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OFFICE OF AIR QUALITY PLANNING AND STANDARDS
EMISSION STANDARDS DIVISION
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MEMORANDUM

SUBJECT: Residual Risk Assessment for the Ethylene Oxide Commercial Sterilization Source Category

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1.0 Introduction - The Residual Risk Program

Section 112(d) of the Clean Air Act (CAA) requires EPA to set technology-based national emissions standards for hazardous air pollutants (NESHAP). These standards are based on the maximum achievable control technology (MACT) for the source category and are sometimes referred to as "MACT standards." The MACT standards for existing sources are based (at a minimum) on average emissions control levels achievable by the best controlled 12 percent of sources in the category. The MACT standards do not consider whether the emission controls reduce risks from the source category to an acceptable level.

Section 112(f) of the CAA directs EPA to evaluate the health and environmental risks remaining after technology-based standards have been promulgated (i.e., residual risks) and requires more stringent regulation if existing standards do not meet certain criteria. Specifically, its focus is to protect the public health with an "ample margin of safety," while also ensuring that "taking into consideration costs, energy, safety, and other relevant factors," residual emissions do not result in "an adverse environmental effect." The CAA defines "adverse environmental effect" as "any significant and widespread adverse effect, which may reasonably be anticipated, to wildlife, aquatic life, or other natural resources, including adverse impacts on populations of endangered or threatened species or significant degradation of environmental quality over broad areas."

The residual risk assessment is performed by EPA as part of the residual risk rule development process, which is generally completed within eight years of the promulgation of

MACT standards. The EPA's 1999 Residual Risk Report to Congress provides more information on the general framework and methods for conducting residual risk assessments. This memo describes the methods and results of the residual risk assessment for the ethylene oxide (EtO) commercial sterilization source category.

1.1 Overview of Risk Assessment Methods

The 1994 National Research Council (NRC) report, *Science and Judgment in Risk Assessment*, and the 1997 Commission on Risk Assessment and Management (CRARM) report, *Framework for Environmental Health Risk Management*, provide recommendations concerning residual risk assessment. Among the recommendations in these two reports is the use of an iterative, or tiered, approach to residual risk assessment. At lower tiers, facilities in a given source category are screened using relatively generic conservative assumptions, and at higher tiers, more site-specific information is used, leading to a more accurate picture of risk. The Residual Risk Report to Congress describes the approach to risk assessment being implemented by EPA in response to the NRC and CRARM recommendations.

In both human health and ecological risk assessments, there is essentially a continuum of possible levels of analysis from the most basic screening approach to the more refined, detailed assessment. Screening level analyses are designed to be relatively simple, inexpensive, and quick. They use existing data, defined decision criteria, and models with simplifying conservative assumptions as inputs. More refined levels of analysis include the refinement of aspects of the analysis that are thought to influence risk most or may contain the greatest uncertainty. Refinements can be made through the use of more sophisticated models and by replacing defaults with more precise estimates. Each refinement requires more effort, but produces results that are less uncertain and less conservative (i.e., less likely to overestimate risk). Under residual risk, an assessment starts at the level considered most appropriate upon examination of the available information during the scoping or problem formulation phase; refined iterations of the assessment occur when necessary.

In residual risk assessments, numerical estimates of the potential for adverse impacts to people are calculated for two categories of adverse health effects:

- Risk of developing cancer
- Potential for developing adverse health effects other than cancer (e.g., reproductive effects) or for cancer if a nonlinear/threshold mode of action is established

To derive estimates of risk, quantitative information on exposure is combined with information on dose-response. This process is typically different for cancer and other effects due to the

underlying assumption that cancer is a nonthreshold phenomenon[1] and that thresholds exist for adverse health effects other than cancer.

For inhalation exposures to carcinogens, individual risk, or the increased lifetime probability of developing cancer as a result of a lifetime of exposure to a HAP, is derived by multiplying the estimated exposure concentration by the cancer unit risk estimate (URE). The URE represents an upper bound of the increased risk of developing cancer for an individual exposed continuously for a lifetime (e.g., 70 years) to a specific concentration (e.g., 1 μg/m3) of that HAP in the air.

For ingestion exposures, the toxicity benchmark, the oral cancer slope factor (CSFo), is used with the appropriate exposure factors (e.g., lifetime, exposure duration, body weight and consumption rate) and media concentrations to arrive at the individual risk from ingestion.

The potential for chronic noncancer effects through inhalation is evaluated by comparing an estimate of the lifetime exposure concentration with an inhalation toxicity benchmark called the reference concentration (RfC). The potential for noncancer effects from ingestion exposures is evaluated by comparing average exposure levels with an oral toxicity value called the reference dose (RfD). The RfC and RfD represent estimates (with uncertainty spanning perhaps an order of magnitude) of daily exposure of the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. Values similar to EPA's RfC and RfD (e.g., MRLs derived by the ATSDR) are used where RfC or RfD values are unavailable.

The hazard quotient (HQ), used to express the potential hazard of noncarcinogens to human health, is a ratio of exposure to the toxicity benchmark. It is commonly calculated and used as a surrogate indicator of noncancer risk. Hazard quotient values less than or equal to 1 indicate that exposures are below the RfC or RfD and not likely to cause adverse effects. Hazard quotient values greater than 1 indicate that the potential for adverse effects is increased; however, the HQ should not be interpreted as a probability.

The hazard index (HI), which is the sum of more than one hazard quotient, addresses multiple risks from several chemicals and is the sum of HQ values for individual pollutants to which an individual is exposed. As an initial screen, all individual HQ values can be added. In a more refined analysis, the aggregation of the HQ values is considered on the basis of toxicological similarity, or similarity of target organs among specific chemicals.[2]

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[1] While recognized by the 1986 Guidelines for Carcinogen Risk Assessment, the current Interim Guidelines (USEPA 1999, 2001) more explicitly recognize the potential for the acceptance of a nonlinear or threshold mode of action for cancer. Accordingly, there may be some substances (e.g., chloroform) for which an RfC/RfD is relied on for cancer as well as other effects.

[2] This approach is consistent with the US EPA's 1986 Mixtures Guidelines (U.S. EPA, 1986c) and Supplemental Guidance (USEPA, 2000).

The potential for acute effects through inhalation is evaluated by comparing an estimate of the short-term (1-hour) exposure concentration with available relevant acute reference values.

2.0 Background - Commercial Ethylene Oxide Sterilizers and Fumigators

The commercial EtO sterilizers and fumigators source category covers the use of EtO as a sterilant or fumigant. Commercial sterilization facilities use EtO as a sterilant for heat- and moisture-sensitive products and as a fumigant to control microorganisms or insects. EtO is used to sterilize or fumigate medical equipment (e.g., syringes and surgical gloves), spices, pharmaceuticals, and cosmetics. Libraries and museums also use EtO to fumigate books and other historical items. The MACT standards apply to all of these kinds of uses, with the following exceptions:

- Beehive fumigators;
- Research and laboratory facilities, as defined in section 112(c)(7) of the Act; and
- Medical facilities such as hospitals, doctor's offices, clinics, or other facilities whose primary purpose is providing medical services to humans or animals.

Commercial EtO sterilization encompasses two main types of processes: (1) bulk sterilization and (2) single-item sterilization. For the single-item sterilization procedure, items are placed in a plastic pouch, sterilant gas is injected into the pouch, and the sealed pouch is placed in an aeration cabinet or room for sterilization. Single-item sterilization processes generally use far less than 1 ton of EtO per year per facility. Facilities that use less than 1 ton of EtO per year are only subject to minimal recordkeeping under the MACT standards.

Bulk sterilization is by far the more commonly used EtO sterilization process (i.e., more items sterilized). Using this process, products to be sterilized are placed in a sterilization chamber and are exposed to a sterilant gas (EtO) at a predetermined temperature, humidity level, and pressure. The typical sterilization cycle consists of six phases:

1. **Presterilization conditioning.** After the products have been loaded into the chamber, a partial vacuum is created. This initial vacuum, or drawdown, prevents dilution of the sterilant gas. Also, if flammable gas mixtures are used, the removal of air reduces the potential for ignition. The chamber temperature and humidity also are adjusted during this phase to ensure proper sterilization.
2. **Sterilization.** The EtO, which is supplied as a liquid, is vaporized and introduced into the chamber to achieve the desired concentration. The chamber pressure is maintained for about 4 to 6 hours.
3. **Evacuation.** Following sufficient exposure time, the EtO gas is evacuated from the chamber with a vacuum pump. This postcycle vacuum phase typically lasts about 10 minutes.
4. **Air wash.** The pressure in the chamber is brought to atmospheric pressure by introducing either air, nitrogen, or CO_2. The combination of evacuation and air

wash phases is repeated from two to four times to remove as much of the EtO from the product as possible.

5. **Chamber exhaust.** Prior to unloading the products from the sterilizer, the chamber door is automatically cracked, and the chamber exhaust is activated. The chamber exhaust is a worker safety system that is responsible for removing EtO from the void space in the sterilizer chamber.
6. **Aeration.** Following their removal from the sterilization chamber, the sterile products are placed in an aeration room and kept there for several hours or days depending on the product. EtO concentrations in the aeration room are maintained at relatively low levels by ventilating the room at a rate of about 20 air changes per hour.

EtO is released during the sterilization cycle from the following primary sources:

- Sterilization chamber vent(s) (i.e., the vent on the vacuum pump gas/liquid separator);
- Sterilization chamber vacuum pump drain;
- Chamber exhaust vent(s); and
- Aeration room vent(s).

The MACT standards cover both area and major sources. Major sources are sources that emit 10 or more tons per year (tpy) of any regulated hazardous air pollutant (HAP) or 25 or more tpy of any combination of HAPs. Area sources, or "nonmajor sources," are sources that do not exceed these limits. The emission reductions and limits set forth in the MACT standards are presented in Table 1.

Table 1. Commercial Sterilization MACT Standards

	Emission Standards		
Source Size (annual EtO usage)	Sterilization Chamber vent	Aeration room vent	Chamber exhaust vent
Usage < 1 ton	No control required; minimal recordkeeping requirements only		
1ton $\leq$ Usage < 10 tons	99% emission reduction	No control	No control
Usage $\geq$ 10 tons	99% emission reduction	1 ppmv maximum outlet concentration or 99% emission reduction	No control

3.0 Methods

3.1 Scope

Facilities – The residual risk program covers all facilities covered by the MACT standards. However, evaluating the residual risks is only mandatory for major sources and is discretionary for area sources. Both major and area sources were included in this assessment.

Emission sources – All emission points associated with a source category are covered under the residual risk program regardless of whether controls were established under the MACT program. For this source category, all EtO emission points were covered under the MACT and are included in this analysis.

Hazardous Air Pollutants – EtO is the only HAP released by sources in this source category.

Pathway – EtO is a gaseous volatile organic compound. The inhalation pathway is expected to be the primary route of exposure for humans, and the assessment of human health risks via inhalation was the focus of this analysis. Some HAPs which are persistent and bioaccumulative can also pose human health risks via pathways other than inhalation (e.g., by depositing to the ground and entering the food chain). The EPA has developed a list of persistent, bioaccumulative, and toxic (PBT) HAPs based on information from the Pollution Prevention program, the Great Waters program, the Toxics Release Inventory (TRI), and additional analysis conducted by the Office of Air Quality Planning and Standards.[3] Ethylene oxide is not on the list of PBTs. Consequently, we believe the non-inhalation risks to be minimal for this source category, and we conclude that a quantitative risk assessment for multipathway exposures is unnecessary.

Receptor (exposed population) – The residual risk program is concerned with general population exposure associated with ambient releases. Consequently, it is focused on long-term (chronic) and short-term (acute) exposures beyond the fenceline. The EPA is also required to consider adverse impacts to the environment (e.g., ecological risks) as a part of a residual risk assessment. Regarding the inhalation exposure pathway for terrestrial mammals, we contend that human toxicity values for the inhalation pathway are protective of terrestrial mammals. Because EtO is not considered to be persistent and bioaccumulative, we expect risks to mammals via ingestion routes and risks to non-terrestrial animals to be insignificant. Therefore, we conclude that a quantitative ecological risk assessment is unnecessary for this source category.

Endpoints – This risk assessment addressed both cancer and effects other than cancer associated with chronic exposures and non-cancer effects associated with acute or short-term

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[3] Air Toxics Risk Assessment Reference Library, Volume 1. EPA-453/K-04-001A. U.S. Environmental Protection Agency. April 2004.

exposures

3.2 Source Category Characterization

Several sources of data were reviewed for this risk assessment, including the National Emissions Inventory (NEI) point source database, the Toxics Release Inventory (TRI), the Ethylene Oxide Sterilization Association (EOSA), MACT compliance reports, and Title V permits. A total of 76 commercial EtO sterilizer sources were identified.[4] Previous lists of commercial EtO sterilizer sources included approximately 120 sources, but some of these sources subsequently have been found not to be in this source category, are no longer operating, or are duplicates of other sources. There are also many sources that were on previous lists based on older TRI or NEI data that were not in the 2000 TRI. Some of these facilities may still be operating but do not appear in the TRI because they use less than the 10,000 pound (5 ton) reporting threshold amount of EtO. Considering the TRI threshold, we conclude that we have identified all major sources and many of the area sources (sources that use less than 10 tpy). Therefore, we believe that our data is representative of the source category.

Information needed to support the risk assessment include the following:

- Facility location (latitude and longitude);
- Urban/rural classification;
- Emission rate (kilograms/year);
- Exit gas temperature (degrees Kelvin);
- Vent type (vertical or non-vertical);
- Point source stack height (meters);
- Cross-sectional area of nearby building contributing to building downwash (m^2);
- Point source stack diameter (meters);
- Point source exit velocity (meters/second);
- Fugitive source release height (meters); and
- Area of fugitive emissions (m^2).

3.2 Post-MACT Emissions

Post-MACT mass emission rates were available for each of the 76 facilities,[5] but we do not know specifically how emissions were estimated for most sources. The MACT standards do not require continuous emissions monitoring; they require an initial control device performance test and continuous monitoring of control device operating parameters to ensure the device is operating properly. Without continuous emissions monitoring data, the only way to estimate

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[4] A. Koppel, J. Laurenson, M. Fisher and D. Burch, ICF, to M. Morris and D. Markwordt, EPA. *Data and assumptions used for the screening-level residual risk analysis of the commercial ethylene oxide sterilizers and fumigators source category.* July 2004.

[5] A. Koppel, *op. cit.*

emissions is using process knowledge of how much EtO goes through the main vent, rear chamber exhaust, and aeration room vent, and considering the respective MACT control requirements for these emission points.

Background information for the MACT standards indicates that approximately 95% of the EtO goes through the main vent, 1% through the rear chamber exhaust, and 4% through the aeration room vent.[6] Knowing these percentages and considering the emission reductions required by the standards (or achieved in excess of the standards), overall emissions can be estimated. We presume that the emissions included in the emissions inventories and the data supplied by the industry were estimated in this way, and we believe this mass-balance methodology is appropriate for this source category because the sterilization process is relatively simple, EtO is the only HAP, and no chemical transformation occurs during the process.

The relative attribution of emissions discussed above is approximate and varies by source. For example, a source that does more air washes may have more than 95% of the EtO going through the main vent and less than 1% exiting the rear chamber exhaust. Also, products vary in the amount of EtO they retain. For example, a source sterilizing spices may have a higher proportion of EtO going through the aeration room vent because spices tend to retain more EtO than medical products. We conclude that these process variations would not bias the risk assessment. A facility that does more air washes might have lower emissions because the main vent is controlled but the rear chamber exhaust is not. An area source that sterilizes a product that retains a relatively high proportion of EtO may have higher emissions because less of the EtO goes through the main vent and more goes through the aeration room vent, which is not required to be controlled for area sources.

Information on the annual amount of EtO used in commercial sterilization (approximately 4,000 tons)[7] supports our emissions data. Approximately 99 percent of EtO goes through the main vent and aeration room vent, and 1 percent through the rear chamber exhaust. Using the total industry usage amount and applying 99 percent MACT control to the main and aeration vents yields approximately 40 tpy. Combined with the 1 percent, or 40 tpy, from the rear chamber exhaust, the total emissions based on source category usage are about 80 tpy. This compares well with the 82 tpy from our database. This comparsion does not address the accuracy of the emissions estimate of an individual facility, but it does support our estimate for the entire source category.

Acute emissions estimates – For this source category, a small source (about one ton per

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[6] *Ethylene Oxide Emissions From Commercial Sterilization/Fumigation Operations - Background Information Document for Proposed Standards.* EPA-453/D-93-016. U.S. Environmental Protection Agency. October 1992.

[7] K. Steilen, Ethylene Oxide Sterilization Association, to D. Markwordt. *NESHAP for Ethylene Oxide Commercial Sterilization and Fumigation Operations.* June 1998.

year of usage) that has no control requirements under the MACT standards would create a worst-case short-term exposure scenario similar to a large source, which can emit up to 10 tpy after control. The emissions from this source category are directly related to the amount of EtO used. Approximately 99 percent (uncontrolled) of the EtO used is emitted from the main vent and aeration room vent, and these emissions are required to be reduced by 99 percent for all sources using more than 10 tpy of EtO per year. The remaining 1 percent of EtO is emitted from the rear chamber exhaust, which is not required to be controlled at any source.

Considering the usage breakdown described in the previous paragraph, the largest user of EtO in the source category (500 tpy) would have main vent and aeration room vent emissions of approximately 5 tpy. The rear chamber exhaust emissions would also be 5 tpy. The emissions from large sources are essentially continuous because such sources are typically operated with multiple sterilization chambers, with one or two at a time routing EtO to a control device. Therefore, the 10 tons of total emissions from the largest user would be approximately 2 pounds per hour. However, if we are conservative and assume that the emissions are not continuous but instead occur only two hours per day, the total hourly emissions could be as high as 30 pounds.

We estimate that a small source emitting one ton per year would create a higher short-term exposure than a larger source because sources that use less than 1 tpy are not required to control emissions and are likely to operate a single chamber in a batch mode. The highest expected charge of EtO into a chamber at a small source is 40 pounds.[8] At 40 pounds per charge, a 1-tpy source would charge about once per week and, for the purposes of the acute assessment, the entire amount is assumed to be released in 1 hour. Since the 40 pounds per hour estimated to be emitted from a small source exceeds the 30 pounds per hour estimated to be emitted from the largest source in the source category, we based our short-term exposure scenario on a small source. The only reasonable case where a large source could create a higher short-term exposure than a small source would be control device failure. However, the large source does not have to release the EtO in the chamber until the control device is repaired, and even if it had to be released, it could be released slowly.

3.2.2 Source Release Characteristics

Data on source release characteristics (e.g., release height, exit velocity, stack gas temperature) were available for about half of the facilities. Where actual data were not available, a number of assumptions were used to fill data gaps.[9]

Stack Height – Approximately 80% of the facilities were missing release height data for their fugitive emissions, and 60% were missing data for point (or vertical) emissions. For

[8] J. Hadley, Ethylene Oxide Sterilization Association, to D. Markwordt, EPA. Section 112(f) "what ifs." February 2004.

[9] A. Koppel, *op. cit.*

fugitive release height, we used 75 percent of the height of the average known EtO building to simulate a combination of windows, side-vents, and roof vents. For stacks, we adopted the NEI default of 12 m, which is almost identical to (less than 1 m higher than) the average height of the known EtO stacks.

Area – Approximately 90% of the facilities needed area data for fugitive emissions, and 60% needed data for vertical emissions. For fugitive (or non-vertical) emissions, this is the area of the release, such as impoundment or cumulative vent areas. For vertical emissions, area refers to the vertical (or wind normal) cross-sectional area, or height by width, of the building. The NEI did not contain default values for area. Therefore, for unknown fugitive releases, we estimated a minimum of 20 vents x 5 m^2/vent = 100 m^2 to a maximum of 500 m^2. Most of the area data provided by industry for fugitive emissions appeared to be for building area, not for vent opening area. Therefore, we used the default vent area for fugitive emissions unless otherwise indicated. For unknown vertical emissions area, we used the average of the known height and width (17 facilities had heights; 12 had lengths/widths), or 7.3 m x 74 m = 540 m^2. For facilities that provided horizontal dimensions but not height, we assumed 7.3 m height and the square root of the area for width. If the building area reported for fugitive emissions for a given facility is larger than the area provided for the vertical emissions for that facility, we used the fugitive emissions building area based on the assumption that this building is close to the vertical source such that it dominates the downwash effect for the vertical emissions. Also, per HEM-Screen guidance, we used the largest area to represent the facility even if the building with the stack had a smaller area.

Stack Diameter – This parameter was not used for fugitive emissions, and about 50% of the facilities needed diameter for stacks. The NEI used a default of 1.2 m for stacks, which was similar to the known EtO stacks and thus adopted for this analysis.

Gas Exit Velocity – This parameter was not used for fugitive emissions, and approximately 25% of the facilities needed velocity for stacks. The NEI has a default for general stacks of 4.6 m/s, but 6.8 m/s was used instead for this analysis because it appeared to be the actual NEI default used for EtO facilities. This value is also closer to the average for the known EtO facilities (10 m/s). Supplied data had several mistakes (impossibly high velocities) that had to be corrected. We used data indicating that the exit velocity of the gas must be less than 400 ft/sec (Kumar, 1997). When a data source reported a gas exit velocity of greater than 400 (with or without units), we assumed that the value was reported in ft^3/min and thus converted the value to m/s by (1) dividing by the area of the stack opening (assuming a perfect circle), (2) dividing by 60 to convert minutes to seconds, and (3) converting English units to metric as appropriate.

Gas Exit Temperature – Approximately 95% needed temperature for fugitive, and approximately 50% needed it for stacks. The NEI used ambient temperature as the default for fugitive sources and 162 degrees F as the default for stack, which were thus used here.

