on the national standard for all external causes of death (observed = 95; expected = 129.98; SMR = 73.1) and accidents (observed = 54; expected = 78.88; SMR = 68.5). Noncancer causes with

SMRs having significant deficits on the local standard, include non-malignant respiratory disease (observed = 49; expected = 67.35; SMR = 72.8); all external causes of death (observed = 95; expected = 136.78; SMR = 69.5) and accidents (observed = 54; expected = 87.98; SMR = 61.4).

The all heart disease SMR is slightly elevated on the national standard but falls below one on the local standard. Nephritis and nephrosis deaths (observed = 7) are elevated with a SMR of 134.1 on the national standard and 119.9 on the local standard.

#### White Women

Among white women, there are 209 deaths. Statistically significant deficits in the all causes of death category are seen on both the national (observed = 209; expected = 264.46; SMR = 79.0) and on the local standard (expected = 247.7; SMR = 84.48). The all cancers SMR, based on 77 deaths, also is in deficit on both the national and local standards with an expected of 93.74 and SMR of 82.1 (national) and an expected of 80.17 and SMR of 96.1 (local). There are no individual cancers with statistically significant increases on either the national or local standards.

All 23 cancers of the respiratory system are lung cancers. While not statistically significant, the lung cancer SMR on the local standard is higher than the lung cancer SMR on the national standard (expected = 16.45; SMR = 139.8 local vs. expected = 21.68; SMR = 106.1 national). The breast cancer SMR (15 observed) is below unity on both the national and local standards.

For the non-cancer causes of death among white women, the all heart disease SMR is significantly low on both the national (observed = 49; expected = 68.5; SMR = 71.5) and

local (observed = 49; expected = 68.1; SMR = 72.0). The SMR for all other causes of death is also significantly in deficit on the national standard (observed = 20; expected = 31.33; SMR = 63.8).

#### Black Men

No statistically significant excesses were observed among black males based on either the national or the local standards. The SMR for all causes (observed = 144) on both standards is significantly in deficit (national, expected = 217.49, SMR = 66.2; local expected = 255.99; SMR = 56.3). The all cancers SMR is also in deficit on both the national standard (SMR = 56.5) and the local standard (SMR = 53.7) based on 25 deaths. Lung cancer accounted for 10 deaths, but the SMR is below unity on both standards. While not significant, the prostate cancer SMR (observed = 7) is elevated on both standards (national, SMR = 230.8; local, SMR = 107.8).

The SMR for all heart disease, as well as several subsets of heart disease, is significantly in deficit on the local standard. Other noncancer SMRs significantly in deficit based on the local standard are cerebrovascular disease (observed = 9), nonmalignant respiratory disease (observed = 5) and all external causes of death (32). SMRs for homicides and other external causes of death are below unity on both standards, with the SMR statistically significant on the national standard.

#### Black Women

There were 23 deaths observed among black women. SMRs for all causes of death on both the national and local standards are significantly below one (national, SMR = 44.3; local, SMR = 38.2). Nine (9) cancer deaths were observed with both national and local

SMRs in deficit. There were 4 breast cancer deaths with a non-significant, slightly elevated SMR on both standards (national, expected = 3.22, SMR = 124.1; local, expected = 3.72, SMR = 107.5).

### Discussion

The update of the mortality experience of the white male component of the Salisbury cohort indicates no statistically significant increases for any cause of death with the exception of benign neoplasms. Standardized mortality ratios for all causes and all cancers are in deficit. Seven of the eight deaths in the benign neoplasms category occurred during the period covered by the first Salisbury cohort mortality report, prepared by Lanes et al. (1994). It appears that Lanes et al. included these deaths within the broader category of benign and unspecified neoplasms. Lanes et al. conducted a nested case-control study of malignant brain tumors and brain tumors not otherwise specified (the benign and unspecified neoplasms that were brain tumors) and on the basis of the case-control analysis concluded that both groups were inversely associated with any exposure to T-55.

The cohort as defined includes anyone who had worked at the plant at any time between November 1, 1965 and December 31, 1988. Of the 5,204 white males in the cohort, 1759 (34%) worked at the plant for less than one year and contributed 30% of the deaths in the current analysis (Table 3). To assess the impact, if any, of the less than one year employees on the current analysis, SMRs were run on the national standard for those with less than one year of employment and for those with one year or more of employment.

For those with less than one year of employment, the SMR for all causes of death is 103.6 (observed = 251; expected = 242.34). For those who worked one year or more, the

all causes of death SMR is 91.4 and is statistically significant (observed = 583; expected = 638.2). The all cancers SMR is below unity for both groups. While several cancer SMRs are above unity in either group, the only statistically significant cancer SMR is for malignant melanoma in the less than one year of employment group (observed = 6; expected = 1.63; SMR = 369.0). Benign neoplasms remain statistically significant in the one year or more of employment group with 7 of the eight deaths (SMR = 365.5). Of the seven, five had 2.6 years or less employment and 2 were employed nine years or more.

It does not appear that the exclusion of those cohort members who worked less than one year would have a pivotal impact on the SMRs at this point in time. Future follow up of this cohort should continue to assess the potential impact of this subset of employees especially if surrogate measures for exposure such as time since first employment are utilized.

Occupational epidemiologic investigations involving women and minorities continue to be uncommon.<sup>6,7,8</sup> The mortality experience of the race/gender groups within the Salisbury cohort is strikingly similar, with both the all causes of death and all cancer causes of death below unity on both the national and local standards. The race/gender groups in this cohort share other similar characteristics. The average age at hire is similar for white males (29.5), black males (27.7) and black females (27.8). White females had an average hire age of 32.9, slightly older than the other three groups.