The specific release characteristics for each of the 76 facilities used in this assessment can be

found in a separate memorandum.[10]

3.2.3 Environmental Setting

Data on the location of facilities and/or emissions points were available for all facilities. These locations were confirmed using aerial photographs of facilities based on address. The classification of the setting as rural or urban is required for dispersion modeling and is rarely identified by existing data sources, so we examined a map of the location of each facility and conducted a qualitative determination about the surrounding structure and asphalt density (based on a simplified version of EPA's definitions of urban and rural in Guideline on Air Quality Models (40 CFR Part 51, Appendix W)).

Discussion of models, data and assumptions associated with source characterization

The database of facilities is thorough, including all facilities in the TRI at the time of data collection. Considering the TRI reporting threshold of 10,000 pounds per year (5 tpy), we conclude that the database includes all major sources (EtO use $\geq$ 10 tpy) and a significant number of area sources (EtO use < 10 tpy), particulary the higher-emitting area sources.

We also conclude that the emissions estimates are of high quality. Although we are not certain of the methods of emissions estimation in most cases (the MACT standards do not require continuous emissions monitoring), it is likely that emissions were estimated using a mass-balance approach. This approach is appropriate for this source category because the sterilization process is relatively simple, EtO is the only HAP, and no chemical transformation occurs during the process. The sum of the emissions for each facility in the database compares well (within 3 percent) to an emissions estimate based on mass balance and the known usage of EtO by the entire industry. While this comparison does not address the accuracy of the emissions estimate of an individual facility, it does support our estimate for the entire source category.

Source release parameters were available for some facilities from the NEI and from the industry. In cases where no data were available, we used defaults that were based on the data that were available. The use of defaults introduces uncertainties into modeling and calculating risks because the default values may not represent the actual conditions at a source. However, we conclude that there would be no bias introduced by the defaults because the actual values could be higher or lower than the default values. Facility location data were available from the TRI and NEI. Actual emission point locations could vary from these, but we conclude that it would not introduce bias because the actual locations may be nearer or farther from the receptor.

3.3 Environmental Fate and Transport Modeling

As discussed above, EtO is a gaseous volatile organic compound which is not expected to

[10] A. Koppel, *op. cit.*

be persistent or bioaccumulative. Therefore, this assessment focuses on the estimation of ground-level air concentration. We conducted two separate dispersion modeling activities to address chronic long-term exposures and acute short-term exposures.

3.3.1 Dispersion Modeling for Chronic Exposures

We selected the EPA Human Exposure Model - Screen (HEM-Screen)[11] for the chronic portion of the residual risk assessment. The HEM-Screen model contains (1) an atmospheric dispersion model with meteorological data, and (2) U.S. Bureau of Census population data for 2000 at the census block level. The number of people within a census block varies, but averages about 40 people.

The HEM-Screen's dispersion model is a Gaussian model (based on the Industrial Source Complex Long Term model, ISCLT2) that has been simplified to improve computational efficiency. Necessary source-related inputs include map coordinates, release heights, exit velocities, stack diameters, temperatures, and annual emission rates. For simplicity, all of the emissions from a source were assumed to originate from a single point (the centroid of the plant site). For this source category, this assumption is not likely to introduce significant uncertainty because the emission points are typically located in the same building or in adjacent buildings.

Specifying the latitude and longitude of the source in HEM-Screen calls the stability array (STAR) summary from the nearest meteorological station for use in the dispersion algorithm. The STAR data are standard climatological frequency-of-occurrence summaries formulated for use in EPA models (obtained from the National Climatic Center, Asheville, NC). A STAR summary is a joint frequency-of-occurrence of wind speed, atmospheric stability, and wind direction, reflecting 5 years of data for 348 U.S. sites. The model produces polar coordinate receptor grid points consisting of 10 downwind distances (extending from 100 or 200 meters to 50 kilometers[12]) located along each of 16 radials. The dispersion model estimates ambient ground-level concentrations for each of the 160 receptor locations on this grid. The model estimates the annual average concentration at these receptor locations which are then used to interpolate for specific locations of an exposed population. The model, therefore, supports the estimation of a maximum off-site ground-level concentration in addition to concentrations specific to an exposed population.

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[11] Supporting documentation is available through the EPA OAQPS *Human Exposure Modeling - Human Exposure Model (HEM)* website at: http://www.epa.gov/ttn/fera/data/human/hemusers-new.pdf.

[12] Fifty kilometers is the nominal distance to which EPA considers most steady-state Gaussian plume models, such as ISCLT2, to be applicable.

We also used a more refined model, HEM-3[13], to model facilities with individual lifetime cancer risk estimates greater than 50 in a million from the HEM-Screen modeling. The HEM-3 model is similar to HEM-Screen in that it is a steady-state Gaussian plume model, but it has some significant differences. The main differences between HEM-3 and HEM-Screen that are relevant to the assessment performed for this source category are:

- HEM-3 estimates cancer risks and exposures, as well as acute and chronic noncancer risks and exposures. HEM-Screen focuses mainly on cancer risks and exposures;
- HEM-3 uses the Industrial Source Complex Short Term model, ISCLT3, and hourly meteorological data whereas HEM-Screen uses ISCLT2 and the frequency-of-occurrence data described above; and
- Both HEM-3 and HEM-Screen calculate risks for individual census blocks, but the two models use different methods for the blocks closest to the facility. The HEM-3 model estimates pollutant concentrations at the census block centroid, whereas HEM-Screen interpolates between receptors on the polar grid to estimate concentration at census block centroids.

In most cases, fenceline data were not available for this source category. Therefore, we used 100 meters as a default value for the first downwind distance at which we modeled ground-level concentrations for the chronic portion of the risk assessment. We have data indicating that fenceline distances for some sources are shorter than 100 meters, which may affect the estimation of maximum offsite concentration. However, the distance to residences (specifically, census block centroids) is the relevant distance for the chronic risk assessment. Attachment 1 shows the effect of the first downwind receptor distance on maximum individual lifetime cancer risk. There are only three facilities where the highest risk occurs at a different census block when the first downwind distance is 20 meters instead of 100 meters, and the risk is not significantly different in these cases. Therefore, 100m as the first downwind receptor distance is reasonable and unlikely to significantly underestimate chronic exposure concentrations or risks.

Discussion of models, data, and assumptions associated with air quality modeling

The use of HEM-Screen and HEM-3, as used for this risk assessment, introduces uncertainties into the results of the assessment. The models include assumptions regarding model algorithms, meteorology, geography, deposition, chemical fate and transport, terrain and building downwash effects, and other components of the models, and there are uncertainties inherent in those assumptions. In the models, meteorologic data are pulled from the built-in set of data for the weather station nearest the source. These data may not be representative of the weather in the area around the source if the weather station is far away or if there are deviations in the weather pattern estimates from the site-specific patterns. Fate and transport characteristics

[13] Supporting documentation is available through the EPA OAQPS *Human Exposure Modeling - Human Exposure Model (HEM)* website at: http://www.epa.gov/ttn/fera/data/hem/hem3_users_guide.pdf

are assumed to be the same for all HAPs (e.g., no chemical transformation to more or less toxic substances; all chemicals assumed to disperse in the same way) and all HAPs are modeled as gases (e.g., no accounting for deposition of pollutants). We do not believe that these assumptions introduce significant uncertainty in this assessment because EtO is a volatile gas that is unlikely to deposit, the half-life in air is long enough (days) so as not to affect modeled concentrations within 50 kilometers of a source, and even if some transformation occurs, the reported transformation products (including formaldehyde and acetaldehyde) either are not HAPs or are less toxic than EtO. More discussion on the limitations of HEM-Screen can be found in a separate memorandum.[14]

A number of studies have been conducted to examine model accuracy, and these studies indicate that: (1) Models are more reliable for estimating longer time-averaged concentrations than for estimating short-term concentrations at specific locations; and (2) the models are reasonably reliable in estimating the magnitude of highest concentrations occurring sometime, somewhere within an area.[15] Errors in highest estimated concentrations of ±10 to 40 percent are typical and well within the factor-of-two accuracy that has long been recognized for these models.

3.3.2 Chronic Exposure Estimation

The estimated annual average concentration at a person's residential location is used as a first approximation or surrogate for their exposure. This is based on the assumption that people spend a majority of their time at home. It is also assumed that the ambient concentration is a surrogate for their exposure and is based on evidence that for many pollutants the long-term indoor concentration closely approximates that found indoors due to penetration and ventilation.

The census data used in HEM-Screen and HEM-3 are at the census block level, which is the smallest defined population unit available. For assessment of population exposures using HEM-Screen and HEM-3, all people within a block are assumed to reside at the centroid of the block (i.e., the area-weighted geographical center of the block). The census block centroid location was used as a surrogate for actual receptor locations and should not bias the results of the assessment because actual residences may be closer to or farther from the source relative to the census block centroid.

Discussion of models, data, and assumptions associated with chronic exposure modeling

In using HEM-Screen and HEM-3, a major assumption of this analysis is that modeled

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[14] *Using the Human Exposure Model (Version 2000) for Residual Risk Tests and Other Risk Screening Assessments.* Memorandum to Maria Pimentel, U.S. Environmental Protection Agency, from Darcie Smith and Phil Norwood, EC/R Incorporated. September 2003.

[15] 40 CFR Part 51, Appendix W.

ambient concentrations at the residential census block centroid are an adequate surrogate for long-term individual exposures. Indoor concentrations of EtO emitted from these facilities will be lower than outdoor levels, as EtO is a relatively reactive pollutant. However, the extent to which these levels are lower depends on a variety of factors, such as the degree and type of ventilation (e.g., air conditioning vs. open windows) and the type of indoor environment (e.g., schools versus residences). Ideally, we would like to model individuals as they move through their communities and undertake different activities, but such modeling is time- and resource-intensive and can only capture a portion of the uncertainty associated with the full range of human activities. Exposure modeling performed as part of the 1999 National Air Toxics Assessment indicates that (at the census tract level) exposure concentrations may be 10 to 15 percent lower than ambient exposure concentrations. In general, we can expect long-term exposures will be overstated for high-end estimates (as most individuals will not spend all their time at their highly affected residences), but may understate the total population exposed (as some individuals living outside the modeled area may regularly commute into the area for work or school).

When looking at long-term, or even lifetime, exposures, it should be noted that relatively few people in the United States reside in one place for their entire lives. For the purposes of this assessment, cancer risk estimates are based on a lifetime exposure at the 2000 census-identified place of residence. While it is impossible to know how this assumption affects the risk experienced by an particular individual (as people can move into higher- or lower-risk areas), we expect this assumption will overstate the exposure to those most exposed (i.e., people already living in high exposure areas are unlikely to move to yet higher exposure areas). However, this assumption will also tend to underestimate the total number of people exposed and population risk (i.e., "incidence") because population levels are generally increasing.

Finally, not all individuals experience the same degree of exposure or internal dose of a given pollutant due to individual-specific parameters such as weight, gender and age. While the health benchmarks used in the analysis crudely account for sensitive populations, a prototypical human (e.g., body weight, ventilation rate) is used to define the benchmark. Because of the variability of these parameters in the population, this factor will result in a degree of uncertainty in the resulting risk estimate.

3.3.3 Dispersion Modeling for Acute Exposures

As a screening assessment of the potential for public health impacts associated with short-term emissions from EtO commercial sterilization sources, a hypothetical 1-hour exposure scenario was constructed from the data available for the chronic assessment. This assessment is constructed in a conservative manner such that the conclusion drawn may be either that there is negligible potential for impacts associated with short-term emissions situations, or that a more sophisticated analysis is needed.

The SCREEN3 air dispersion model was used. The SCREEN3 model is a screening-

level Gaussian dispersion model used to predict maximum 1-hour impacts immediately downwind (plume center-line) from a source.[16] The SCREEN3 model examines a range of stability classes and wind speeds to identify the "worst case" meteorological conditions, which is the combination of wind speed and stability that results in the maximum ground level concentration. Considering engineering knowledge of the process, the release characteristics for the hypothetical source modeled were selected from site-specific source data with the objective of constructing a release scenario that would produce maximum estimates of potential short-term exposure levels. The SCREEN3 model was then used to predict worst-case 1-hour concentrations at locations from 100 meters to 5000 meters downwind from the source. Parameter values used for the SCREEN3 model run are included in Attachment 2.

One hundred meters is the default value in the SCREEN3 model for the first downwind distance at which ground-level concentrations are modeled, and it is the value we used for the acute portion of the risk assessment. Although we have data indicating there are fenceline distances shorter than 100 meters, we conclude that it is appropriate to use the 100 meter distance because it is unlikely that a person would be exposed for one hour at the shortest fenceline distance in the worst-case meteorological conditions. Further, a SCREEN3 modeling run using the same parameters of the hypothetical source but with discrete downwind distances from 10 to 100 meters resulted in a maximum concentration that exceeded the 100-meter concentration by less than 20 percent.

The highest of the modeled concentrations (at or beyond 100 meters) was considered in relation to the available 1-hour reference values pertinent to such an exposure scenario, which included Emergency Response Planning Guidelines developed by the American Industrial Hygiene Association, interim Acute Exposure Guideline Levels developed by the National Advisory Committee, and the Level of Concern (or IDLH/10) per the Agency's *Technical Guidance for Hazards Analysis*.[17]

Discussion of models, data, and assumptions in acute dispersion and exposure modeling

In many ways, modeling acute exposures is more difficult than modeling chronic exposures in that the purpose is usually not to estimate exposure over a typical hour, but rather to estimate exposures where several factors conspire to result in unusually high short-term

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[16] A relatively large degree of conservatism is incorporated in the modeling procedure to provide reasonable assurance that maximum concentrations will not be underestimated *(Screening Procedures for Estimating the Air Quality Impacts of Stationary Sources, Revised*, USEPA 1992). The SCREEN3 model contains a set of generic meteorological conditions (wind speed and atmospheric stability combinations) that are designed to predict maximum one hour ground level conditions at user specified downwind distances (*SCREEN3 Model Users Guide* USEPA 1995).

[17] *Technical Guidance for Hazards Analysis*. EPA-OSWER-86-0001. U.S. Environmental Protection Agency, Federal Emergency Management Agency, U.S. Department of Transportation. December 1987.

exposures. The approach used here is to utilize high-end estimates of various parameters (short-term emission rates, "worst-case" meteorological conditions) to determine an estimate of how high acute exposure might be. While the joint probability of all of these factors happening at any given time is quite low, the purpose here is not to estimate average acute exposures, but to capture rare events that may still affect public health.

3.4 Ethylene Oxide Dose-Response Information

The Integrated Risk Information System (IRIS), EPA's clearinghouse for toxicity information, is our primary source of health effects information. The URE, CSFo, and RfC/RfD values presented in IRIS are consensus values developed by EPA workgroups. However, IRIS does not contain URE, CSFo, and RfC/RfD values for all HAPs, including EtO. Many HAPs have dose-response assessments developed by several environmental agencies or organizations. Because different organizations developed these assessments at different times for purposes that were similar but not identical, it is inevitable that the results are not totally consistent. In some cases interagency differences are substantial, especially between assessments that were done many years apart. In lieu of chemical-specific decisions to resolve these discrepancies, EPA has applied a consistent default priority scheme to the sources of chronic dose-response information.

Hazard identification and dose-response assessment information for chronic exposure was obtained from various sources and prioritized according to (1) consistency with EPA risk assessment guidelines and (2) level of independent review received. The prioritization process is aimed at incorporating into our assessments the best available science with respect to dose-response information. The following four sources were used to select a URE and RfC (or similar values) for use in this assessment (listed in hierarchical order):

- IRIS - EPA's Integrated Risk Information System (U.S. EPA, 2004).
- ATSDR - the Agency for Toxics Substance and Disease Registry's Minimal Risk Levels (ATSDR, 1999a).
- California EPA's Reference Exposure Levels (RELs)(CalEPA, 1999b) and Unit Risk values. (CalEPA, 1999a)
- HEAST - the Health Effects Assessment Tables (U.S. EPA, 1997c).

In residual risk assessments, draft RfCs, RfDs, and UREs under development for the EPA IRIS process are given priority over existing IRIS files on a case-by-case basis, where such assessments have already undergone external peer review and subsequent revision. Consistent with EPA's commitment to sound science, we do not include draft assessments that have not undergone peer review. This practice conforms to the 1996 changes to the IRIS review process requiring such external peer review. Where externally peer reviewed IRIS draft assessments are not available to supersede existing EPA IRIS values, current IRIS information is used. For substances lacking current IRIS assessments, ATSDR chronic MRLs (available only for noncancer effects) receive next preference, followed by CalEPA chronic RELs and UREs. Where ATSDR or CalEPA assessments do not exist, HEAST assessments may be used.

Although no formal prioritization scheme has been developed for the use of acute values in residual risk assessments, the hazard assessment requirements of the Risk Management Program regulation intended to protect the public from accidental releases under CAA section 112(r) include a hierarchy for the consideration of three of the acute reference values included in this analysis.[18] Recognizing variations in the methodologies used in their derivation, the AEGL values are considered preferable to the ERPG values, which are considered preferable to the Levels of Concern for purposes of evaluating potential hazard associated with accidental release conditions. While there may inherent differences between hazard assessment for accidental release conditions and short-term elevations in concentration relevant to residual risk assessments, this hierarchy is considered relevant here because our short-term exposure scenario is similar to an accidental release in that it is expected to occur infrequently, if at all.

A flexible, transparent approach has been employed for evaluation of the potential for acute impacts which is intended to utilize all the available relevant values. The acute scenario developed for the initial level of assessment is designed to be a worst-case scenario. To evaluate the potential for harm associated with this scenario, all the available acute reference values are displayed with it in a comparative manner. The availability of each of the types of reference values is noted along with the relationships among the reference values and with the projected acute exposure. Where the projected acute exposure is similar or greater than any of the reference values, that is noted along with any salient aspects of the projected exposure and the reference value. In recognition of the lack of all acute reference values for all pollutants, this is considered the best, most transparent approach. It is noted, however, that the lack of the same types of reference values for all pollutants assessed injects an inherent inconsistency across pollutants in the robustness of this evaluation.

The use of multiple acute benchmarks gives the reader some notion of the uncertainty in this part of the analysis, though the differences in these values often represents the varying purposes for which these were developed. The use of acute exposure benchmarks is a somewhat less-well-developed program within EPA (relative to the use of chronic benchmarks); therefore a greater degree of uncertainty is associated. The EPA is developing an Acute Reference Exposure (ARE) value for EtO, which could be lower than the acute benchmarks used in the risk assessment. The schedule for the development of the EtO ARE can be found at: http://cfpub.epa.gov/iristrac.

Table 2 presents chronic and acute dose-response values for EtO. These values are described in more detail on EPA's Air Toxics Website at http://www.epa.gov/ttn/atw/toxsource/summary.html.

[18] 61 FR 31667-31730.

Table 2. Ethylene Oxide Dose-Response Values

Chronic		Acute				
URE[a] (per µg/m^3)	RfC[b] (µg/m^3)	AEGL-2[c] (µg/m^3)	AEGL-3 (µg/m^3)	ERPG-2[d] (µg/m^3)	ERPG-3 (µg/m^3)	IDLH/10[e] (µg/m^3)
8.8 E-05[f]	30	81,000	360,000	90,000	900,000	140,000

[a]Unit risk estimate (URE): The upper-bound excess lifetime cancer risk estimated to result from continuous exposure to an agent at a concentration of 1 µg/m^3 in air. The interpretation of unit risk would be as follows: if URE = 1.5 x 10-6 µg/m^3, up to 1.5 additional people are expected to develop cancer in their lifetime per 1,000,000 people exposed continuously for a lifetime to 1 µg of the chemical per m^3 of air.
[b]Rather than an EPA RfC, this value is a Reference Exposure Level (REL) developed by California EPA. Similar to EPA's RfC, the REL is defined by California EPA as "an airborne level that would pose no significant health risk to individuals exposed to that level for an indefinite period of time".
[c]Acute Exposure Guideline Level (AEGL). The AEGLs for a substance take the form of a matrix, with separate ambient levels above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic, non-sensory effects (AEGL-1), irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape(AEGL-2), and life-threatening health effects or death (AEGL-3).
[d]Emergency Response Planning Guideline (ERPG). The ERPGs represent concentrations for exposure of the general population for up to 1 hour associated with effects expected to be mild or transient (ERPG-1), irreversible or serious (ERPG-2), and potentially life-threatening or lethal (ERPG-3).
[e]IDLH: Immediately dangerous to life or health.

The National Institute of Occupational Safety and Health (NIOSH) also recommends a 10 minute ceiling value of 5 ppm (9 mg/m^3).[19] While concerns about mutagenicity and its relationship to both cancer and reproductive effects were recognized in the decision to set a ceiling value for occupational exposures which commonly are experienced in burst-like episode, the magnitude of the value is not quantitatively based on risk of these effects. Rather, the quantitative basis of this ceiling value derives primarily from analytical limits of detection or technological feasibility. In implementing this value as a 15 minute time weighted average excursion limit - along with an 8 hour Permissible Exposure Limit (PEL)- the Occupational Safety and Health Administration focused its discussion of associated risk benefits on the rationale that it would yield a reduction (albeit unquantifiable) in worker daily time weighted average exposures, and associated lifetime cancer risk below that which might be associated with the 8 hour PEL alone.[20] Given this background on its quantitative basis, and implementation of this short-term value as an occupational safety technique rather than as a reference value intended for environmental risk assessment applications, it is not presented along with the acute values relied upon for this assessment.

3.4.1 Carcinogenicity of Ethylene Oxide

Because Agency chronic dose-response values for EtO are not currently available, a dose-response value from the California Environmental Protection Agency (CalEPA) was used in the

[19] NIOSH. 2004. Appendix of NIOSH Pocket Guide to Chemical Hazards, Government Printing Office. http://www.cdc.gov/niosh/npg/npg.html

[20] USDOL. Occupational Exposure to Ethylene Oxide. Federal Register, Volume: 53, Issue: 66, Page 11515 (53 FR 11414). April 6, 1988.

cancer risk assessment for this source category.[21] The CalEPA unit risk estimate describes the excess cancer risk associated with an inhalation exposure to a concentration of 1 $\mu g/m^3$ of EtO. This estimate was determined using a linearized 95% upper confidence interval. In other words, there is a 95% probability that the actual unit risk is lower than the CalEPA value, and only a 5% probability that it is higher. An EPA assessment for EtO is currently under way. The EPA has not yet completed a full evaluation of the data on which it will determine an EPA cancer unit risk estimate for EtO. The schedule for EPA assessment of EtO can be found at: http://cfpub.epa.gov/iristrac.

3.4.2 Effects Other Than Cancer Associated With Ethylene Oxide

Adverse effects other than cancer observed in workers exposed to ethylene oxide at low levels for several months or years include irritation of the eyes, skin, and mucous membranes and effects on the functioning of the nervous system. There is also some evidence that exposure to ethylene oxide can cause an increased rate of miscarriages in female workers exposed to ethylene oxide.[22] Studies in animals have shown that breathing ethylene oxide at high levels can interfere with their ability to reproduce and, at lower levels, can have adverse effects on the nervous system.[23]

The CalEPA based the derivation of the EtO chronic REL on the finding of neurotoxicity in a subchronic inhalation study of mice.[24] The REL is the concentration at or below which adverse health effects are not likely to occur. The REL was derived from the no-observed-adverse-effect level (NOAEL) from the study and has a cumulative uncertainty factor of 100.

The strengths of the REL for EtO include the use of an animal study with both a LOAEL and a NOAEL and the use of an endpoint seen in both animals and humans. Major areas of uncertainty are the short time-frame of the key study, the lack of an appropriate human study, and the limited number of developmental toxicity studies.

Acute exposure of workers to ethylene oxide at the odor detection level has been associated with eye and upper respiratory tract irritation, as well as effects on the nervous system. Acute exposure at somewhat higher levels has also been associated with hematologic effects and

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[21] http://www.oehha.ca.gov/air/cancer_guide

[22] ATSDR. 1990. Toxicological Profile for Ethylene Oxide. TP-90-16. Agency for Toxic Substances and Disease Registry. http://www.atsdr.cdc.gov/toxprofiles/tp137.html

[23] California Office of Environmental Health and Hazard Assessment. 2000. Determination of Noncancer Chronic Reference Exposure Levels Batch 2A December 2000. Chronic Toxicity Summary for Ethylene Oxide. http://www.oehha.ca.gov/air/chronic_rels/pdf/75218.pdf

[24] Snellings WM, Weil CS, and Maronpot RR. 1984. A subchronic inhalation study on the toxicologic potential of ethylene oxide in $B6C3F_1$ mice. Toxicol. Appl. Pharmacol. 76:510-518

more severe effects on the central nervous system. Additionally, human studies have provided suggestive evidence of reproductive toxicity.[25] Experimental animals exposed acutely to ethylene oxide showed evidence of eye and respiratory tract irritation, effects on the central and peripheral nervous system, and evidence of reproductive, developmental and genetic toxicity.[26] The AEGL-2 values were based on a developmental toxicity study in rats[27] and the application of a cumulative uncertainty factor of 100 to the exposure concentration associated with a decrease in fetal weight. An AEGL-1 was not derived because the odor threshold and concentrations causing mild sensory irritation would be above the AEGL-2 levels.

4.0 Results and Discussion

4.1 Human Health

The estimated ambient concentration at each census block is presumed representative of the air breathed continuously throughout a lifetime (70 years) by people living in that block. The census block concentration estimates were (1) multiplied by the EtO URE to obtain an estimate of individual lifetime cancer risk for each block, and (2) divided by the chronic RfC to quantify the noncancer hazard quotient (HQ) for each block. Finally, potential annual population impact was quantified by multiplying the individual lifetime cancer risk estimates for each census block by the number of people living in that block, dividing by 70, and then summing the individual block values across census blocks. These calculations were performed for every census block within 50 kilometers of the source.

Table 3 summarizes the results of the chronic assessment. There are 44 sources with census block estimates that exceed 1 in 1 million individual lifetime cancer risk, 19 sources with census block estimates that exceed 10 in 1 million individual lifetime cancer risk, and no sources predicted to exceed 100 in a million individual lifetime cancer risk at a census block centroid. Approximately 250,000 people live in areas where the individual lifetime cancer risk estimates are greater than 1 in 1 million, 7,300 people live in areas where the individual lifetime cancer risk estimates exceed 10 in 1 million, and no people live in areas where individual lifetime cancer risk estimates exceed 100 in 1 million. There are no sources with census block estimates that exceed a chronic HQ of 1 (the maximum predicted HQ from any source is 0.03). The HEM-Screen input and output files for all 76 sources modeled are presented in Attachments 3 through 6. Attachment 7 contains the HEM-3 results for the facilities with HEM-Screen cancer risk greater than 50 in a million. The HEM-Screen input and output files for only the major sources

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[25] ATSDR, *op. cit.*

[26] ATSDR, *op. cit.*

[27] Snellings, W. M.; Maronpot, R. R.; Zelenak, J. P.; Laffon, C. P. 1982. Teratology study in Fischer 344 rats exposed to ethylene oxide by inhalation. *Toxicology of Applied Pharmacology.* 64:476-481.

are presented in Attachments 8 through 11.

Table 3. Summary of Chronic Risk Assessment Results for 76 Modeled Sources

Highest census block individual lifetime cancer risk	90 in a million
Number of sources with a census block individual lifetime cancer risk at or above 100 in a million	0
Number of sources with a census block individual lifetime cancer risk at or above 10 in a million	19
Number of sources with a census block individual lifetime cancer risk at or above 1 in a million	44
Number of people residing in census blocks for which individual lifetime cancer risk is at or above 100 in a million	0
Number of people residing in census blocks for which individual lifetime cancer risk is at or above 10 in a million	7,200
Number of people residing in census blocks for which individual lifetime cancer risk is at or above 1 in a million	250,000
Potential population impact (cancer cases/year)	0.04
Total population within 50 km of any source	99 million
Chronic noncancer results	
Highest census block HQ	0.03

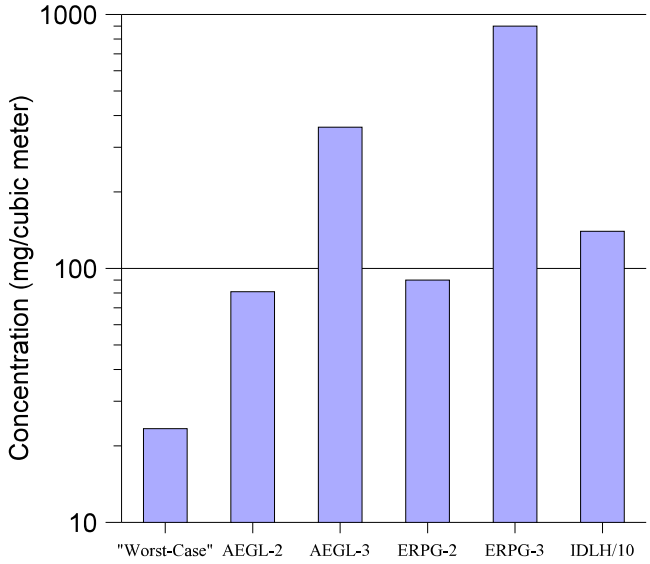
The cancer risk assessment indicates that no source poses a lifetime cancer risk greater than 100 in a million, while approximately half of the modeled sources pose a lifetime cancer risk greater than 1 in a million. The chronic noncancer assessment indicated that no source emitted EtO in quantities that resulted in exposures that approached the inhalation reference concentration, indicating that chronic noncancer effects are unlikely to occur.

Figure 1 illustrates the relationship of the "worst-case" 1- hour concentration estimate derived for this source category to the available acute reference values. As can be seen from the figure, three types of acute reference values are available: interim AEGLs, ERPGs and the IDLH/10. The worst-case concentration estimate is approximately one-third of the lowest of these reference values (the 1-hour interim AEGL-2 value).[28] Details of the inputs used and

[28] The interim AEGL-2 value was derived from the exposure resulting in reduced fetal weight in rats. This interim AEGL-2 value reflects consideration of EPA comment on an earlier draft value that was not based on developmental effects. An AEGL-1 value has not been derived because the odor

results of the acute assessment are presented in Attachment 2.

Figure 1. Short-Term Concentration Comparisons



4.2 Major sources of Uncertainty

No quantitative uncertainty analysis has been performed for this risk assessment, but we can anticipate what are likely to account for the most significant sources of uncertainty in the overall assessment. In the area of source and emissions characterization, we believe that the source coverage and EtO emissions data are relatively strong. For source release characteristics, the defaulting that was necessary for missing data introduces uncertainty, but we conclude that there should be no bias introduced.

The exposure-related uncertainties are generally well documented and are consistent with other residual risk analyses. The assumption of an individual exposed to EtO at their home for 70-years is generally a conservative one; few individuals spend their lifetimes at one residence, to say nothing of indoor/outdoor concentration gradients and commuting patterns. In addition, there are uncertainties related to dispersion modeling, but this is unlikely to create uncertainty larger than a factor of 2.

Generally speaking, cancer UREs are conservative upper-bound estimates of risk. This is

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threshold and concentrations causing mild sensory irritation are higher than the AEGL-2.

tempered somewhat in that the response of potentially sensitive populations (such as children, individuals with auto-immune disorders) are not explicitly modeled. Chronic noncancer benchmarks are designed to identify a level where we do not expect adverse effects in the general population, but this does not necessarily mean that exposures above the benchmarks are certain to cause effects. Given the roughly order of magnitude uncertainty in RfCs and related measures, this does not mean absolutely zero risk either. Finally, the acute benchmarks used in this analyses were adapted for use from other policy needs. Given the varying applications for which these benchmarks were designed (and the inherent uncertainties in their derivation), significant uncertainties remain here as well. Ongoing EPA assessment of EO cancer, noncancer and acute benchmarks should serve to reduce these uncertainties somewhat.

Conclusions

While the potential for acute health effects, chronic non-cancer, and ecological effects appear to be low for this source category, the estimated cancer risks are above one in one million for a significant number of the modeled sources. This analysis is not exhaustive and it is not intended to be. We have used (1) the best emissions data currently available to us, (2) reasonable dispersion models, and (3) exposure locations where receptor populations currently reside. A number of assumptions, modeling choices, and uncertainties are associated with the assessment being presented here. While some of these will tend to overestimate the predicted risk, others will tend to underestimate the predicted risk. On balance, using our scientific judgment and risk assessment experience, we believe the predicted results are health-protective, meaning the predicted risk estimates are likely higher than those which would be expected to actually occur in the exposed population.

cc: Dave Markwordt

Attachments

Attachment 1: Effect of First Downwind Receptor Distance on Maximum Individual Lifetime Cancer Risk

	Distance From Source to First Receptor						
	20m		100m		200m		
Facility	Pop	Risk[a]	Pop	Risk[a]	Pop	Risk[a]	Comments
ETO-18	94	3.08e-04	94	1.48e-04	34	6.85e-05	
ETO-19	3	9.68e-05	3	9.37e-05	3	9.68e-05	
ETO-8	3	7.64e-05	3	7.37e-05	3	7.64e-05	
ETO-27	39	6.90e-05	39	6.61e-05	39	6.90e-05	
ETO-4	49	6.37e-05	49	6.12e-05	49	4.29e-05	
ETO-5	54	6.37e-05	54	6.07e-05	54	6.37e-05	
ETO-57	16	3.19e-05	15	1.31e-05	8	6.36e-06	Census block difference between 20m and 100m distances
ETO-24	1	2.44e-05	1	2.35e-05	1	2.44e-05	
ETO-11	26	2.33e-05	26	2.23e-05	26	2.33e-05	
ETO-22	65	2.17e-05	65	2.14e-05	65	2.17e-05	
ETO-118	28	1.73e-05	28	1.64e-05	28	1.73e-05	
ETO-42	181	1.68e-05	181	1.60e-05	181	1.68e-05	
ETO-12	4	1.66e-05	4	1.66e-05	4	1.66e-05	
ETO-13	7	1.50e-05	7	1.50e-05	7	1.50e-05	
ETO-14	158	1.24e-05	158	9.75e-06	158	1.24e-05	
ETO-91	17	1.23e-05	17	1.23e-05	17	1.23e-05	
ETO-10	3	1.18e-05	3	1.19e-05	3	1.19e-05	
ETO-29	28	1.06e-05	28	1.12e-05	28	1.06e-05	
ETO-3	107	9.86e-06	107	9.86e-06	107	9.86e-06	
ETO-1	322	7.37e-06	322	6.91e-06	322	7.37e-06	
ETO-48	22	6.88e-06	22	5.21e-06	35	4.62e-06	
ETO-9	2	6.69e-06	2	6.69e-06	2	6.69e-06	
ETO-44	16	6.59e-06	6	5.93e-06	16	6.67e-06	Census block difference between 20m and 100m distances
ETO-36	153	5.91e-06	153	5.91e-06	153	5.91e-06	
ETO-35	3	4.89e-06	3	4.76e-06	3	4.89e-06	
ETO-15	1	4.80e-06	1	4.75e-06	1	4.75e-06	
ETO-7	171	4.11e-06	171	3.62e-06	171	4.11e-06	
ETO-20	92	4.02e-06	92	3.22e-06	92	1.33e-06	
ETO-23	111	3.85e-06	111	3.85e-06	111	3.85e-06	
ETO-67	185	3.64e-06	185	3.45e-06	185	2.94e-06	
ETO-61	28	2.36e-06	28	2.21e-06	28	2.19e-06	
ETO-63	16	2.21e-06	16	2.12e-06	16	2.21e-06	
ETO-37	53	2.08e-06	53	2.17e-06	53	2.08e-06	
ETO-26	3	2.02e-06	3	2.01e-06	3	2.02e-06	
ETO-59	926	1.87e-06	926	1.84e-06	926	1.87e-06	
ETO-62	3	1.82e-06	3	1.78e-06	3	1.82e-06	
ETO-49	9	1.59e-06	9	1.55e-06	9	1.59e-06	

ETO-58	51	1.55e-06	51	1.39e-06	51	1.27e-06	
ETO-55	9	1.54e-06	9	1.03e-06	9	4.37e-07	
ETO-33	48	1.48e-06	48	1.48e-06	48	1.48e-06	
ETO-45	35	1.46e-06	35	1.47e-06	35	1.46e-06	
ETO-38	25	1.44e-06	25	1.14e-06	25	1.44e-06	
ETO-56	1,050	1.08e-06	1,050	9.85e-07	1,050	1.08e-06	
ETO-60	71	9.45e-07	71	9.47e-07	71	9.45e-07	
ETO-51	11	9.14e-07	11	8.29e-07	11	9.14e-07	
ETO-108	35	8.64e-07	35	4.29e-07	35	1.27e-07	
ETO-2	4	7.18e-07	4	7.18e-07	4	7.18e-07	
ETO-52	8	6.49e-07	8	6.46e-07	8	3.52e-07	
ETO-41	11	6.35e-07	11	6.35e-07	11	6.35e-07	
ETO-75	19	6.32e-07	19	6.20e-07	19	6.32e-07	
ETO-72	61	6.18e-07	61	5.70e-07	61	4.22e-07	
ETO-68	479	6.11e-07	479	5.97e-07	479	6.11e-07	
ETO-47	462	5.67e-07	462	5.67e-07	462	5.67e-07	
ETO-40	70	5.46e-07	70	5.46e-07	70	5.46e-07	
ETO-66	150	5.25e-07	150	5.21e-07	150	5.25e-07	
ETO-71	6	5.23e-07	6	4.53e-07	6	3.51e-07	
ETO-65	1	4.84e-07	1	4.64e-07	1	4.84e-07	
ETO-39	104	4.19e-07	104	3.94e-07	104	4.19e-07	
ETO-50	535	3.50e-07	535	3.50e-07	535	3.50e-07	
ETO-53	2	3.31e-07	2	3.31e-07	2	3.31e-07	
ETO-99	68	3.20e-07	68	3.01e-07	68	3.20e-07	
ETO-25	22	2.43e-07	22	2.27e-07	22	2.43e-07	
ETO-116	156	2.11e-07	156	2.11e-07	156	2.11e-07	
ETO-119	2	1.80e-07	2	1.81e-07	2	1.80e-07	
ETO-80	23	8.87e-08	23	8.17e-08	23	5.91e-08	
ETO-64	69	4.19e-08	69	4.19e-08	69	4.19e-08	
ETO-43	87	3.80e-08	87	3.80e-08	87	3.80e-08	
ETO-69	49	3.32e-08	49	3.35e-08	49	3.32e-08	
ETO-70	522	2.82e-08	522	2.82e-08	522	2.82e-08	
ETO-32	5	1.13e-08	5	9.41e-09	5	1.13e-08	
ETO-74	2	1.08e-08	2	1.08e-08	2	1.08e-08	
ETO-77	80	6.74e-09	80	5.95e-09	80	6.74e-09	
ETO-46	105	3.27e-09	28	4.74e-09	105	3.00e-09	Census block difference between 20m and 100m distances
ETO-54	1	2.91e-09	1	2.91e-09	1	2.91e-09	
ETO-21		8.80e-43	343	2.37e-06	343	2.37e-06	In HEM-Screen, the only radii set that includes a 20m ring extends out to only 2000m, and there is no census block within 2000m
ETO-117		8.80e-43	49,300	8.80e-43	49,300	8.80e-43	

[a] Risk was estimated using HEM-Screen and does not reflect the more refined assessment of the higher-risk facilities. The purpose of this table is to show the relative effect of varying the distance from the source to the first modeled receptor.

Attachment 2: Acute assessment SCREEN3 run

```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

Ethylene Oxide Acute Assessment

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE            =        POINT
   EMISSION RATE (G/S)    =      5.00000
   STACK HEIGHT (M)       =       4.5700
   STK INSIDE DIAM (M)    =        .1000
   STK EXIT VELOCITY (M/S)=       1.4600
   STK GAS EXIT TEMP (K)  =     348.0000
   AMBIENT AIR TEMP (K)   =     293.0000
   RECEPTOR HEIGHT (M)    =        .0000
   URBAN/RURAL OPTION     =        RURAL
   BUILDING HEIGHT (M)    =        .0000
   MIN HORIZ BLDG DIM (M) =        .0000
   MAX HORIZ BLDG DIM (M) =        .0000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.


BUOY. FLUX =     .006 M**4/S**3;  MOM. FLUX =     .004 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

  DIST      CONC              U10M   USTK   MIX HT   PLUME   SIGMA   SIGMA
   (M)   (UG/M**3)   STAB   (M/S)   (M/S)    (M)   HT (M)   Y (M)   Z (M)  DWASH
-------  ----------  ----  -----   -----   ------  ------  ------  ------  -----
   100.   .2339E+05    4     1.0     1.0    320.0    5.00    8.20    4.65    NO
   200.   .1012E+05    4     1.0     1.0    320.0    5.00   15.56    8.50    NO
   300.    7303.       6     1.0     1.0  10000.0    8.96   11.30    5.76    NO
   400.    6919.       6     1.0     1.0  10000.0    8.96   14.69    7.16    NO
   500.    5966.       6     1.0     1.0  10000.0    8.96   18.01    8.49    NO
   600.    5031.       6     1.0     1.0  10000.0    8.96   21.27    9.77    NO
   700.    4241.       6     1.0     1.0  10000.0    8.96   24.49   11.00    NO
   800.    3623.       6     1.0     1.0  10000.0    8.96   27.66   12.04    NO
   900.    3130.       6     1.0     1.0  10000.0    8.96   30.80   13.04    NO
  1000.    2731.       6     1.0     1.0  10000.0    8.96   33.91   14.01    NO
  1100.    2414.       6     1.0     1.0  10000.0    8.96   36.98   14.87    NO
  1200.    2151.       6     1.0     1.0  10000.0    8.96   40.03   15.71    NO
  1300.    1932.       6     1.0     1.0  10000.0    8.96   43.06   16.52    NO
  1400.    1746.       6     1.0     1.0  10000.0    8.96   46.06   17.31    NO
  1500.    1588.       6     1.0     1.0  10000.0    8.96   49.05   18.07    NO
  1600.    1452.       6     1.0     1.0  10000.0    8.96   52.01   18.82    NO
  1700.    1334.       6     1.0     1.0  10000.0    8.96   54.95   19.56    NO
  1800.    1230.       6     1.0     1.0  10000.0    8.96   57.88   20.27    NO
  1900.    1139.       6     1.0     1.0  10000.0    8.96   60.79   20.97    NO
  2000.    1059.       6     1.0     1.0  10000.0    8.96   63.69   21.66    NO
```

2100.	991.1	6	1.0	1.0	10000.0	8.96	66.57	22.25	NO
2200.	930.1	6	1.0	1.0	10000.0	8.96	69.44	22.82	NO
2300.	875.3	6	1.0	1.0	10000.0	8.96	72.29	23.37	NO
2400.	825.7	6	1.0	1.0	10000.0	8.96	75.13	23.92	NO
2500.	780.6	6	1.0	1.0	10000.0	8.96	77.96	24.46	NO
2600.	739.6	6	1.0	1.0	10000.0	8.96	80.77	24.98	NO
2700.	702.0	6	1.0	1.0	10000.0	8.96	83.58	25.50	NO
2800.	667.6	6	1.0	1.0	10000.0	8.96	86.37	26.01	NO
2900.	636.0	6	1.0	1.0	10000.0	8.96	89.16	26.51	NO
3000.	606.8	6	1.0	1.0	10000.0	8.96	91.93	27.01	NO
3500.	495.1	6	1.0	1.0	10000.0	8.96	105.66	29.01	NO
4000.	414.9	6	1.0	1.0	10000.0	8.96	119.18	30.86	NO
4500.	354.8	6	1.0	1.0	10000.0	8.96	132.51	32.60	NO
5000.	308.4	6	1.0	1.0	10000.0	8.96	145.68	34.23	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 100. M:

100.	.2339E+05	4	1.0	1.0	320.0	5.00	8.20	4.65	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SUMMARY OF SCREEN MODEL RESULTS ***
****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	.2339E+05	100.	0.