The average length of employment for all men in the cohort was almost identical 8.13 years for white males vs. 8.03 years for black males. For all women, the numbers were 7.51 years for white women and 7.57 years for black women. When members of the study

cohort who worked less than one year were excluded, the average length of employment is 12.11 years for white males vs. 12.16 years for black males; 10.38 years for white females and 10.98 years for black females. The maximum length of employment (for those employed for a minimum of one year) also varies little among the race/gender groups--33.1 for white males, 32.8 for black males, 32.9 for white females and 31.6 for black females.

A majority of the cohort held hourly jobs (84%). Of this cohort majority, black men held the highest percentage (93%), followed by black females (88%); white males were third with 84% and white women with 80%.

Because race/gender differences have not been adequately studied in occupational epidemiology, knowledge gaps exist involving any possible effects of potential workplace exposures on health outcomes of women and minorities. It is incumbent upon researchers to address this situation.

#### Summary

This follow up of employees from a synthetic fibers plant showed no unusual patterns of mortality. The increase in the number of deaths since the initial analysis allowed us to refine this follow up analysis by race and gender, rather than analyzing all cohort members combined as was done in the Lane's study. Therefore, comparisons of the analyses are inappropriate. In interpreting the results of this study, it should be kept in mind that the cohort is still relatively young (16% of white males have died). A major limitation of this study is the lack of work history data to allow classification of employees to the plant operation with the exposure of interest. No formal work history records were available for either the initial follow up or the current follow up. Information from the personnel file

indicating department allowed some limited assumptions to be made concerning work area for the nested case control study in the initial follow up. Because of circumstances pertaining to the sale of this facility in the interim, these data were not available for use in the current follow up. Future follow up, however, should take pains to remedy this deficiency.

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## ACKNOWLEDGEMENTS

This study was supported by funds from the Celanese Americas Corporation and Epidemiology Associates of Princeton.

TABLE 1: Distribution of the Salisbury Cohort by Vital Status as of December 31, 1998.

Race/Gender	Total Cohort		Vital Status			
	n	%	Alive		Dead	
	n	%	n	%	n	%
Total:	8,878	100	7,668	86	1,210	14
White	7,290	100	6,247	86	1,043	14
Male	5,204	100	4,370	84	834	16
Female	2,086	100	1,877	90	209	10
Black	1,588	100	1,421	89	167	11
Male	1,006	100	862	86	144	14
Female	582	100	559	96	23	4

ABLE 2: Cohort Mortality Study of the Salisbury, North Carolina Plant: Observed (OBS), Expected (EXP), Expected (EXP) standardized Mortality Ratio (SMR) and 95% Confidence Intervals (CI) by Cause of Death, White Males

CAUSE OF DEATH (Based on Revision at Time of Death)	OBS	EXP	SMR	95% CI	
				Lower	Upper
All Causes of Death	834	880.54	94.7	88.4	101.4
All Malignant Neoplasms	212	224.97	94.2	82.0	107.8
Cancer of Digestive Organs & Peritoneum	35	52.63	66.5 **	46.3	92.5
Cancer of Respiratory System	83	84.89	97.8	77.9	121.2
Cancer of Bronchus, Trachea, Lung	82	81.24	100.9	80.3	125.3
Cancer of Prostate (Males only)	12	12.47	96.2	49.7	168.1
Cancer of Testes and Other Male Genital Organs	3	1.19	252.9	52.2	739.1
Cancer of Kidney	9	6.31	142.5	65.2	270.6
Cancer of Bladder and Other Urinary Organs	4	4.52	88.4	24.1	226.5
Malignant Melanoma of Skin	10	5.44	183.9	88.2	338.1
Cancer of Central Nervous System	13	8.20	158.5	84.4	271.0
Cancer of All Lymphatic, Hematopoietic Tissue	21	23.67	88.7	54.9	135.6
All Other Malignant Neoplasms	17	18.21	93.4	54.4	149.5
Benign Neoplasms	8	2.65	301.8 **	130.3	594.7
Diabetes Mellitus	11	16.35	67.3	33.6	120.4
Cerebrovascular Disease	29	32.43	89.4	59.9	128.4
All Heart Disease	284	282.69	100.5	89.1	112.9
Non-malignant Respiratory Disease (NMRD)	49	53.61	91.4	67.6	120.8
Cirrhosis of Liver	18	26.50	67.9	40.3	107.4
Nephritis & Nephrosis	7	5.22	134.1	53.9	276.3
All External Causes of Death	95	129.98	73.1 **	59.1	89.3
Accidents	54	78.88	68.5 **	51.4	89.3
Suicides	25	33.67	74.3	48.1	109.6
Homicides & Other External Causes	16	17.44	91.8	52.4	149.0

\* Expected numbers based on U.S. mortality for white men. Number at risk: 5,204; Person years: 135730.7  
\*\* Significant at 5% level

ABLE 3: Distribution of White Males in the Salisbury by Length of Employment and Vital Status

<u>length of employment</u>	<u>Total</u>		<u>Alive</u>		<u>Dead</u>	
	#	%	#	%	#	%
< 1 year	1759	100	1508	70	251	30
1 year or more	3445	100	2862	30	583	70
TOTAL	5204	100	4370	100	834	100