Attachment 3: Cancer HEM-Screen input file for all sources

```
00076     ff  0.000088
Ethylene Oxide
ETO-1  EtO Source
175817 661801                    100002
H       206.212.1 5400 1.2  6.8 345
F        22.7 5.2 1001   0    0 293
Ethylene Oxide
ETO-2  EtO Source
402617 743004                    000005
F        46.5 5.2 1001   0    0 293
H        37.612.1 5400 1.2  6.8 345
F        46.5 5.2 1001   0    0 293
H        37.612.1 5400 1.2  6.8 345
H        37.613.7 5400 1.7   12 377
Ethylene Oxide
ETO-3  EtO Source
362132 922317                    100002
F        95.3 5.2 1001   0    0 293
H       907.212.1 5400 1.2  6.8 345
Ethylene Oxide
ETO-4  EtO Source
414452 875638                    000003
F      2848.6 7.6 1001   0  9.1 294
H       127.018.3 5400 2.5100.6 311
H       108.9 9.1 5400 0.2 30.5 311
Ethylene Oxide
ETO-5  EtO Source
425512 721810                    100003
F        11.0 5.2 1001   0    0 293
F      1644.7 5.2 1001   0    0 293
H        46.312.5 5400 1.2  6.8 345
Ethylene Oxide
ETO-7  EtO Source
422020 875347                    000003
H       362.918.3 5670 0.3 30.5 311
H       154.215.2 5670 0.3 44.2 336
H       154.215.2 5670 0.3 44.2 336
Ethylene Oxide
ETO-8  EtO Source
333636 835010                    000002
F      4100.5 5.2 1001   0    0 293
H      1458.819.8 5400 1.4 17.8 500
Ethylene Oxide
ETO-9  EtO Source
421958 880750                    100001
H       884.7 4.9 5400 0.1 68.2 394
Ethylene Oxide
ETO-10  EtO Source
332342 815906                    100002
F      3619.7 5.2 1001   0    0 293
```

H 136.1 9.1 5400 0.8 30.8 366
Ethylene Oxide
ETO-11 EtO Source
364522 863435 100003
F 226.8 5.2 1001 0 14.3 293
H 45.412.2 1820 0.4 14.7 345
F 644.1 7.6 1001 0 14.9 293
Ethylene Oxide
ETO-12 EtO Source
334954 842804 100003
F 63.5 9.1 1001 0 0.6 293
H 108.915.2 5400 0.9 9.1 312
H 1179.3 9.1 5400 0.3 4.9 311
Ethylene Oxide
ETO-13 EtO Source
4046401120130 100003
F 54.4 5.2 1001 0 0 293
H 1297.314.6 3750 0.7 4.3 293
H 1288.212.2 3750 0.3 4.9 293
Ethylene Oxide
ETO-14 EtO Source
415043 873902 000002
H 85.821.3 6960 0.2 4.1 294
H 957.521.3 6960 0.2 4.1 294
Ethylene Oxide
ETO-15 EtO Source
373010 772120 100002
H 1723.713.7 4970 1.1 14.8 405
H 1632.913.7 4970 0.8 20.4 293
Ethylene Oxide
ETO-18 EtO Source
181660 670822 100003
F 10.9 5.2 1001 0 0 293
F 277.6 5.2 1001 0 0 293
H 455.412.2 5400 1.2 6.8 345
Ethylene Oxide
ETO-19 EtO Source
302545 883100 100003
F 1383.5 5.2 1001 0 0 293
F 1383.5 5.2 1001 0 0 293
H 780.212.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-20 EtO Source
404232 740343 000001
H 54.412.287.70 0.1 8.2 322
Ethylene Oxide
ETO-21 EtO Source
3151301064115 100004
H 2023.012.244.50 1.2100.6 450
H 90.718.344.50 0.6 3 294
H 1914.212.244.50 0.3 4.9 293
F 90.710.737.21 0 3 293

Ethylene Oxide
ETO-22 EtO Source
350455 900343 000002
H 684.010.7 4450 1.1 7.4 405
H 756.6 9.8 4450 0.2 10.2 293
Ethylene Oxide
ETO-23 EtO Source
343336 820748 100002
F 562.5 5.2 1001 0 21.3 389
H 263.115.2 7240 2 3.3 561
Ethylene Oxide
ETO-24 EtO Source
372214 894111 100002
H 1877.9 7.6 8950 0.8 13.1 316
H 3138.9 7.6 8950 0.8 20.4 318
Ethylene Oxide
ETO-25 EtO Source
414201 713508 100001
H 90.721.3 5760 0.9 11.2 293
Ethylene Oxide
ETO-26 EtO Source
3400051181316 000003
H 45.4 5.2 5400 1.2 60.7 293
H 172.412.2 5400 1.2 4.6 345
F 18.1 5.2 1001 0 6.8 293
Ethylene Oxide
ETO-27 EtO Source
350141 820358 100002
F 1414.3 5.2 1001 0 0 293
H 304.412.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-29 EtO Source
3944051050710 000001
H 1378.912.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-32 EtO Source
355510 813402 100001
H 1.412.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-33 EtO Source
333650 965645 000002
F 412.8 5.2 1001 0 0 293
H 353.812.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-35 EtO Source
403401 795129 100001
H 340.2 7.9 5400 0.2 0.8 327
Ethylene Oxide
ETO-36 EtO Source
334334 843502 000002
H 372.910.7 4450 1.1 7.4 405
H 527.5 7 4450 0.8 13.4 293

Ethylene Oxide
ETO-37 EtO Source
422015 713800 100002
H 27.2 8.8 6250 1 11 344
H 544.314.9 6250 2 2.3 950
Ethylene Oxide
ETO-38 EtO Source
403405 742546 000002
H 72.618.3 4720 0.2 13.3 293
H 72.618.3 4720 0.3 32.3 293
Ethylene Oxide
ETO-39 EtO Source
3143401061726 100003
H 18.114.9 6750 2 1.9 356
H 27.2 4.9 6750 0.8 13.4 368
H 18.1 4.9 6750 0.8 10.4 356
Ethylene Oxide
ETO-40 EtO Source
391638 763338 000001
H 163.321.3 5760 0.2 3.1 293
Ethylene Oxide
ETO-41 EtO Source
3403251173300 000003
F 113.4 5.2 1001 0 0 293
H 136.112.1 5400 1.2 6.7 345
H 107.0 5.2 5400 1.2 4.6 293
Ethylene Oxide
ETO-42 EtO Source
312022 891853 000002
F 336.1 5.2 1001 0 0 293
H 0.012.2 5400 1.2 6.8 345
Ethylene Oxide
ETO-43 EtO Source
421807 875347 000002
H 0.8 7.6 5400 0.5 0 294
H 8.210.1 5400 0.1 0.1 294
Ethylene Oxide
ETO-44 EtO Source
280211 823938 000001
H 508.017.7 5400 0.5 24.4 289
Ethylene Oxide
ETO-45 EtO Source
432054 733554 100002
H 163.323.8 5400 0.6 13.7 364
H 72.610.7 5400 0.9 0.6 294
Ethylene Oxide
ETO-46 EtO Source
403830 741249 000001
H 0.318.3 4970 0.2 27.7 293
Ethylene Oxide
ETO-47 EtO Source
3128181002310 000003

F 11.1 5.2 1001 0 0 293
F 11.1 5.2 1001 0 0 293
H 381.912.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-48 EtO Source
385640 951330 000001
H 340.212.2 5400 1.2 6.8 345
Ethylene Oxide
ETO-49 EtO Source
350748 805702 100003
H 90.718.3 5400 0.9 39.6 355
H 90.712.2 5400 0.9 15.2 311
F 90.7 7.6 1001 0 4.9 294
Ethylene Oxide
ETO-50 EtO Source
450757 931615 000001
H 127.011.3 4130 0.6 4.6 372
Ethylene Oxide
ETO-51 EtO Source
412018 725215 000002
F 2.3 5.2 1001 0 0 293
H 113.412.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-52 EtO Source
354649 794851 000001
H 27.215.2 9120 1.2 1.9 351
Ethylene Oxide
ETO-53 EtO Source
344419 822230 000001
H 117.912.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-54 EtO Source
3931151194309 000001
H 0.413.7 5120 0.2 2.3 293
Ethylene Oxide
ETO-55 EtO Source
355517 800146 000002
F 1.4 5.2 1001 0 0 293
H 33.112.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-56 EtO Source
391008 764646 000003
H 56.712.2 5400 0.2 6.1 311
H 56.719.8 5400 0.2 3 297
F 2.3 5.2 1001 0 0 293
Ethylene Oxide
ETO-57 EtO Source
391414 863737 100003
F 51.7 5.2 1001 0 0 293
F 51.7 5.2 1001 0 0 293
H 10.412.2 5400 1.2 6.8 345
Ethylene Oxide

```
ETO-58  EtO Source
425245 854103                   000001
H       199.615.2 3430 1.1  2.4 308
Ethylene Oxide
ETO-59  EtO Source
392430 764550                   000001
H       113.4 3.7 5400 0.2  6.8 297
Ethylene Oxide
ETO-60  EtO Source
403806 752008                   000001
H       105.712.1 5400 1.2  6.8 345
Ethylene Oxide
ETO-61  EtO Source
3359481181218                    000003
F        27.2 5.2 1001   0    0 293
H        54.4 5.2 5400 1.2  4.6 293
H         5.412.2 5400 1.2    7 345
Ethylene Oxide
ETO-62  EtO Source
344615 821751                   000002
F        68.9 5.2 1001   0    0 293
H        21.812.1 5400 1.2  6.8 345
Ethylene Oxide
ETO-63  EtO Source
414511 875525                   000001
H        90.7 7.2 5400 0.3  6.1 300
Ethylene Oxide
ETO-64  EtO Source
410750 743610                   100001
H        18.318.9 5400 0.1  6.8 300
Ethylene Oxide
ETO-65  EtO Source
382410 753424                   000001
H        81.615.2 5400 0.1 10.1 298
Ethylene Oxide
ETO-66  EtO Source
350808 805743                   000002
H         0.912.1 5400 1.2  6.8 345
F        69.9 5.2 1001   0    0 293
Ethylene Oxide
ETO-67  EtO Source
3120471105719                    100002
F        36.3 5.2 1001   0    0 293
H         0.4 8.5 8170 0.7  5.5 345
Ethylene Oxide
ETO-68  EtO Source
420813 875929                   000002
H        40.8 6.1 5400 0.1  0.1 294
H        16.3 7.3 5400   0 64.8 311
Ethylene Oxide
ETO-69  EtO Source
450000 922700                   000001
```

H 6.412.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-70 EtO Source
324756 970250 000001
H 24.518.3 5990 0.3 8.5 293
Ethylene Oxide
ETO-71 EtO Source
362650 833448 100001
H 32.212.2 5400 1.2 6.8 345
Ethylene Oxide
ETO-72 EtO Source
424111 830722 000001
H 15.715.2 5400 0.1 28 305
Ethylene Oxide
ETO-74 EtO Source
275307 824044 000001
H 9.1 4.6 5400 0.1 1.5 298
Ethylene Oxide
ETO-75 EtO Source
353910 802948 100002
H 18.112.2 7380 1 0.71033
H 9.1 0.9 7380 0.5 17.5 311
Ethylene Oxide
ETO-77 EtO Source
392935 764025 000002
H 0.922.9 5400 0.1 6.1 311
H 0.922.9 5400 0.1 6.1 311
Ethylene Oxide
ETO-80 EtO Source
3243011170933 000001
H 1.818.3 5070 0.3 1.2 293
Ethylene Oxide
ETO-91 EtO Source
4524281223239 000001
H 907.2 0.3 5400 0.5 5 458
Ethylene Oxide
ETO-99 EtO Source
430004 773919 100001
H 21.812.2 3300 0.1 3.7 301
Ethylene Oxide
ETO-108 EtO Source
450506 931508 000001
H 4.5 4.310170 0.3 1.1 339
Ethylene Oxide
ETO-116 EtO Source
3330101171000 000002
H 0.6 8.5 4610 0.8 15.2 408
F 63.5 5.2 1001 0 0 293
Ethylene Oxide
ETO-117 EtO Source
3515351135647 100001
H 0.012.5 2220 0.1 10.4 293

Ethylene Oxide
ETO-118 EtO Source
3944051050710 000003
H 63.5 6.1 5400 0.4 3.1 295
H 132.4 6.1 5400 0.9 4.6 295
H 753.0 8.5 5400 0.9 5.6 295
Ethylene Oxide
ETO-119 EtO Source
3239181143322 100002
H 18.112.2 5400 1.1 2.6 977
H 9.112.2 5400 0.5 11.7 311

Attachment 4: Noncancer HEM-Screen input file for all sources

```
00076     ff  0.033333
Ethylene Oxide
ETO-1  EtO Source
175817 661801                    100002
H       206.212.1 5400 1.2  6.8 345
F        22.7 5.2 1001   0    0 293
Ethylene Oxide
ETO-2  EtO Source
402617 743004                    000005
F        46.5 5.2 1001   0    0 293
H        37.612.1 5400 1.2  6.8 345
F        46.5 5.2 1001   0    0 293
H        37.612.1 5400 1.2  6.8 345
H        37.613.7 5400 1.7   12 377
Ethylene Oxide
ETO-3  EtO Source
362132 922317                    100002
F        95.3 5.2 1001   0    0 293
H       907.212.1 5400 1.2  6.8 345
Ethylene Oxide
ETO-4  EtO Source
414452 875638                    000003
F      2848.6 7.6 1001   0  9.1 294
H       127.018.3 5400 2.5100.6 311
H       108.9 9.1 5400 0.2 30.5 311
Ethylene Oxide
ETO-5  EtO Source
425512 721810                    100003
F        11.0 5.2 1001   0    0 293
F      1644.7 5.2 1001   0    0 293
H        46.312.5 5400 1.2  6.8 345
Ethylene Oxide
ETO-7  EtO Source
422020 875347                    000003
H       362.918.3 5670 0.3 30.5 311
H       154.215.2 5670 0.3 44.2 336
H       154.215.2 5670 0.3 44.2 336
Ethylene Oxide
ETO-8  EtO Source
333636 835010                    000002
F      4100.5 5.2 1001   0    0 293
H      1458.819.8 5400 1.4 17.8 500
Ethylene Oxide
ETO-9  EtO Source
421958 880750                    100001
H       884.7 4.9 5400 0.1 68.2 394
Ethylene Oxide
ETO-10  EtO Source
332342 815906                    100002
F      3619.7 5.2 1001   0    0 293
```

H 136.1 9.1 5400 0.8 30.8 366
Ethylene Oxide
ETO-11 EtO Source
364522 863435 100003
F 226.8 5.2 1001 0 14.3 293
H 45.412.2 1820 0.4 14.7 345
F 644.1 7.6 1001 0 14.9 293
Ethylene Oxide
ETO-12 EtO Source
334954 842804 100003
F 63.5 9.1 1001 0 0.6 293
H 108.915.2 5400 0.9 9.1 312
H 1179.3 9.1 5400 0.3 4.9 311
Ethylene Oxide
ETO-13 EtO Source
4046401120130 100003
F 54.4 5.2 1001 0 0 293
H 1297.314.6 3750 0.7 4.3 293
H 1288.212.2 3750 0.3 4.9 293
Ethylene Oxide
ETO-14 EtO Source
415043 873902 000002
H 85.821.3 6960 0.2 4.1 294
H 957.521.3 6960 0.2 4.1 294
Ethylene Oxide
ETO-15 EtO Source
373010 772120 100002
H 1723.713.7 4970 1.1 14.8 405
H 1632.913.7 4970 0.8 20.4 293
Ethylene Oxide
ETO-18 EtO Source
181660 670822 100003
F 10.9 5.2 1001 0 0 293
F 277.6 5.2 1001 0 0 293
H 455.412.2 5400 1.2 6.8 345
Ethylene Oxide
ETO-19 EtO Source
302545 883100 100003
F 1383.5 5.2 1001 0 0 293
F 1383.5 5.2 1001 0 0 293
H 780.212.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-20 EtO Source
404232 740343 000001
H 54.412.287.70 0.1 8.2 322
Ethylene Oxide
ETO-21 EtO Source
3151301064115 100004
H 2023.012.244.50 1.2100.6 450
H 90.718.344.50 0.6 3 294
H 1914.212.244.50 0.3 4.9 293
F 90.710.737.21 0 3 293

Ethylene Oxide
ETO-22 EtO Source
350455 900343 000002
H 684.010.7 4450 1.1 7.4 405
H 756.6 9.8 4450 0.2 10.2 293
Ethylene Oxide
ETO-23 EtO Source
343336 820748 100002
F 562.5 5.2 1001 0 21.3 389
H 263.115.2 7240 2 3.3 561
Ethylene Oxide
ETO-24 EtO Source
372214 894111 100002
H 1877.9 7.6 8950 0.8 13.1 316
H 3138.9 7.6 8950 0.8 20.4 318
Ethylene Oxide
ETO-25 EtO Source
414201 713508 100001
H 90.721.3 5760 0.9 11.2 293
Ethylene Oxide
ETO-26 EtO Source
3400051181316 000003
H 45.4 5.2 5400 1.2 60.7 293
H 172.412.2 5400 1.2 4.6 345
F 18.1 5.2 1001 0 6.8 293
Ethylene Oxide
ETO-27 EtO Source
350141 820358 100002
F 1414.3 5.2 1001 0 0 293
H 304.412.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-29 EtO Source
3944051050710 000001
H 1378.912.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-32 EtO Source
355510 813402 100001
H 1.412.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-33 EtO Source
333650 965645 000002
F 412.8 5.2 1001 0 0 293
H 353.812.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-35 EtO Source
403401 795129 100001
H 340.2 7.9 5400 0.2 0.8 327
Ethylene Oxide
ETO-36 EtO Source
334334 843502 000002
H 372.910.7 4450 1.1 7.4 405
H 527.5 7 4450 0.8 13.4 293

Ethylene Oxide
ETO-37 EtO Source
422015 713800 100002
H 27.2 8.8 6250 1 11 344
H 544.314.9 6250 2 2.3 950
Ethylene Oxide
ETO-38 EtO Source
403405 742546 000002
H 72.618.3 4720 0.2 13.3 293
H 72.618.3 4720 0.3 32.3 293
Ethylene Oxide
ETO-39 EtO Source
3143401061726 100003
H 18.114.9 6750 2 1.9 356
H 27.2 4.9 6750 0.8 13.4 368
H 18.1 4.9 6750 0.8 10.4 356
Ethylene Oxide
ETO-40 EtO Source
391638 763338 000001
H 163.321.3 5760 0.2 3.1 293
Ethylene Oxide
ETO-41 EtO Source
3403251173300 000003
F 113.4 5.2 1001 0 0 293
H 136.112.1 5400 1.2 6.7 345
H 107.0 5.2 5400 1.2 4.6 293
Ethylene Oxide
ETO-42 EtO Source
312022 891853 000002
F 336.1 5.2 1001 0 0 293
H 0.012.2 5400 1.2 6.8 345
Ethylene Oxide
ETO-43 EtO Source
421807 875347 000002
H 0.8 7.6 5400 0.5 0 294
H 8.210.1 5400 0.1 0.1 294
Ethylene Oxide
ETO-44 EtO Source
280211 823938 000001
H 508.017.7 5400 0.5 24.4 289
Ethylene Oxide
ETO-45 EtO Source
432054 733554 100002
H 163.323.8 5400 0.6 13.7 364
H 72.610.7 5400 0.9 0.6 294
Ethylene Oxide
ETO-46 EtO Source
403830 741249 000001
H 0.318.3 4970 0.2 27.7 293
Ethylene Oxide
ETO-47 EtO Source
3128181002310 000003

F 11.1 5.2 1001 0 0 293
F 11.1 5.2 1001 0 0 293
H 381.912.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-48 EtO Source
385640 951330 000001
H 340.212.2 5400 1.2 6.8 345
Ethylene Oxide
ETO-49 EtO Source
350748 805702 100003
H 90.718.3 5400 0.9 39.6 355
H 90.712.2 5400 0.9 15.2 311
F 90.7 7.6 1001 0 4.9 294
Ethylene Oxide
ETO-50 EtO Source
450757 931615 000001
H 127.011.3 4130 0.6 4.6 372
Ethylene Oxide
ETO-51 EtO Source
412018 725215 000002
F 2.3 5.2 1001 0 0 293
H 113.412.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-52 EtO Source
354649 794851 000001
H 27.215.2 9120 1.2 1.9 351
Ethylene Oxide
ETO-53 EtO Source
344419 822230 000001
H 117.912.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-54 EtO Source
3931151194309 000001
H 0.413.7 5120 0.2 2.3 293
Ethylene Oxide
ETO-55 EtO Source
355517 800146 000002
F 1.4 5.2 1001 0 0 293
H 33.112.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-56 EtO Source
391008 764646 000003
H 56.712.2 5400 0.2 6.1 311
H 56.719.8 5400 0.2 3 297
F 2.3 5.2 1001 0 0 293
Ethylene Oxide
ETO-57 EtO Source
391414 863737 100003
F 51.7 5.2 1001 0 0 293
F 51.7 5.2 1001 0 0 293
H 10.412.2 5400 1.2 6.8 345
Ethylene Oxide

ETO-58 EtO Source
425245 854103 000001
H 199.615.2 3430 1.1 2.4 308
Ethylene Oxide
ETO-59 EtO Source
392430 764550 000001
H 113.4 3.7 5400 0.2 6.8 297
Ethylene Oxide
ETO-60 EtO Source
403806 752008 000001
H 105.712.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-61 EtO Source
3359481181218 000003
F 27.2 5.2 1001 0 0 293
H 54.4 5.2 5400 1.2 4.6 293
H 5.412.2 5400 1.2 7 345
Ethylene Oxide
ETO-62 EtO Source
344615 821751 000002
F 68.9 5.2 1001 0 0 293
H 21.812.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-63 EtO Source
414511 875525 000001
H 90.7 7.2 5400 0.3 6.1 300
Ethylene Oxide
ETO-64 EtO Source
410750 743610 100001
H 18.318.9 5400 0.1 6.8 300
Ethylene Oxide
ETO-65 EtO Source
382410 753424 000001
H 81.615.2 5400 0.1 10.1 298
Ethylene Oxide
ETO-66 EtO Source
350808 805743 000002
H 0.912.1 5400 1.2 6.8 345
F 69.9 5.2 1001 0 0 293
Ethylene Oxide
ETO-67 EtO Source
3120471105719 100002
F 36.3 5.2 1001 0 0 293
H 0.4 8.5 8170 0.7 5.5 345
Ethylene Oxide
ETO-68 EtO Source
420813 875929 000002
H 40.8 6.1 5400 0.1 0.1 294
H 16.3 7.3 5400 0 64.8 311
Ethylene Oxide
ETO-69 EtO Source
450000 922700 000001

H 6.412.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-70 EtO Source
324756 970250 000001
H 24.518.3 5990 0.3 8.5 293
Ethylene Oxide
ETO-71 EtO Source
362650 833448 100001
H 32.212.2 5400 1.2 6.8 345
Ethylene Oxide
ETO-72 EtO Source
424111 830722 000001
H 15.715.2 5400 0.1 28 305
Ethylene Oxide
ETO-74 EtO Source
275307 824044 000001
H 9.1 4.6 5400 0.1 1.5 298
Ethylene Oxide
ETO-75 EtO Source
353910 802948 100002
H 18.112.2 7380 1 0.71033
H 9.1 0.9 7380 0.5 17.5 311
Ethylene Oxide
ETO-77 EtO Source
392935 764025 000002
H 0.922.9 5400 0.1 6.1 311
H 0.922.9 5400 0.1 6.1 311
Ethylene Oxide
ETO-80 EtO Source
3243011170933 000001
H 1.818.3 5070 0.3 1.2 293
Ethylene Oxide
ETO-91 EtO Source
4524281223239 000001
H 907.2 0.3 5400 0.5 5 458
Ethylene Oxide
ETO-99 EtO Source
430004 773919 100001
H 21.812.2 3300 0.1 3.7 301
Ethylene Oxide
ETO-108 EtO Source
450506 931508 000001
H 4.5 4.310170 0.3 1.1 339
Ethylene Oxide
ETO-116 EtO Source
3330101171000 000002
H 0.6 8.5 4610 0.8 15.2 408
F 63.5 5.2 1001 0 0 293
Ethylene Oxide
ETO-117 EtO Source
3515351135647 100001
H 0.012.5 2220 0.1 10.4 293

Ethylene Oxide
ETO-118 EtO Source
3944051050710 000003
H 63.5 6.1 5400 0.4 3.1 295
H 132.4 6.1 5400 0.9 4.6 295
H 753.0 8.5 5400 0.9 5.6 295
Ethylene Oxide
ETO-119 EtO Source
3239181143322 100002
H 18.112.2 5400 1.1 2.6 977
H 9.112.2 5400 0.5 11.7 311

Attachment 5: Cancer HEM-Screen output file for all sources

HUMAN EXPOSURE MODEL
STANDARD SUMMARY REPORT

Date: 12/7/2004 Time: 11:19
Chemical Name: Ethylene Oxide Unit Risk: 8.80E-05

REPORT DESCRIPTION
100m

MODELING OPTIONS
Input File Name: c:\program files\hem_vb_wrapper_v3\input\etotest.hem
Radii Set: " 0.1, 0.5, 1.0, 2.0, 5.0,10.0,20.0,30.0,40.0,50.0"
Census Data: 2000
Atmospheric Decay: No

HEM-SCREEN EXPOSURE RESULTS

	Concentration	Population	Exposure
MAX:	1.68E+00	94	1.58E+02
MIN:	1.00E-38	"98,700,000"	3.27E+04

Level	Concentration	Population	Exposure
1	4.14E+00		0.00E+00
3	1.00E+00	285	3.66E+02
4	5.00E-01	"1,350"	1.11E+03
5	2.50E-01	"3,160"	1.69E+03
6	1.00E-01	"8,530"	2.42E+03
7	5.00E-02	"22,800"	3.44E+03
8	2.50E-02	"75,900"	5.23E+03
9	1.00E-02	"295,000"	8.52E+03
10	5.00E-03	"689,000"	1.13E+04
11	2.50E-03	"1,750,000"	1.49E+04
12	1.00E-03	"6,150,000"	2.13E+04
13	5.00E-04	"14,000,000"	2.68E+04
14	2.50E-04	"20,700,000"	2.93E+04
15	1.00E-04	"33,000,000"	3.12E+04
16	5.00E-05	"43,900,000"	3.20E+04
17	2.50E-05	"55,100,000"	3.24E+04
18	1.00E-05	"71,200,000"	3.27E+04
19	5.00E-06	"80,400,000"	3.27E+04
20	2.50E-06	"87,300,000"	3.27E+04
21	1.00E-06	"91,400,000"	3.27E+04
22	5.00E-07	"94,400,000"	3.27E+04
23	2.50E-07	"96,600,000"	3.27E+04
24	1.00E-07	"97,900,000"	3.27E+04
25	5.00E-08	"98,400,000"	3.27E+04

26	2.50E-08	"98,500,000"	3.27E+04
27	1.00E-08	"98,600,000"	3.27E+04
28	5.00E-09	"98,600,000"	3.27E+04
29	2.50E-09	"98,600,000"	3.27E+04
30	1.00E-09	"98,600,000"	3.27E+04
31	5.00E-10	"98,600,000"	3.27E+04
32	2.50E-10	"98,600,000"	3.27E+04
33	1.00E-10	"98,600,000"	3.27E+04
34	5.00E-11	"98,600,000"	3.27E+04
35	2.50E-11	"98,600,000"	3.27E+04
36	1.00E-11	"98,600,000"	3.27E+04
37	5.00E-12	"98,600,000"	3.27E+04
38	2.50E-12	"98,600,000"	3.27E+04
39	1.00E-12	"98,600,000"	3.27E+04
40	5.00E-13	"98,600,000"	3.27E+04
41	2.50E-13	"98,600,000"	3.27E+04
42	1.00E-13	"98,600,000"	3.27E+04
43	5.00E-14	"98,600,000"	3.27E+04
44	2.50E-14	"98,600,000"	3.27E+04
45	1.00E-14	"98,600,000"	3.27E+04
46	5.00E-15	"98,600,000"	3.27E+04
47	2.50E-15	"98,600,000"	3.27E+04
48	1.00E-15	"98,600,000"	3.27E+04
49	5.00E-16	"98,600,000"	3.27E+04
50	2.50E-16	"98,600,000"	3.27E+04
51	1.00E-16	"98,600,000"	3.27E+04
52	5.00E-17	"98,600,000"	3.27E+04
53	2.50E-17	"98,600,000"	3.27E+04
54	1.00E-17	"98,600,000"	3.27E+04
55	5.00E-18	"98,600,000"	3.27E+04
56	2.50E-18	"98,600,000"	3.27E+04
57	1.00E-18	"98,600,000"	3.27E+04
58	5.00E-19	"98,600,000"	3.27E+04
59	2.50E-19	"98,600,000"	3.27E+04
60	1.00E-19	"98,600,000"	3.27E+04
61	5.00E-20	"98,600,000"	3.27E+04
62	2.50E-20	"98,600,000"	3.27E+04
63	1.00E-20	"98,600,000"	3.27E+04
64	5.00E-21	"98,600,000"	3.27E+04
65	2.50E-21	"98,600,000"	3.27E+04
66	1.00E-21	"98,600,000"	3.27E+04
67	5.00E-22	"98,600,000"	3.27E+04
68	2.50E-22	"98,600,000"	3.27E+04
69	1.00E-22	"98,600,000"	3.27E+04
70	5.00E-23	"98,600,000"	3.27E+04
71	2.50E-23	"98,600,000"	3.27E+04
72	1.00E-23	"98,600,000"	3.27E+04
73	5.00E-24	"98,600,000"	3.27E+04
74	2.50E-24	"98,600,000"	3.27E+04
75	1.00E-24	"98,600,000"	3.27E+04
76	5.00E-25	"98,600,000"	3.27E+04
77	2.50E-25	"98,600,000"	3.27E+04

78	1.00E-25	"98,600,000"	3.27E+04
79	5.00E-26	"98,600,000"	3.27E+04
80	2.50E-26	"98,600,000"	3.27E+04
81	1.00E-26	"98,600,000"	3.27E+04
82	5.00E-27	"98,600,000"	3.27E+04
83	2.50E-27	"98,600,000"	3.27E+04
84	1.00E-27	"98,600,000"	3.27E+04
85	5.00E-28	"98,600,000"	3.27E+04
86	2.50E-28	"98,600,000"	3.27E+04
87	1.00E-28	"98,600,000"	3.27E+04
88	5.00E-29	"98,600,000"	3.27E+04
89	2.50E-29	"98,600,000"	3.27E+04
90	1.00E-29	"98,600,000"	3.27E+04
91	5.00E-30	"98,600,000"	3.27E+04
92	2.50E-30	"98,600,000"	3.27E+04
93	1.00E-30	"98,600,000"	3.27E+04
94	5.00E-31	"98,600,000"	3.27E+04
95	2.50E-31	"98,600,000"	3.27E+04
96	1.00E-31	"98,600,000"	3.27E+04
97	5.00E-32	"98,600,000"	3.27E+04
98	2.50E-32	"98,600,000"	3.27E+04
99	1.00E-32	"98,600,000"	3.27E+04
100	5.00E-33	"98,600,000"	3.27E+04
101	2.50E-33	"98,600,000"	3.27E+04
102	1.00E-33	"98,600,000"	3.27E+04
103	5.00E-34	"98,600,000"	3.27E+04
104	2.50E-34	"98,600,000"	3.27E+04
105	1.00E-34	"98,600,000"	3.27E+04
106	5.00E-35	"98,600,000"	3.27E+04
107	2.50E-35	"98,600,000"	3.27E+04
108	1.00E-35	"98,600,000"	3.27E+04
109	5.00E-36	"98,600,000"	3.27E+04
110	2.50E-36	"98,600,000"	3.27E+04
111	1.00E-36	"98,600,000"	3.27E+04
112	5.00E-37	"98,600,000"	3.27E+04
113	2.50E-37	"98,600,000"	3.27E+04
114	1.00E-37	"98,600,000"	3.27E+04
115	5.00E-38	"98,600,000"	3.27E+04
116	2.50E-38	"98,600,000"	3.27E+04
117	1.00E-38	"98,700,000"	3.27E+04

HEM-SCREEN RISK RESULTS

	Risk Level	Population	Exposure * Risk
MAX:	1.48E-04	47	6.95E-03
MIN:	8.80E-43	"98,700,000"	2.88E+00

Level	Risk Level	Population	Exposure * Unit Risk
1	3.65E-04		0.00E+00
3	1.00E-04	94	1.39E-02
4	5.00E-05	"1,230"	9.18E-02
5	2.50E-05	"2,640"	1.37E-01

6	1.00E-05	"7,230"	2.01E-01
7	5.00E-06	"20,200"	2.90E-01
8	2.50E-06	"62,600"	4.29E-01
9	1.00E-06	"249,000"	7.06E-01
10	5.00E-07	"596,000"	9.47E-01
11	2.50E-07	"1,460,000"	1.24E+00
12	1.00E-07	"5,120,000"	1.78E+00
13	5.00E-08	"12,200,000"	2.28E+00
14	2.50E-08	"19,500,000"	2.55E+00
15	1.00E-08	"31,000,000"	2.73E+00
16	5.00E-09	"42,000,000"	2.81E+00
17	2.50E-09	"52,900,000"	2.85E+00
18	1.00E-09	"69,400,000"	2.87E+00
19	5.00E-10	"78,900,000"	2.88E+00
20	2.50E-10	"86,600,000"	2.88E+00
21	1.00E-10	"90,800,000"	2.88E+00
22	5.00E-11	"93,800,000"	2.88E+00
23	2.50E-11	"96,300,000"	2.88E+00
24	1.00E-11	"97,700,000"	2.88E+00
25	5.00E-12	"98,400,000"	2.88E+00
26	2.50E-12	"98,500,000"	2.88E+00
27	1.00E-12	"98,600,000"	2.88E+00
28	5.00E-13	"98,600,000"	2.88E+00
29	2.50E-13	"98,600,000"	2.88E+00
30	1.00E-13	"98,600,000"	2.88E+00
31	5.00E-14	"98,600,000"	2.88E+00
32	2.50E-14	"98,600,000"	2.88E+00
33	1.00E-14	"98,600,000"	2.88E+00
34	5.00E-15	"98,600,000"	2.88E+00
35	2.50E-15	"98,600,000"	2.88E+00
36	1.00E-15	"98,600,000"	2.88E+00
37	5.00E-16	"98,600,000"	2.88E+00
38	2.50E-16	"98,600,000"	2.88E+00
39	1.00E-16	"98,600,000"	2.88E+00
40	5.00E-17	"98,600,000"	2.88E+00
41	2.50E-17	"98,600,000"	2.88E+00
42	1.00E-17	"98,600,000"	2.88E+00
43	5.00E-18	"98,600,000"	2.88E+00
44	2.50E-18	"98,600,000"	2.88E+00
45	1.00E-18	"98,600,000"	2.88E+00
46	5.00E-19	"98,600,000"	2.88E+00
47	2.50E-19	"98,600,000"	2.88E+00
48	1.00E-19	"98,600,000"	2.88E+00
49	5.00E-20	"98,600,000"	2.88E+00
50	2.50E-20	"98,600,000"	2.88E+00
51	1.00E-20	"98,600,000"	2.88E+00
52	5.00E-21	"98,600,000"	2.88E+00
53	2.50E-21	"98,600,000"	2.88E+00
54	1.00E-21	"98,600,000"	2.88E+00
55	5.00E-22	"98,600,000"	2.88E+00
56	2.50E-22	"98,600,000"	2.88E+00
57	1.00E-22	"98,600,000"	2.88E+00

58	5.00E-23	"98,600,000"	2.88E+00
59	2.50E-23	"98,600,000"	2.88E+00
60	1.00E-23	"98,600,000"	2.88E+00
61	5.00E-24	"98,600,000"	2.88E+00
62	2.50E-24	"98,600,000"	2.88E+00
63	1.00E-24	"98,600,000"	2.88E+00
64	5.00E-25	"98,600,000"	2.88E+00
65	2.50E-25	"98,600,000"	2.88E+00
66	1.00E-25	"98,600,000"	2.88E+00
67	5.00E-26	"98,600,000"	2.88E+00
68	2.50E-26	"98,600,000"	2.88E+00
69	1.00E-26	"98,600,000"	2.88E+00
70	5.00E-27	"98,600,000"	2.88E+00
71	2.50E-27	"98,600,000"	2.88E+00
72	1.00E-27	"98,600,000"	2.88E+00
73	5.00E-28	"98,600,000"	2.88E+00
74	2.50E-28	"98,600,000"	2.88E+00
75	1.00E-28	"98,600,000"	2.88E+00
76	5.00E-29	"98,600,000"	2.88E+00
77	2.50E-29	"98,600,000"	2.88E+00
78	1.00E-29	"98,600,000"	2.88E+00
79	5.00E-30	"98,600,000"	2.88E+00
80	2.50E-30	"98,600,000"	2.88E+00
81	1.00E-30	"98,600,000"	2.88E+00
82	5.00E-31	"98,600,000"	2.88E+00
83	2.50E-31	"98,600,000"	2.88E+00
84	1.00E-31	"98,600,000"	2.88E+00
85	5.00E-32	"98,600,000"	2.88E+00
86	2.50E-32	"98,600,000"	2.88E+00
87	1.00E-32	"98,600,000"	2.88E+00
88	5.00E-33	"98,600,000"	2.88E+00
89	2.50E-33	"98,600,000"	2.88E+00
90	1.00E-33	"98,600,000"	2.88E+00
91	5.00E-34	"98,600,000"	2.88E+00
92	2.50E-34	"98,600,000"	2.88E+00
93	1.00E-34	"98,600,000"	2.88E+00
94	5.00E-35	"98,600,000"	2.88E+00
95	2.50E-35	"98,600,000"	2.88E+00
96	1.00E-35	"98,600,000"	2.88E+00
97	5.00E-36	"98,600,000"	2.88E+00
98	2.50E-36	"98,600,000"	2.88E+00
99	1.00E-36	"98,600,000"	2.88E+00
100	5.00E-37	"98,600,000"	2.88E+00
101	2.50E-37	"98,600,000"	2.88E+00
102	1.00E-37	"98,600,000"	2.88E+00
103	5.00E-38	"98,600,000"	2.88E+00
104	2.50E-38	"98,600,000"	2.88E+00
105	8.80E-43	"98,600,000"	2.88E+00

HEM-SCREEN RESULTS

Source	Max Concentration	People	Max Exposure	Lifetime Incidence	Max Risk	Annual Incid.	Repeat Interval
ETO-18 EtO Source	1.68E+00	94	1.58E+02	1.39E-02	1.48E-04	0.0024	420
ETO-19 EtO Source	1.06E+00	3	3.19E+00	2.81E-04	9.37E-05	0.0015	690
ETO-8 EtO Source	8.38E-01	3	2.51E+00	2.21E-04	7.37E-05	0.0015	670
ETO-27 EtO Source	7.51E-01	39	2.93E+01	2.58E-03	6.61E-05	0.0013	760
ETO-4 EtO Source	6.96E-01	49	3.41E+01	3.00E-03	6.12E-05	0.0042	240
ETO-5 EtO Source	6.90E-01	54	3.72E+01	3.28E-03	6.07E-05	0.0011	880
ETO-24 EtO Source	2.67E-01	1	2.67E-01	2.35E-05	2.35E-05	0.0011	900
ETO-11 EtO Source	2.53E-01	26	6.58E+00	5.79E-04	2.23E-05	0.0003	"3,200.00"
ETO-22 EtO Source	2.43E-01	65	1.58E+01	1.39E-03	2.14E-05	0.0008	"1,200.00"
ETO-12 EtO Source	1.88E-01	4	7.54E-01	6.63E-05	1.66E-05	0.0039	260
ETO-118 EtO Source	1.86E-01	28	5.21E+00	4.59E-04	1.64E-05	0.001	980
ETO-42 EtO Source	1.82E-01	181	3.29E+01	2.90E-03	1.60E-05	0.0002	"5,200.00"
ETO-13 EtO Source	1.70E-01	7	1.19E+00	1.05E-04	1.50E-05	0.0018	540
ETO-57 EtO Source	1.49E-01	15	2.23E+00	1.96E-04	1.31E-05	0.0001	"11,000.00"
ETO-91 EtO Source	1.40E-01	17	2.38E+00	2.09E-04	1.23E-05	0.0007	"1,500.00"
ETO-10 EtO Source	1.35E-01	3	4.05E-01	3.56E-05	1.19E-05	0.0037	270
ETO-29 EtO Source	1.28E-01	28	3.58E+00	3.15E-04	1.12E-05	0.0013	770
ETO-3 EtO Source	1.12E-01	107	1.20E+01	1.05E-03	9.86E-06	0.0002	"5,200.00"
ETO-14 EtO Source	1.11E-01	158	1.75E+01	1.54E-03	9.75E-06	0.0021	470
ETO-1 EtO Source	7.85E-02	322	2.53E+01	2.22E-03	6.91E-06	0.0004	"2,700.00"
ETO-9 EtO Source	7.60E-02	2	1.52E-01	1.34E-05	6.69E-06	0.0012	840
ETO-44 EtO Source	6.74E-02	6	4.05E-01	3.56E-05	5.93E-06	0.0003	"2,900.00"
ETO-36 EtO Source	6.72E-02	153	1.03E+01	9.05E-04	5.91E-06	0.0005	"2,100.00"
ETO-48 EtO Source	5.92E-02	22	1.30E+00	1.15E-04	5.21E-06	0.0002	"6,400.00"
ETO-35 EtO Source	5.40E-02	3	1.62E-01	1.43E-05	4.76E-06	0.0005	"1,800.00"
ETO-15 EtO Source	5.40E-02	1	5.40E-02	4.75E-06	4.75E-06	0.0027	370
ETO-23 EtO Source	4.37E-02	111	4.85E+00	4.27E-04	3.85E-06	0.0002	"4,300.00"
ETO-7 EtO Source	4.11E-02	171	7.03E+00	6.19E-04	3.62E-06	0.0004	"2,600.00"
ETO-67 EtO Source	3.92E-02	185	7.25E+00	6.38E-04	3.45E-06	<0.0001	"43,000.00"
ETO-20 EtO Source	3.66E-02	92	3.37E+00	2.96E-04	3.22E-06	0.0003	"3,700.00"
ETO-21 EtO Source	2.69E-02	343	9.23E+00	8.13E-04	2.37E-06	0.001	"1,000.00"
ETO-61 EtO Source	2.51E-02	28	7.04E-01	6.20E-05	2.21E-06	0.0003	"3,100.00"
ETO-37 EtO Source	2.47E-02	53	1.31E+00	1.15E-04	2.17E-06	0.0007	"1,400.00"
ETO-63 EtO Source	2.41E-02	16	3.85E-01	3.39E-05	2.12E-06	0.0001	"8,000.00"
ETO-26 EtO Source	2.28E-02	3	6.85E-02	6.03E-06	2.01E-06	0.0008	"1,200.00"
ETO-59 EtO Source	2.09E-02	926	1.94E+01	1.71E-03	1.84E-06	0.0001	"9,200.00"
ETO-62 EtO Source	2.02E-02	3	6.06E-02	5.33E-06	1.78E-06	<0.0001	"26,000.00"
ETO-49 EtO Source	1.76E-02	9	1.59E-01	1.40E-05	1.55E-06	0.0003	"3,300.00"
ETO-33 EtO Source	1.69E-02	48	8.10E-01	7.12E-05	1.48E-06	<0.0001	"54,000.00"
ETO-45 EtO Source	1.67E-02	35	5.85E-01	5.15E-05	1.47E-06	<0.0001	"22,000.00"
ETO-58 EtO Source	1.58E-02	51	8.07E-01	7.10E-05	1.39E-06	0.0001	"9,200.00"
ETO-38 EtO Source	1.29E-02	25	3.23E-01	2.84E-05	1.14E-06	0.0002	"5,100.00"
ETO-55 EtO Source	1.17E-02	9	1.05E-01	9.24E-06	1.03E-06	<0.0001	"73,000.00"
ETO-56 EtO Source	1.12E-02	"1,050"	1.18E+01	1.03E-03	9.85E-07	0.0001	"10,000.00"
ETO-60 EtO Source	1.08E-02	71	7.64E-01	6.73E-05	9.47E-07	0.0001	"16,000.00"
ETO-51 EtO Source	9.42E-03	11	1.04E-01	9.12E-06	8.29E-07	<0.0001	"28,000.00"
ETO-2 EtO Source	8.16E-03	4	3.27E-02	2.87E-06	7.18E-07	0.0002	"5,300.00"
ETO-52 EtO Source	7.35E-03	8	5.88E-02	5.17E-06	6.46E-07	<0.0001	"220,000.00"
ETO-41 EtO Source	7.22E-03	11	7.94E-02	6.99E-06	6.35E-07	0.0003	"3,600.00"
ETO-75 EtO Source	7.04E-03	19	1.34E-01	1.18E-05	6.20E-07	<0.0001	"37,000.00"

ETO-68 EtO Source	6.79E-03	479	3.25E+00	2.86E-04	5.97E-07	0.0001	"13,000.00"
ETO-72 EtO Source	6.47E-03	61	3.95E-01	3.48E-05	5.70E-07	<0.0001	"76,000.00"
ETO-47 EtO Source	6.44E-03	462	2.97E+00	2.62E-04	5.67E-07	<0.0001	"28,000.00"
ETO-40 EtO Source	6.21E-03	70	4.35E-01	3.82E-05	5.46E-07	0.0002	"6,200.00"
ETO-66 EtO Source	5.92E-03	150	8.89E-01	7.82E-05	5.21E-07	<0.0001	"29,000.00"
ETO-65 EtO Source	5.27E-03	1	5.27E-03	4.64E-07	4.64E-07	<0.0001	"76,000.00"
ETO-71 EtO Source	5.15E-03	6	3.09E-02	2.72E-06	4.53E-07	<0.0001	"150,000.00"
ETO-108 EtO Source	4.88E-03	35	1.71E-01	1.50E-05	4.29E-07	<0.0001	"210,000.00"
ETO-39 EtO Source	4.47E-03	104	4.65E-01	4.09E-05	3.94E-07	0.0001	"8,600.00"
ETO-50 EtO Source	3.97E-03	535	2.13E+00	1.87E-04	3.50E-07	0.0001	"12,000.00"
ETO-53 EtO Source	3.76E-03	2	7.52E-03	6.61E-07	3.31E-07	<0.0001	"37,000.00"
ETO-99 EtO Source	3.42E-03	68	2.33E-01	2.05E-05	3.01E-07	<0.0001	"38,000.00"
ETO-25 EtO Source	2.58E-03	22	5.67E-02	4.99E-06	2.27E-07	0.0001	"12,000.00"
ETO-116 EtO Source	2.40E-03	156	3.75E-01	3.30E-05	2.11E-07	<0.0001	"36,000.00"
ETO-119 EtO Source	2.06E-03	2	4.12E-03	3.62E-07	1.81E-07	<0.0001	"170,000.00"
ETO-80 EtO Source	9.28E-04	23	2.13E-02	1.88E-06	8.17E-08	<0.0001	"290,000.00"
ETO-64 EtO Source	4.76E-04	69	3.29E-02	2.89E-06	4.19E-08	<0.0001	"100,000.00"
ETO-43 EtO Source	4.31E-04	87	3.75E-02	3.30E-06	3.80E-08	<0.0001	"190,000.00"
ETO-69 EtO Source	3.81E-04	49	1.87E-02	1.64E-06	3.35E-08	<0.0001	**********
ETO-70 EtO Source	3.20E-04	522	1.67E-01	1.47E-05	2.82E-08	<0.0001	"82,000.00"
ETO-74 EtO Source	1.22E-04	2	2.45E-04	2.15E-08	1.08E-08	<0.0001	"140,000.00"
ETO-32 EtO Source	1.07E-04	5	5.35E-04	4.70E-08	9.41E-09	<0.0001	**********
ETO-77 EtO Source	6.76E-05	80	5.41E-03	4.76E-07	5.95E-09	<0.0001	**********
ETO-46 EtO Source	5.39E-05	28	1.51E-03	1.33E-07	4.74E-09	<0.0001	**********
ETO-54 EtO Source	3.31E-05	1	3.31E-05	2.91E-09	2.91E-09	<0.0001	**********
ETO-117 EtO Source	1.00E-38	"49,300"	4.93E-34	4.33E-38	8.80E-43	<0.0001	

*** END OF REPORT ***

Attachment 6: Noncancer HEM-Screen output file for all sources

HUMAN EXPOSURE MODEL
STANDARD SUMMARY REPORT

Date: 12/8/2004 Time: 09:14
Chemical Name: Ethylene Oxide Unit Risk: 3.33E-02

REPORT DESCRIPTION
eonc

MODELING OPTIONS
Input File Name: c:\program files\hem_vb_wrapper_v3\input\eonctest.hem
Radii Set: " 0.1, 0.5, 1.0, 2.0, 5.0,10.0,20.0,30.0,40.0,50.0"
Census Data: 2000
Atmospheric Decay: No

HEM-SCREEN EXPOSURE RESULTS

	Concentration	Population	Exposure
MAX:	1.68E+00	94	1.58E+02
MIN:	1.00E-38	"98,700,000"	3.27E+04

Level	Concentration	Population	Exposure
1	4.14E+00		0.00E+00
3	1.00E+00	285	3.66E+02
4	5.00E-01	"1,350"	1.11E+03
5	2.50E-01	"3,160"	1.69E+03
6	1.00E-01	"8,530"	2.42E+03
7	5.00E-02	"22,800"	3.44E+03
8	2.50E-02	"75,900"	5.23E+03
9	1.00E-02	"295,000"	8.52E+03
10	5.00E-03	"689,000"	1.13E+04
11	2.50E-03	"1,750,000"	1.49E+04
12	1.00E-03	"6,150,000"	2.13E+04
13	5.00E-04	"14,000,000"	2.68E+04
14	2.50E-04	"20,700,000"	2.93E+04
15	1.00E-04	"33,000,000"	3.12E+04
16	5.00E-05	"43,900,000"	3.20E+04
17	2.50E-05	"55,100,000"	3.24E+04
18	1.00E-05	"71,200,000"	3.27E+04
19	5.00E-06	"80,400,000"	3.27E+04
20	2.50E-06	"87,300,000"	3.27E+04
21	1.00E-06	"91,400,000"	3.27E+04
22	5.00E-07	"94,400,000"	3.27E+04
23	2.50E-07	"96,600,000"	3.27E+04
24	1.00E-07	"97,900,000"	3.27E+04
25	5.00E-08	"98,400,000"	3.27E+04

26	2.50E-08	"98,500,000"	3.27E+04
27	1.00E-08	"98,600,000"	3.27E+04
28	5.00E-09	"98,600,000"	3.27E+04
29	2.50E-09	"98,600,000"	3.27E+04
30	1.00E-09	"98,600,000"	3.27E+04
31	5.00E-10	"98,600,000"	3.27E+04
32	2.50E-10	"98,600,000"	3.27E+04
33	1.00E-10	"98,600,000"	3.27E+04
34	5.00E-11	"98,600,000"	3.27E+04
35	2.50E-11	"98,600,000"	3.27E+04
36	1.00E-11	"98,600,000"	3.27E+04
37	5.00E-12	"98,600,000"	3.27E+04
38	2.50E-12	"98,600,000"	3.27E+04
39	1.00E-12	"98,600,000"	3.27E+04
40	5.00E-13	"98,600,000"	3.27E+04
41	2.50E-13	"98,600,000"	3.27E+04
42	1.00E-13	"98,600,000"	3.27E+04
43	5.00E-14	"98,600,000"	3.27E+04
44	2.50E-14	"98,600,000"	3.27E+04
45	1.00E-14	"98,600,000"	3.27E+04
46	5.00E-15	"98,600,000"	3.27E+04
47	2.50E-15	"98,600,000"	3.27E+04
48	1.00E-15	"98,600,000"	3.27E+04
49	5.00E-16	"98,600,000"	3.27E+04
50	2.50E-16	"98,600,000"	3.27E+04
51	1.00E-16	"98,600,000"	3.27E+04
52	5.00E-17	"98,600,000"	3.27E+04
53	2.50E-17	"98,600,000"	3.27E+04
54	1.00E-17	"98,600,000"	3.27E+04
55	5.00E-18	"98,600,000"	3.27E+04
56	2.50E-18	"98,600,000"	3.27E+04
57	1.00E-18	"98,600,000"	3.27E+04
58	5.00E-19	"98,600,000"	3.27E+04
59	2.50E-19	"98,600,000"	3.27E+04
60	1.00E-19	"98,600,000"	3.27E+04
61	5.00E-20	"98,600,000"	3.27E+04
62	2.50E-20	"98,600,000"	3.27E+04
63	1.00E-20	"98,600,000"	3.27E+04
64	5.00E-21	"98,600,000"	3.27E+04
65	2.50E-21	"98,600,000"	3.27E+04
66	1.00E-21	"98,600,000"	3.27E+04
67	5.00E-22	"98,600,000"	3.27E+04
68	2.50E-22	"98,600,000"	3.27E+04
69	1.00E-22	"98,600,000"	3.27E+04
70	5.00E-23	"98,600,000"	3.27E+04
71	2.50E-23	"98,600,000"	3.27E+04
72	1.00E-23	"98,600,000"	3.27E+04
73	5.00E-24	"98,600,000"	3.27E+04
74	2.50E-24	"98,600,000"	3.27E+04
75	1.00E-24	"98,600,000"	3.27E+04
76	5.00E-25	"98,600,000"	3.27E+04
77	2.50E-25	"98,600,000"	3.27E+04

78	1.00E-25	"98,600,000"	3.27E+04
79	5.00E-26	"98,600,000"	3.27E+04
80	2.50E-26	"98,600,000"	3.27E+04
81	1.00E-26	"98,600,000"	3.27E+04
82	5.00E-27	"98,600,000"	3.27E+04
83	2.50E-27	"98,600,000"	3.27E+04
84	1.00E-27	"98,600,000"	3.27E+04
85	5.00E-28	"98,600,000"	3.27E+04
86	2.50E-28	"98,600,000"	3.27E+04
87	1.00E-28	"98,600,000"	3.27E+04
88	5.00E-29	"98,600,000"	3.27E+04
89	2.50E-29	"98,600,000"	3.27E+04
90	1.00E-29	"98,600,000"	3.27E+04
91	5.00E-30	"98,600,000"	3.27E+04
92	2.50E-30	"98,600,000"	3.27E+04
93	1.00E-30	"98,600,000"	3.27E+04
94	5.00E-31	"98,600,000"	3.27E+04
95	2.50E-31	"98,600,000"	3.27E+04
96	1.00E-31	"98,600,000"	3.27E+04
97	5.00E-32	"98,600,000"	3.27E+04
98	2.50E-32	"98,600,000"	3.27E+04
99	1.00E-32	"98,600,000"	3.27E+04
100	5.00E-33	"98,600,000"	3.27E+04
101	2.50E-33	"98,600,000"	3.27E+04
102	1.00E-33	"98,600,000"	3.27E+04
103	5.00E-34	"98,600,000"	3.27E+04
104	2.50E-34	"98,600,000"	3.27E+04
105	1.00E-34	"98,600,000"	3.27E+04
106	5.00E-35	"98,600,000"	3.27E+04
107	2.50E-35	"98,600,000"	3.27E+04
108	1.00E-35	"98,600,000"	3.27E+04
109	5.00E-36	"98,600,000"	3.27E+04
110	2.50E-36	"98,600,000"	3.27E+04
111	1.00E-36	"98,600,000"	3.27E+04
112	5.00E-37	"98,600,000"	3.27E+04
113	2.50E-37	"98,600,000"	3.27E+04
114	1.00E-37	"98,600,000"	3.27E+04
115	5.00E-38	"98,600,000"	3.27E+04
116	2.50E-38	"98,600,000"	3.27E+04
117	1.00E-38	"98,700,000"	3.27E+04

HEM-SCREEN RISK RESULTS

	Risk Level	Population	Exposure * Risk
MAX:	5.60E-02	47	2.63E+00
MIN:	3.33E-40	"98,700,000"	1.09E+03

Level	Risk Level	Population	Exposure * Unit Risk
1	1.38E-01		0.00E+00
3	5.00E-02	94	5.26E+00
4	2.50E-02	401	1.54E+01
5	1.00E-02	"2,100"	4.67E+01

6	5.00E-03	"4,390"	6.38E+01
7	2.50E-03	"14,900"	9.84E+01
8	1.00E-03	"57,300"	1.57E+02
9	5.00E-04	"167,000"	2.32E+02
10	2.50E-04	"428,000"	3.22E+02
11	1.00E-04	"1,360,000"	4.60E+02
12	5.00E-05	"3,440,000"	6.02E+02
13	2.50E-05	"8,960,000"	7.92E+02
14	1.00E-05	"19,000,000"	9.61E+02
15	5.00E-06	"26,800,000"	1.02E+03
16	2.50E-06	"37,400,000"	1.05E+03
17	1.00E-06	"52,000,000"	1.08E+03
18	5.00E-07	"65,600,000"	1.09E+03
19	2.50E-07	"75,100,000"	1.09E+03
20	1.00E-07	"86,100,000"	1.09E+03
21	5.00E-08	"89,500,000"	1.09E+03
22	2.50E-08	"92,600,000"	1.09E+03
23	1.00E-08	"96,200,000"	1.09E+03
24	5.00E-09	"97,500,000"	1.09E+03
25	2.50E-09	"98,200,000"	1.09E+03
26	1.00E-09	"98,500,000"	1.09E+03
27	5.00E-10	"98,600,000"	1.09E+03
28	2.50E-10	"98,600,000"	1.09E+03
29	1.00E-10	"98,600,000"	1.09E+03
30	5.00E-11	"98,600,000"	1.09E+03
31	2.50E-11	"98,600,000"	1.09E+03
32	1.00E-11	"98,600,000"	1.09E+03
33	5.00E-12	"98,600,000"	1.09E+03
34	2.50E-12	"98,600,000"	1.09E+03
35	1.00E-12	"98,600,000"	1.09E+03
36	5.00E-13	"98,600,000"	1.09E+03
37	2.50E-13	"98,600,000"	1.09E+03
38	1.00E-13	"98,600,000"	1.09E+03
39	5.00E-14	"98,600,000"	1.09E+03
40	2.50E-14	"98,600,000"	1.09E+03
41	1.00E-14	"98,600,000"	1.09E+03
42	5.00E-15	"98,600,000"	1.09E+03
43	2.50E-15	"98,600,000"	1.09E+03
44	1.00E-15	"98,600,000"	1.09E+03
45	5.00E-16	"98,600,000"	1.09E+03
46	2.50E-16	"98,600,000"	1.09E+03
47	1.00E-16	"98,600,000"	1.09E+03
48	5.00E-17	"98,600,000"	1.09E+03
49	2.50E-17	"98,600,000"	1.09E+03
50	1.00E-17	"98,600,000"	1.09E+03
51	5.00E-18	"98,600,000"	1.09E+03
52	2.50E-18	"98,600,000"	1.09E+03
53	1.00E-18	"98,600,000"	1.09E+03
54	5.00E-19	"98,600,000"	1.09E+03
55	2.50E-19	"98,600,000"	1.09E+03
56	1.00E-19	"98,600,000"	1.09E+03
57	5.00E-20	"98,600,000"	1.09E+03

58	2.50E-20	"98,600,000"	1.09E+03
59	1.00E-20	"98,600,000"	1.09E+03
60	5.00E-21	"98,600,000"	1.09E+03
61	2.50E-21	"98,600,000"	1.09E+03
62	1.00E-21	"98,600,000"	1.09E+03
63	5.00E-22	"98,600,000"	1.09E+03
64	2.50E-22	"98,600,000"	1.09E+03
65	1.00E-22	"98,600,000"	1.09E+03
66	5.00E-23	"98,600,000"	1.09E+03
67	2.50E-23	"98,600,000"	1.09E+03
68	1.00E-23	"98,600,000"	1.09E+03
69	5.00E-24	"98,600,000"	1.09E+03
70	2.50E-24	"98,600,000"	1.09E+03
71	1.00E-24	"98,600,000"	1.09E+03
72	5.00E-25	"98,600,000"	1.09E+03
73	2.50E-25	"98,600,000"	1.09E+03
74	1.00E-25	"98,600,000"	1.09E+03
75	5.00E-26	"98,600,000"	1.09E+03
76	2.50E-26	"98,600,000"	1.09E+03
77	1.00E-26	"98,600,000"	1.09E+03
78	5.00E-27	"98,600,000"	1.09E+03
79	2.50E-27	"98,600,000"	1.09E+03
80	1.00E-27	"98,600,000"	1.09E+03
81	5.00E-28	"98,600,000"	1.09E+03
82	2.50E-28	"98,600,000"	1.09E+03
83	1.00E-28	"98,600,000"	1.09E+03
84	5.00E-29	"98,600,000"	1.09E+03
85	2.50E-29	"98,600,000"	1.09E+03
86	1.00E-29	"98,600,000"	1.09E+03
87	5.00E-30	"98,600,000"	1.09E+03
88	2.50E-30	"98,600,000"	1.09E+03
89	1.00E-30	"98,600,000"	1.09E+03
90	5.00E-31	"98,600,000"	1.09E+03
91	2.50E-31	"98,600,000"	1.09E+03
92	1.00E-31	"98,600,000"	1.09E+03
93	5.00E-32	"98,600,000"	1.09E+03
94	2.50E-32	"98,600,000"	1.09E+03
95	1.00E-32	"98,600,000"	1.09E+03
96	5.00E-33	"98,600,000"	1.09E+03
97	2.50E-33	"98,600,000"	1.09E+03
98	1.00E-33	"98,600,000"	1.09E+03
99	5.00E-34	"98,600,000"	1.09E+03
100	2.50E-34	"98,600,000"	1.09E+03
101	1.00E-34	"98,600,000"	1.09E+03
102	5.00E-35	"98,600,000"	1.09E+03
103	2.50E-35	"98,600,000"	1.09E+03
104	1.00E-35	"98,600,000"	1.09E+03
105	5.00E-36	"98,600,000"	1.09E+03
106	2.50E-36	"98,600,000"	1.09E+03
107	1.00E-36	"98,600,000"	1.09E+03
108	5.00E-37	"98,600,000"	1.09E+03
109	2.50E-37	"98,600,000"	1.09E+03

110	1.00E-37	"98,600,000"	1.09E+03
111	5.00E-38	"98,600,000"	1.09E+03
112	2.50E-38	"98,600,000"	1.09E+03
113	3.33E-40	"98,700,000"	1.09E+03

HEM-SCREEN RESULTS

Source	Max Concentration	People	Max Exposure	Lifetime Incidence	Max Risk	Annual Incid.	Repeat Interval
ETO-18 EtO Source	1.68E+00	94	1.58E+02	5.26E+00	5.60E-02	0.91	1.1
ETO-19 EtO Source	1.06E+00	3	3.19E+00	1.06E-01	3.55E-02	0.55	1.8
ETO-8 EtO Source	8.38E-01	3	2.51E+00	8.38E-02	2.79E-02	0.56	1.8
ETO-27 EtO Source	7.51E-01	39	2.93E+01	9.76E-01	2.50E-02	0.5	2
ETO-4 EtO Source	6.96E-01	49	3.41E+01	1.14E+00	2.32E-02	1.6	0.63
ETO-5 EtO Source	6.90E-01	54	3.72E+01	1.24E+00	2.30E-02	0.43	2.3
ETO-24 EtO Source	2.67E-01	1	2.67E-01	8.91E-03	8.91E-03	0.42	2.4
ETO-11 EtO Source	2.53E-01	26	6.58E+00	2.19E-01	8.43E-03	0.12	8.5
ETO-22 EtO Source	2.43E-01	65	1.58E+01	5.27E-01	8.11E-03	0.32	3.1
ETO-12 EtO Source	1.88E-01	4	7.54E-01	2.51E-02	6.28E-03	1.5	0.68
ETO-118 EtO Source	1.86E-01	28	5.21E+00	1.74E-01	6.21E-03	0.38	2.6
ETO-42 EtO Source	1.82E-01	181	3.29E+01	1.10E+00	6.07E-03	0.073	14
ETO-13 EtO Source	1.70E-01	7	1.19E+00	3.97E-02	5.68E-03	0.7	1.4
ETO-57 EtO Source	1.49E-01	15	2.23E+00	7.43E-02	4.95E-03	0.034	29
ETO-91 EtO Source	1.40E-01	17	2.38E+00	7.93E-02	4.66E-03	0.26	3.9
ETO-10 EtO Source	1.35E-01	3	4.05E-01	1.35E-02	4.50E-03	1.4	0.71
ETO-29 EtO Source	1.28E-01	28	3.58E+00	1.19E-01	4.26E-03	0.49	2
ETO-3 EtO Source	1.12E-01	107	1.20E+01	4.00E-01	3.73E-03	0.073	14
ETO-14 EtO Source	1.11E-01	158	1.75E+01	5.84E-01	3.69E-03	0.81	1.2
ETO-1 EtO Source	7.85E-02	322	2.53E+01	8.43E-01	2.62E-03	0.14	7.1
ETO-9 EtO Source	7.60E-02	2	1.52E-01	5.07E-03	2.53E-03	0.45	2.2
ETO-44 EtO Source	6.74E-02	6	4.05E-01	1.35E-02	2.25E-03	0.13	7.6
ETO-36 EtO Source	6.72E-02	153	1.03E+01	3.43E-01	2.24E-03	0.18	5.5
ETO-48 EtO Source	5.92E-02	22	1.30E+00	4.34E-02	1.97E-03	0.059	17
ETO-15 EtO Source	5.40E-02	1	5.40E-02	1.80E-03	1.80E-03	1	0.98
ETO-35 EtO Source	5.40E-02	3	1.62E-01	5.40E-03	1.80E-03	0.21	4.9
ETO-23 EtO Source	4.37E-02	111	4.85E+00	1.62E-01	1.46E-03	0.088	11
ETO-7 EtO Source	4.11E-02	171	7.03E+00	2.34E-01	1.37E-03	0.15	6.8
ETO-67 EtO Source	3.92E-02	185	7.25E+00	2.42E-01	1.31E-03	0.0089	110
ETO-20 EtO Source	3.66E-02	92	3.37E+00	1.12E-01	1.22E-03	0.1	9.9
ETO-21 EtO Source	2.69E-02	343	9.23E+00	3.08E-01	8.97E-04	0.38	2.6
ETO-61 EtO Source	2.51E-02	28	7.04E-01	2.35E-02	8.38E-04	0.12	8.2
ETO-37 EtO Source	2.47E-02	53	1.31E+00	4.36E-02	8.23E-04	0.26	3.8
ETO-63 EtO Source	2.41E-02	16	3.85E-01	1.28E-02	8.02E-04	0.047	21
ETO-26 EtO Source	2.28E-02	3	6.85E-02	2.28E-03	7.61E-04	0.31	3.3
ETO-59 EtO Source	2.09E-02	926	1.94E+01	6.46E-01	6.98E-04	0.041	24
ETO-62 EtO Source	2.02E-02	3	6.06E-02	2.02E-03	6.73E-04	0.015	67
ETO-49 EtO Source	1.76E-02	9	1.59E-01	5.29E-03	5.88E-04	0.12	8.7
ETO-33 EtO Source	1.69E-02	48	8.10E-01	2.70E-02	5.62E-04	0.0071	140
ETO-45 EtO Source	1.67E-02	35	5.85E-01	1.95E-02	5.57E-04	0.018	57
ETO-58 EtO Source	1.58E-02	51	8.07E-01	2.69E-02	5.27E-04	0.041	24
ETO-38 EtO Source	1.29E-02	25	3.23E-01	1.08E-02	4.31E-04	0.074	14

ETO-55 EtO Source	1.17E-02	9	1.05E-01	3.50E-03	3.89E-04	0.0052	190
ETO-56 EtO Source	1.12E-02	"1,050"	1.18E+01	3.92E-01	3.73E-04	0.037	27
ETO-60 EtO Source	1.08E-02	71	7.64E-01	2.55E-02	3.59E-04	0.024	42
ETO-51 EtO Source	9.42E-03	11	1.04E-01	3.45E-03	3.14E-04	0.013	74
ETO-2 EtO Source	8.16E-03	4	3.27E-02	1.09E-03	2.72E-04	0.072	14
ETO-52 EtO Source	7.35E-03	8	5.88E-02	1.96E-03	2.45E-04	0.0017	570
ETO-41 EtO Source	7.22E-03	11	7.94E-02	2.65E-03	2.41E-04	0.11	9.5
ETO-75 EtO Source	7.04E-03	19	1.34E-01	4.46E-03	2.35E-04	0.01	98
ETO-68 EtO Source	6.79E-03	479	3.25E+00	1.08E-01	2.26E-04	0.029	34
ETO-72 EtO Source	6.47E-03	61	3.95E-01	1.32E-02	2.16E-04	0.005	200
ETO-47 EtO Source	6.44E-03	462	2.97E+00	9.91E-02	2.15E-04	0.013	74
ETO-40 EtO Source	6.21E-03	70	4.35E-01	1.45E-02	2.07E-04	0.061	16
ETO-66 EtO Source	5.92E-03	150	8.89E-01	2.96E-02	1.97E-04	0.013	76
ETO-65 EtO Source	5.27E-03	1	5.27E-03	1.76E-04	1.76E-04	0.005	200
ETO-71 EtO Source	5.15E-03	6	3.09E-02	1.03E-03	1.72E-04	0.0025	400
ETO-108 EtO Source	4.88E-03	35	1.71E-01	5.69E-03	1.63E-04	0.0018	550
ETO-39 EtO Source	4.47E-03	104	4.65E-01	1.55E-02	1.49E-04	0.044	23
ETO-50 EtO Source	3.97E-03	535	2.13E+00	7.09E-02	1.32E-04	0.03	33
ETO-53 EtO Source	3.76E-03	2	7.52E-03	2.51E-04	1.25E-04	0.01	98
ETO-99 EtO Source	3.42E-03	68	2.33E-01	7.76E-03	1.14E-04	0.0098	100
ETO-25 EtO Source	2.58E-03	22	5.67E-02	1.89E-03	8.59E-05	0.031	33
ETO-116 EtO Source	2.40E-03	156	3.75E-01	1.25E-02	8.00E-05	0.011	95
ETO-119 EtO Source	2.06E-03	2	4.12E-03	1.37E-04	6.86E-05	0.0022	460
ETO-80 EtO Source	9.28E-04	23	2.13E-02	7.11E-04	3.09E-05	0.0013	760
ETO-64 EtO Source	4.76E-04	69	3.29E-02	1.10E-03	1.59E-05	0.0037	270
ETO-43 EtO Source	4.31E-04	87	3.75E-02	1.25E-03	1.44E-05	0.002	490
ETO-69 EtO Source	3.81E-04	49	1.87E-02	6.22E-04	1.27E-05	0.0001	"9,300.00"
ETO-70 EtO Source	3.20E-04	522	1.67E-01	5.57E-03	1.07E-05	0.0046	220
ETO-74 EtO Source	1.22E-04	2	2.45E-04	8.16E-06	4.08E-06	0.0027	370
ETO-32 EtO Source	1.07E-04	5	5.35E-04	1.78E-05	3.56E-06	0.0002	"5,200.00"
ETO-77 EtO Source	6.76E-05	80	5.41E-03	1.80E-04	2.25E-06	0.0002	"4,900.00"
ETO-46 EtO Source	5.39E-05	28	1.51E-03	5.03E-05	1.80E-06	0.0003	"3,400.00"
ETO-54 EtO Source	3.31E-05	1	3.31E-05	1.10E-06	1.10E-06	0.0001	"18,000.00"
ETO-117 EtO Source	1.00E-38	"49,300"	4.93E-34	1.64E-35	3.33E-40	<0.0001	

*** END OF REPORT ***

Attachment 7: HEM-3 results for facilities with HEM-Screen cancer risks > 50 in a million

Facility	Maximum Individual Lifetime Cancer Risk	Maximum Hazard Index
ETO-18	8E-5	0.03
ETO-19	9E-5	0.03
ETO-8	7E-5	0.03
ETO-27	5E-5	0.02
ETO-4	6E-5	0.02
ETO-5	3E-5	0.01

Attachment 8: Cancer HEM-Screen input file for major sources

```
          00061     ff  0.000088
Ethylene Oxide
ETO-1  EtO Source
175817 661801                    100002
H       206.212.1 5400 1.2  6.8 345
F        22.7 5.2 1001   0    0 293
Ethylene Oxide
ETO-2  EtO Source
402617 743004                    000005
F        46.5 5.2 1001   0    0 293
H        37.612.1 5400 1.2  6.8 345
F        46.5 5.2 1001   0    0 293
H        37.612.1 5400 1.2  6.8 345
H        37.613.7 5400 1.7   12 377
Ethylene Oxide
ETO-3  EtO Source
362132 922317                    100002
F        95.3 5.2 1001   0    0 293
H       907.212.1 5400 1.2  6.8 345
Ethylene Oxide
ETO-4  EtO Source
414452 875638                    000003
F      2848.6 7.6 1001   0  9.1 294
H       127.018.3 5400 2.5100.6 311
H       108.9 9.1 5400 0.2 30.5 311
Ethylene Oxide
ETO-5  EtO Source
425512 721810                    100003
F        11.0 5.2 1001   0    0 293
F      1644.7 5.2 1001   0    0 293
H        46.312.5 5400 1.2  6.8 345
Ethylene Oxide
ETO-7  EtO Source
422020 875347                    000003
H       362.918.3 5670 0.3 30.5 311
H       154.215.2 5670 0.3 44.2 336
H       154.215.2 5670 0.3 44.2 336
Ethylene Oxide
ETO-8  EtO Source
333636 835010                    000002
F      4100.5 5.2 1001   0    0 293
H      1458.819.8 5400 1.4 17.8 500
Ethylene Oxide
ETO-9  EtO Source
421958 880750                    100001
H       884.7 4.9 5400 0.1 68.2 394
Ethylene Oxide
ETO-10  EtO Source
332342 815906                    100002
F      3619.7 5.2 1001   0    0 293
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H 136.1 9.1 5400 0.8 30.8 366
Ethylene Oxide
ETO-11 EtO Source
364522 863435 100003
F 226.8 5.2 1001 0 14.3 293
H 45.412.2 1820 0.4 14.7 345
F 644.1 7.6 1001 0 14.9 293
Ethylene Oxide
ETO-12 EtO Source
334954 842804 100003
F 63.5 9.1 1001 0 0.6 293
H 108.915.2 5400 0.9 9.1 312
H 1179.3 9.1 5400 0.3 4.9 311
Ethylene Oxide
ETO-13 EtO Source
4046401120130 100003
F 54.4 5.2 1001 0 0 293
H 1297.314.6 3750 0.7 4.3 293
H 1288.212.2 3750 0.3 4.9 293
Ethylene Oxide
ETO-14 EtO Source
415043 873902 000002
H 85.821.3 6960 0.2 4.1 294
H 957.521.3 6960 0.2 4.1 294
Ethylene Oxide
ETO-15 EtO Source
373010 772120 100002
H 1723.713.7 4970 1.1 14.8 405
H 1632.913.7 4970 0.8 20.4 293
Ethylene Oxide
ETO-18 EtO Source
181660 670822 100003
F 10.9 5.2 1001 0 0 293
F 277.6 5.2 1001 0 0 293
H 455.412.2 5400 1.2 6.8 345
Ethylene Oxide
ETO-19 EtO Source
302545 883100 100003
F 1383.5 5.2 1001 0 0 293
F 1383.5 5.2 1001 0 0 293
H 780.212.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-20 EtO Source
404232 740343 000001
H 54.412.287.70 0.1 8.2 322
Ethylene Oxide
ETO-21 EtO Source
3151301064115 100004
H 2023.012.244.50 1.2100.6 450
H 90.718.344.50 0.6 3 294
H 1914.212.244.50 0.3 4.9 293
F 90.710.737.21 0 3 293

Ethylene Oxide
ETO-22 EtO Source
350455 900343 000002
H 684.010.7 4450 1.1 7.4 405
H 756.6 9.8 4450 0.2 10.2 293
Ethylene Oxide
ETO-23 EtO Source
343336 820748 100002
F 562.5 5.2 1001 0 21.3 389
H 263.115.2 7240 2 3.3 561
Ethylene Oxide
ETO-24 EtO Source
372214 894111 100002
H 1877.9 7.6 8950 0.8 13.1 316
H 3138.9 7.6 8950 0.8 20.4 318
Ethylene Oxide
ETO-25 EtO Source
414201 713508 100001
H 90.721.3 5760 0.9 11.2 293
Ethylene Oxide
ETO-26 EtO Source
3400051181316 000003
H 45.4 5.2 5400 1.2 60.7 293
H 172.412.2 5400 1.2 4.6 345
F 18.1 5.2 1001 0 6.8 293
Ethylene Oxide
ETO-27 EtO Source
350141 820358 100002
F 1414.3 5.2 1001 0 0 293
H 304.412.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-29 EtO Source
3944051050710 000001
H 1378.912.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-32 EtO Source
355510 813402 100001
H 1.412.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-33 EtO Source
333650 965645 000002
F 412.8 5.2 1001 0 0 293
H 353.812.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-35 EtO Source
403401 795129 100001
H 340.2 7.9 5400 0.2 0.8 327
Ethylene Oxide
ETO-36 EtO Source
334334 843502 000002
H 372.910.7 4450 1.1 7.4 405
H 527.5 7 4450 0.8 13.4 293

Ethylene Oxide
ETO-37 EtO Source
422015 713800 100002
H 27.2 8.8 6250 1 11 344
H 544.314.9 6250 2 2.3 950
Ethylene Oxide
ETO-38 EtO Source
403405 742546 000002
H 72.618.3 4720 0.2 13.3 293
H 72.618.3 4720 0.3 32.3 293
Ethylene Oxide
ETO-39 EtO Source
3143401061726 100003
H 18.114.9 6750 2 1.9 356
H 27.2 4.9 6750 0.8 13.4 368
H 18.1 4.9 6750 0.8 10.4 356
Ethylene Oxide
ETO-40 EtO Source
391638 763338 000001
H 163.321.3 5760 0.2 3.1 293
Ethylene Oxide
ETO-41 EtO Source
3403251173300 000003
F 113.4 5.2 1001 0 0 293
H 136.112.1 5400 1.2 6.7 345
H 107.0 5.2 5400 1.2 4.6 293
Ethylene Oxide
ETO-44 EtO Source
280211 823938 000001
H 508.017.7 5400 0.5 24.4 289
Ethylene Oxide
ETO-45 EtO Source
432054 733554 100002
H 163.323.8 5400 0.6 13.7 364
H 72.610.7 5400 0.9 0.6 294
Ethylene Oxide
ETO-46 EtO Source
403830 741249 000001
H 0.318.3 4970 0.2 27.7 293
Ethylene Oxide
ETO-47 EtO Source
3128181002310 000003
F 11.1 5.2 1001 0 0 293
F 11.1 5.2 1001 0 0 293
H 381.912.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-48 EtO Source
385640 951330 000001
H 340.212.2 5400 1.2 6.8 345
Ethylene Oxide
ETO-49 EtO Source
350748 805702 100003

H 90.718.3 5400 0.9 39.6 355
H 90.712.2 5400 0.9 15.2 311
F 90.7 7.6 1001 0 4.9 294
Ethylene Oxide
ETO-50 EtO Source
450757 931615 000001
H 127.011.3 4130 0.6 4.6 372
Ethylene Oxide
ETO-51 EtO Source
412018 725215 000002
F 2.3 5.2 1001 0 0 293
H 113.412.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-52 EtO Source
354649 794851 000001
H 27.215.2 9120 1.2 1.9 351
Ethylene Oxide
ETO-54 EtO Source
3931151194309 000001
H 0.413.7 5120 0.2 2.3 293
Ethylene Oxide
ETO-55 EtO Source
355517 800146 000002
F 1.4 5.2 1001 0 0 293
H 33.112.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-56 EtO Source
391008 764646 000003
H 56.712.2 5400 0.2 6.1 311
H 56.719.8 5400 0.2 3 297
F 2.3 5.2 1001 0 0 293
Ethylene Oxide
ETO-57 EtO Source
391414 863737 100003
F 51.7 5.2 1001 0 0 293
F 51.7 5.2 1001 0 0 293
H 10.412.2 5400 1.2 6.8 345
Ethylene Oxide
ETO-58 EtO Source
425245 854103 000001
H 199.615.2 3430 1.1 2.4 308
Ethylene Oxide
ETO-59 EtO Source
392430 764550 000001
H 113.4 3.7 5400 0.2 6.8 297
Ethylene Oxide
ETO-60 EtO Source
403806 752008 000001
H 105.712.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-61 EtO Source
3359481181218 000003

F 27.2 5.2 1001 0 0 293
H 54.4 5.2 5400 1.2 4.6 293
H 5.412.2 5400 1.2 7 345
Ethylene Oxide
ETO-62 EtO Source
344615 821751 000002
F 68.9 5.2 1001 0 0 293
H 21.812.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-67 EtO Source
3120471105719 100002
F 36.3 5.2 1001 0 0 293
H 0.4 8.5 8170 0.7 5.5 345
Ethylene Oxide
ETO-70 EtO Source
324756 970250 000001
H 24.518.3 5990 0.3 8.5 293
Ethylene Oxide
ETO-71 EtO Source
362650 833448 100001
H 32.212.2 5400 1.2 6.8 345
Ethylene Oxide
ETO-75 EtO Source
353910 802948 100002
H 18.112.2 7380 1 0.71033
H 9.1 0.9 7380 0.5 17.5 311
Ethylene Oxide
ETO-80 EtO Source
3243011170933 000001
H 1.818.3 5070 0.3 1.2 293
Ethylene Oxide
ETO-91 EtO Source
4524281223239 000001
H 907.2 0.3 5400 0.5 5 458
Ethylene Oxide
ETO-117 EtO Source
3515351135647 100001
H 0.012.5 2220 0.1 10.4 293
Ethylene Oxide
ETO-118 EtO Source
3944051050710 000003
H 63.5 6.1 5400 0.4 3.1 295
H 132.4 6.1 5400 0.9 4.6 295
H 753.0 8.5 5400 0.9 5.6 295
Ethylene Oxide
ETO-119 EtO Source
3239181143322 100002
H 18.112.2 5400 1.1 2.6 977
H 9.112.2 5400 0.5 11.7 311

Attachment 9: Noncancer HEM-Screen input file for major sources

```
00061     ff 0.03333
Ethylene Oxide
ETO-1  EtO Source
175817 661801                    100002
H       206.212.1 5400 1.2  6.8 345
F        22.7 5.2 1001   0    0 293
Ethylene Oxide
ETO-2  EtO Source
402617 743004                    000005
F        46.5 5.2 1001   0    0 293
H        37.612.1 5400 1.2  6.8 345
F        46.5 5.2 1001   0    0 293
H        37.612.1 5400 1.2  6.8 345
H        37.613.7 5400 1.7   12 377
Ethylene Oxide
ETO-3  EtO Source
362132 922317                    100002
F        95.3 5.2 1001   0    0 293
H       907.212.1 5400 1.2  6.8 345
Ethylene Oxide
ETO-4  EtO Source
414452 875638                    000003
F      2848.6 7.6 1001   0  9.1 294
H       127.018.3 5400 2.5100.6 311
H       108.9 9.1 5400 0.2 30.5 311
Ethylene Oxide
ETO-5  EtO Source
425512 721810                    100003
F        11.0 5.2 1001   0    0 293
F      1644.7 5.2 1001   0    0 293
H        46.312.5 5400 1.2  6.8 345
Ethylene Oxide
ETO-7  EtO Source
422020 875347                    000003
H       362.918.3 5670 0.3 30.5 311
H       154.215.2 5670 0.3 44.2 336
H       154.215.2 5670 0.3 44.2 336
Ethylene Oxide
ETO-8  EtO Source
333636 835010                    000002
F      4100.5 5.2 1001   0    0 293
H      1458.819.8 5400 1.4 17.8 500
Ethylene Oxide
ETO-9  EtO Source
421958 880750                    100001
H       884.7 4.9 5400 0.1 68.2 394
Ethylene Oxide
ETO-10  EtO Source
332342 815906                    100002
F      3619.7 5.2 1001   0    0 293
```

H 136.1 9.1 5400 0.8 30.8 366
Ethylene Oxide
ETO-11 EtO Source
364522 863435 100003
F 226.8 5.2 1001 0 14.3 293
H 45.412.2 1820 0.4 14.7 345
F 644.1 7.6 1001 0 14.9 293
Ethylene Oxide
ETO-12 EtO Source
334954 842804 100003
F 63.5 9.1 1001 0 0.6 293
H 108.915.2 5400 0.9 9.1 312
H 1179.3 9.1 5400 0.3 4.9 311
Ethylene Oxide
ETO-13 EtO Source
4046401120130 100003
F 54.4 5.2 1001 0 0 293
H 1297.314.6 3750 0.7 4.3 293
H 1288.212.2 3750 0.3 4.9 293
Ethylene Oxide
ETO-14 EtO Source
415043 873902 000002
H 85.821.3 6960 0.2 4.1 294
H 957.521.3 6960 0.2 4.1 294
Ethylene Oxide
ETO-15 EtO Source
373010 772120 100002
H 1723.713.7 4970 1.1 14.8 405
H 1632.913.7 4970 0.8 20.4 293
Ethylene Oxide
ETO-18 EtO Source
181660 670822 100003
F 10.9 5.2 1001 0 0 293
F 277.6 5.2 1001 0 0 293
H 455.412.2 5400 1.2 6.8 345
Ethylene Oxide
ETO-19 EtO Source
302545 883100 100003
F 1383.5 5.2 1001 0 0 293
F 1383.5 5.2 1001 0 0 293
H 780.212.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-20 EtO Source
404232 740343 000001
H 54.412.287.70 0.1 8.2 322
Ethylene Oxide
ETO-21 EtO Source
3151301064115 100004
H 2023.012.244.50 1.2100.6 450
H 90.718.344.50 0.6 3 294
H 1914.212.244.50 0.3 4.9 293
F 90.710.737.21 0 3 293

Ethylene Oxide
ETO-22 EtO Source
350455 900343 000002
H 684.010.7 4450 1.1 7.4 405
H 756.6 9.8 4450 0.2 10.2 293
Ethylene Oxide
ETO-23 EtO Source
343336 820748 100002
F 562.5 5.2 1001 0 21.3 389
H 263.115.2 7240 2 3.3 561
Ethylene Oxide
ETO-24 EtO Source
372214 894111 100002
H 1877.9 7.6 8950 0.8 13.1 316
H 3138.9 7.6 8950 0.8 20.4 318
Ethylene Oxide
ETO-25 EtO Source
414201 713508 100001
H 90.721.3 5760 0.9 11.2 293
Ethylene Oxide
ETO-26 EtO Source
3400051181316 000003
H 45.4 5.2 5400 1.2 60.7 293
H 172.412.2 5400 1.2 4.6 345
F 18.1 5.2 1001 0 6.8 293
Ethylene Oxide
ETO-27 EtO Source
350141 820358 100002
F 1414.3 5.2 1001 0 0 293
H 304.412.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-29 EtO Source
3944051050710 000001
H 1378.912.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-32 EtO Source
355510 813402 100001
H 1.412.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-33 EtO Source
333650 965645 000002
F 412.8 5.2 1001 0 0 293
H 353.812.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-35 EtO Source
403401 795129 100001
H 340.2 7.9 5400 0.2 0.8 327
Ethylene Oxide
ETO-36 EtO Source
334334 843502 000002
H 372.910.7 4450 1.1 7.4 405
H 527.5 7 4450 0.8 13.4 293

Ethylene Oxide
ETO-37 EtO Source
422015 713800 100002
H 27.2 8.8 6250 1 11 344
H 544.314.9 6250 2 2.3 950
Ethylene Oxide
ETO-38 EtO Source
403405 742546 000002
H 72.618.3 4720 0.2 13.3 293
H 72.618.3 4720 0.3 32.3 293
Ethylene Oxide
ETO-39 EtO Source
3143401061726 100003
H 18.114.9 6750 2 1.9 356
H 27.2 4.9 6750 0.8 13.4 368
H 18.1 4.9 6750 0.8 10.4 356
Ethylene Oxide
ETO-40 EtO Source
391638 763338 000001
H 163.321.3 5760 0.2 3.1 293
Ethylene Oxide
ETO-41 EtO Source
3403251173300 000003
F 113.4 5.2 1001 0 0 293
H 136.112.1 5400 1.2 6.7 345
H 107.0 5.2 5400 1.2 4.6 293
Ethylene Oxide
ETO-44 EtO Source
280211 823938 000001
H 508.017.7 5400 0.5 24.4 289
Ethylene Oxide
ETO-45 EtO Source
432054 733554 100002
H 163.323.8 5400 0.6 13.7 364
H 72.610.7 5400 0.9 0.6 294
Ethylene Oxide
ETO-46 EtO Source
403830 741249 000001
H 0.318.3 4970 0.2 27.7 293
Ethylene Oxide
ETO-47 EtO Source
3128181002310 000003
F 11.1 5.2 1001 0 0 293
F 11.1 5.2 1001 0 0 293
H 381.912.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-48 EtO Source
385640 951330 000001
H 340.212.2 5400 1.2 6.8 345
Ethylene Oxide
ETO-49 EtO Source
350748 805702 100003

H 90.718.3 5400 0.9 39.6 355
H 90.712.2 5400 0.9 15.2 311
F 90.7 7.6 1001 0 4.9 294
Ethylene Oxide
ETO-50 EtO Source
450757 931615 000001
H 127.011.3 4130 0.6 4.6 372
Ethylene Oxide
ETO-51 EtO Source
412018 725215 000002
F 2.3 5.2 1001 0 0 293
H 113.412.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-52 EtO Source
354649 794851 000001
H 27.215.2 9120 1.2 1.9 351
Ethylene Oxide
ETO-54 EtO Source
3931151194309 000001
H 0.413.7 5120 0.2 2.3 293
Ethylene Oxide
ETO-55 EtO Source
355517 800146 000002
F 1.4 5.2 1001 0 0 293
H 33.112.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-56 EtO Source
391008 764646 000003
H 56.712.2 5400 0.2 6.1 311
H 56.719.8 5400 0.2 3 297
F 2.3 5.2 1001 0 0 293
Ethylene Oxide
ETO-57 EtO Source
391414 863737 100003
F 51.7 5.2 1001 0 0 293
F 51.7 5.2 1001 0 0 293
H 10.412.2 5400 1.2 6.8 345
Ethylene Oxide
ETO-58 EtO Source
425245 854103 000001
H 199.615.2 3430 1.1 2.4 308
Ethylene Oxide
ETO-59 EtO Source
392430 764550 000001
H 113.4 3.7 5400 0.2 6.8 297
Ethylene Oxide
ETO-60 EtO Source
403806 752008 000001
H 105.712.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-61 EtO Source
3359481181218 000003

F 27.2 5.2 1001 0 0 293
H 54.4 5.2 5400 1.2 4.6 293
H 5.412.2 5400 1.2 7 345
Ethylene Oxide
ETO-62 EtO Source
344615 821751 000002
F 68.9 5.2 1001 0 0 293
H 21.812.1 5400 1.2 6.8 345
Ethylene Oxide
ETO-67 EtO Source
3120471105719 100002
F 36.3 5.2 1001 0 0 293
H 0.4 8.5 8170 0.7 5.5 345
Ethylene Oxide
ETO-70 EtO Source
324756 970250 000001
H 24.518.3 5990 0.3 8.5 293
Ethylene Oxide
ETO-71 EtO Source
362650 833448 100001
H 32.212.2 5400 1.2 6.8 345
Ethylene Oxide
ETO-75 EtO Source
353910 802948 100002
H 18.112.2 7380 1 0.71033
H 9.1 0.9 7380 0.5 17.5 311
Ethylene Oxide
ETO-80 EtO Source
3243011170933 000001
H 1.818.3 5070 0.3 1.2 293
Ethylene Oxide
ETO-91 EtO Source
4524281223239 000001
H 907.2 0.3 5400 0.5 5 458
Ethylene Oxide
ETO-117 EtO Source
3515351135647 100001
H 0.012.5 2220 0.1 10.4 293
Ethylene Oxide
ETO-118 EtO Source
3944051050710 000003
H 63.5 6.1 5400 0.4 3.1 295
H 132.4 6.1 5400 0.9 4.6 295
H 753.0 8.5 5400 0.9 5.6 295
Ethylene Oxide
ETO-119 EtO Source
3239181143322 100002
H 18.112.2 5400 1.1 2.6 977
H 9.112.2 5400 0.5 11.7 311

Attachment 10: Cancer HEM-Screen output file for major sources

HUMAN EXPOSURE MODEL
STANDARD SUMMARY REPORT

Date: 12/14/2004 Time: 10:49
Chemical Name: Ethylene Oxide Unit Risk: 8.80E-05

REPORT DESCRIPTION
majors

MODELING OPTIONS
Input File Name: c:\program files\hem_vb_wrapper_v3\input\eotestmj.hem
Radii Set: " 0.1, 0.5, 1.0, 2.0, 5.0,10.0,20.0,30.0,40.0,50.0"
Census Data: 2000
Atmospheric Decay: No

HEM-SCREEN EXPOSURE RESULTS

	Concentration	Population	Exposure
MAX:	1.68E+00	94	1.58E+02
MIN:	1.00E-38	"91,300,000"	3.23E+04

Level	Concentration	Population	Exposure
1	4.14E+00		0.00E+00
3	1.00E+00	285	3.66E+02
4	5.00E-01	"1,350"	1.11E+03
5	2.50E-01	"3,160"	1.69E+03
6	1.00E-01	"8,350"	2.39E+03
7	5.00E-02	"22,600"	3.40E+03
8	2.50E-02	"74,900"	5.17E+03
9	1.00E-02	"292,000"	8.44E+03
10	5.00E-03	"681,000"	1.11E+04
11	2.50E-03	"1,720,000"	1.47E+04
12	1.00E-03	"6,040,000"	2.11E+04
13	5.00E-04	"13,700,000"	2.64E+04
14	2.50E-04	"20,600,000"	2.89E+04
15	1.00E-04	"32,600,000"	3.08E+04
16	5.00E-05	"43,500,000"	3.16E+04
17	2.50E-05	"54,300,000"	3.20E+04
18	1.00E-05	"69,500,000"	3.22E+04
19	5.00E-06	"77,600,000"	3.23E+04
20	2.50E-06	"83,800,000"	3.23E+04
21	1.00E-06	"85,700,000"	3.23E+04
22	5.00E-07	"87,500,000"	3.23E+04
23	2.50E-07	"89,200,000"	3.23E+04
24	1.00E-07	"90,400,000"	3.23E+04
25	5.00E-08	"91,000,000"	3.23E+04

26	2.50E-08	"91,200,000"	3.23E+04
27	1.00E-08	"91,300,000"	3.23E+04
28	5.00E-09	"91,300,000"	3.23E+04
29	2.50E-09	"91,300,000"	3.23E+04
30	1.00E-09	"91,300,000"	3.23E+04
31	5.00E-10	"91,300,000"	3.23E+04
32	2.50E-10	"91,300,000"	3.23E+04
33	1.00E-10	"91,300,000"	3.23E+04
34	5.00E-11	"91,300,000"	3.23E+04
35	2.50E-11	"91,300,000"	3.23E+04
36	1.00E-11	"91,300,000"	3.23E+04
37	5.00E-12	"91,300,000"	3.23E+04
38	2.50E-12	"91,300,000"	3.23E+04
39	1.00E-12	"91,300,000"	3.23E+04
40	5.00E-13	"91,300,000"	3.23E+04
41	2.50E-13	"91,300,000"	3.23E+04
42	1.00E-13	"91,300,000"	3.23E+04
43	5.00E-14	"91,300,000"	3.23E+04
44	2.50E-14	"91,300,000"	3.23E+04
45	1.00E-14	"91,300,000"	3.23E+04
46	5.00E-15	"91,300,000"	3.23E+04
47	2.50E-15	"91,300,000"	3.23E+04
48	1.00E-15	"91,300,000"	3.23E+04
49	5.00E-16	"91,300,000"	3.23E+04
50	2.50E-16	"91,300,000"	3.23E+04
51	1.00E-16	"91,300,000"	3.23E+04
52	5.00E-17	"91,300,000"	3.23E+04
53	2.50E-17	"91,300,000"	3.23E+04
54	1.00E-17	"91,300,000"	3.23E+04
55	5.00E-18	"91,300,000"	3.23E+04
56	2.50E-18	"91,300,000"	3.23E+04
57	1.00E-18	"91,300,000"	3.23E+04
58	5.00E-19	"91,300,000"	3.23E+04
59	2.50E-19	"91,300,000"	3.23E+04
60	1.00E-19	"91,300,000"	3.23E+04
61	5.00E-20	"91,300,000"	3.23E+04
62	2.50E-20	"91,300,000"	3.23E+04
63	1.00E-20	"91,300,000"	3.23E+04
64	5.00E-21	"91,300,000"	3.23E+04
65	2.50E-21	"91,300,000"	3.23E+04
66	1.00E-21	"91,300,000"	3.23E+04
67	5.00E-22	"91,300,000"	3.23E+04
68	2.50E-22	"91,300,000"	3.23E+04
69	1.00E-22	"91,300,000"	3.23E+04
70	5.00E-23	"91,300,000"	3.23E+04
71	2.50E-23	"91,300,000"	3.23E+04
72	1.00E-23	"91,300,000"	3.23E+04
73	5.00E-24	"91,300,000"	3.23E+04
74	2.50E-24	"91,300,000"	3.23E+04
75	1.00E-24	"91,300,000"	3.23E+04
76	5.00E-25	"91,300,000"	3.23E+04
77	2.50E-25	"91,300,000"	3.23E+04

78	1.00E-25	"91,300,000"	3.23E+04
79	5.00E-26	"91,300,000"	3.23E+04
80	2.50E-26	"91,300,000"	3.23E+04
81	1.00E-26	"91,300,000"	3.23E+04
82	5.00E-27	"91,300,000"	3.23E+04
83	2.50E-27	"91,300,000"	3.23E+04
84	1.00E-27	"91,300,000"	3.23E+04
85	5.00E-28	"91,300,000"	3.23E+04
86	2.50E-28	"91,300,000"	3.23E+04
87	1.00E-28	"91,300,000"	3.23E+04
88	5.00E-29	"91,300,000"	3.23E+04
89	2.50E-29	"91,300,000"	3.23E+04
90	1.00E-29	"91,300,000"	3.23E+04
91	5.00E-30	"91,300,000"	3.23E+04
92	2.50E-30	"91,300,000"	3.23E+04
93	1.00E-30	"91,300,000"	3.23E+04
94	5.00E-31	"91,300,000"	3.23E+04
95	2.50E-31	"91,300,000"	3.23E+04
96	1.00E-31	"91,300,000"	3.23E+04
97	5.00E-32	"91,300,000"	3.23E+04
98	2.50E-32	"91,300,000"	3.23E+04
99	1.00E-32	"91,300,000"	3.23E+04
100	5.00E-33	"91,300,000"	3.23E+04
101	2.50E-33	"91,300,000"	3.23E+04
102	1.00E-33	"91,300,000"	3.23E+04
103	5.00E-34	"91,300,000"	3.23E+04
104	2.50E-34	"91,300,000"	3.23E+04
105	1.00E-34	"91,300,000"	3.23E+04
106	5.00E-35	"91,300,000"	3.23E+04
107	2.50E-35	"91,300,000"	3.23E+04
108	1.00E-35	"91,300,000"	3.23E+04
109	5.00E-36	"91,300,000"	3.23E+04
110	2.50E-36	"91,300,000"	3.23E+04
111	1.00E-36	"91,300,000"	3.23E+04
112	5.00E-37	"91,300,000"	3.23E+04
113	2.50E-37	"91,300,000"	3.23E+04
114	1.00E-37	"91,300,000"	3.23E+04
115	5.00E-38	"91,300,000"	3.23E+04
116	2.50E-38	"91,300,000"	3.23E+04
117	1.00E-38	"91,300,000"	3.23E+04

HEM-SCREEN RISK RESULTS

	Risk Level	Population	Exposure * Risk
MAX:	1.48E-04	47	6.95E-03
MIN:	8.80E-43	"91,300,000"	2.84E+00

Level	Risk Level	Population	Exposure * Unit Risk
1	3.65E-04		0.00E+00
3	1.00E-04	94	1.39E-02
4	5.00E-05	"1,230"	9.18E-02
5	2.50E-05	"2,640"	1.37E-01

6	1.00E-05	"7,050"	1.98E-01
7	5.00E-06	"20,000"	2.87E-01
8	2.50E-06	"62,100"	4.25E-01
9	1.00E-06	"247,000"	7.00E-01
10	5.00E-07	"590,000"	9.37E-01
11	2.50E-07	"1,440,000"	1.23E+00
12	1.00E-07	"5,030,000"	1.76E+00
13	5.00E-08	"11,900,000"	2.24E+00
14	2.50E-08	"19,400,000"	2.52E+00
15	1.00E-08	"30,700,000"	2.69E+00
16	5.00E-09	"41,700,000"	2.77E+00
17	2.50E-09	"52,200,000"	2.81E+00
18	1.00E-09	"67,700,000"	2.83E+00
19	5.00E-10	"76,300,000"	2.84E+00
20	2.50E-10	"83,200,000"	2.84E+00
21	1.00E-10	"85,400,000"	2.84E+00
22	5.00E-11	"87,200,000"	2.84E+00
23	2.50E-11	"88,900,000"	2.84E+00
24	1.00E-11	"90,200,000"	2.84E+00
25	5.00E-12	"90,900,000"	2.84E+00
26	2.50E-12	"91,200,000"	2.84E+00
27	1.00E-12	"91,300,000"	2.84E+00
28	5.00E-13	"91,300,000"	2.84E+00
29	2.50E-13	"91,300,000"	2.84E+00
30	1.00E-13	"91,300,000"	2.84E+00
31	5.00E-14	"91,300,000"	2.84E+00
32	2.50E-14	"91,300,000"	2.84E+00
33	1.00E-14	"91,300,000"	2.84E+00
34	5.00E-15	"91,300,000"	2.84E+00
35	2.50E-15	"91,300,000"	2.84E+00
36	1.00E-15	"91,300,000"	2.84E+00
37	5.00E-16	"91,300,000"	2.84E+00
38	2.50E-16	"91,300,000"	2.84E+00
39	1.00E-16	"91,300,000"	2.84E+00
40	5.00E-17	"91,300,000"	2.84E+00
41	2.50E-17	"91,300,000"	2.84E+00
42	1.00E-17	"91,300,000"	2.84E+00
43	5.00E-18	"91,300,000"	2.84E+00
44	2.50E-18	"91,300,000"	2.84E+00
45	1.00E-18	"91,300,000"	2.84E+00
46	5.00E-19	"91,300,000"	2.84E+00
47	2.50E-19	"91,300,000"	2.84E+00
48	1.00E-19	"91,300,000"	2.84E+00
49	5.00E-20	"91,300,000"	2.84E+00
50	2.50E-20	"91,300,000"	2.84E+00
51	1.00E-20	"91,300,000"	2.84E+00
52	5.00E-21	"91,300,000"	2.84E+00
53	2.50E-21	"91,300,000"	2.84E+00
54	1.00E-21	"91,300,000"	2.84E+00
55	5.00E-22	"91,300,000"	2.84E+00
56	2.50E-22	"91,300,000"	2.84E+00
57	1.00E-22	"91,300,000"	2.84E+00

58	5.00E-23	"91,300,000"	2.84E+00
59	2.50E-23	"91,300,000"	2.84E+00
60	1.00E-23	"91,300,000"	2.84E+00
61	5.00E-24	"91,300,000"	2.84E+00
62	2.50E-24	"91,300,000"	2.84E+00
63	1.00E-24	"91,300,000"	2.84E+00
64	5.00E-25	"91,300,000"	2.84E+00
65	2.50E-25	"91,300,000"	2.84E+00
66	1.00E-25	"91,300,000"	2.84E+00
67	5.00E-26	"91,300,000"	2.84E+00
68	2.50E-26	"91,300,000"	2.84E+00
69	1.00E-26	"91,300,000"	2.84E+00
70	5.00E-27	"91,300,000"	2.84E+00
71	2.50E-27	"91,300,000"	2.84E+00
72	1.00E-27	"91,300,000"	2.84E+00
73	5.00E-28	"91,300,000"	2.84E+00
74	2.50E-28	"91,300,000"	2.84E+00
75	1.00E-28	"91,300,000"	2.84E+00
76	5.00E-29	"91,300,000"	2.84E+00
77	2.50E-29	"91,300,000"	2.84E+00
78	1.00E-29	"91,300,000"	2.84E+00
79	5.00E-30	"91,300,000"	2.84E+00
80	2.50E-30	"91,300,000"	2.84E+00
81	1.00E-30	"91,300,000"	2.84E+00
82	5.00E-31	"91,300,000"	2.84E+00
83	2.50E-31	"91,300,000"	2.84E+00
84	1.00E-31	"91,300,000"	2.84E+00
85	5.00E-32	"91,300,000"	2.84E+00
86	2.50E-32	"91,300,000"	2.84E+00
87	1.00E-32	"91,300,000"	2.84E+00
88	5.00E-33	"91,300,000"	2.84E+00
89	2.50E-33	"91,300,000"	2.84E+00
90	1.00E-33	"91,300,000"	2.84E+00
91	5.00E-34	"91,300,000"	2.84E+00
92	2.50E-34	"91,300,000"	2.84E+00
93	1.00E-34	"91,300,000"	2.84E+00
94	5.00E-35	"91,300,000"	2.84E+00
95	2.50E-35	"91,300,000"	2.84E+00
96	1.00E-35	"91,300,000"	2.84E+00
97	5.00E-36	"91,300,000"	2.84E+00
98	2.50E-36	"91,300,000"	2.84E+00
99	1.00E-36	"91,300,000"	2.84E+00
100	5.00E-37	"91,300,000"	2.84E+00
101	2.50E-37	"91,300,000"	2.84E+00
102	1.00E-37	"91,300,000"	2.84E+00
103	5.00E-38	"91,300,000"	2.84E+00
104	2.50E-38	"91,300,000"	2.84E+00
105	8.80E-43	"91,300,000"	2.84E+00

HEM-SCREEN RESULTS

Source	Max Concentration	People	Max Exposure	Lifetime Incidence	Max Risk	Annual Incid.	Repeat Interval
ETO-18 EtO Source	1.68E+00	94	1.58E+02	1.39E-02	1.48E-04	0.0024	420
ETO-19 EtO Source	1.06E+00	3	3.19E+00	2.81E-04	9.37E-05	0.0015	690
ETO-8 EtO Source	8.38E-01	3	2.51E+00	2.21E-04	7.37E-05	0.0015	670
ETO-27 EtO Source	7.51E-01	39	2.93E+01	2.58E-03	6.61E-05	0.0013	760
ETO-4 EtO Source	6.96E-01	49	3.41E+01	3.00E-03	6.12E-05	0.0042	240
ETO-5 EtO Source	6.90E-01	54	3.72E+01	3.28E-03	6.07E-05	0.0011	880
ETO-24 EtO Source	2.67E-01	1	2.67E-01	2.35E-05	2.35E-05	0.0011	900
ETO-11 EtO Source	2.53E-01	26	6.58E+00	5.79E-04	2.23E-05	0.0003	"3,200.00"
ETO-22 EtO Source	2.43E-01	65	1.58E+01	1.39E-03	2.14E-05	0.0008	"1,200.00"
ETO-12 EtO Source	1.88E-01	4	7.54E-01	6.63E-05	1.66E-05	0.0039	260
ETO-118 EtO Source	1.86E-01	28	5.21E+00	4.59E-04	1.64E-05	0.001	980
ETO-13 EtO Source	1.70E-01	7	1.19E+00	1.05E-04	1.50E-05	0.0018	540
ETO-57 EtO Source	1.49E-01	15	2.23E+00	1.96E-04	1.31E-05	0.0001	"11,000.00"
ETO-91 EtO Source	1.40E-01	17	2.38E+00	2.09E-04	1.23E-05	0.0007	"1,500.00"
ETO-10 EtO Source	1.35E-01	3	4.05E-01	3.56E-05	1.19E-05	0.0037	270
ETO-29 EtO Source	1.28E-01	28	3.58E+00	3.15E-04	1.12E-05	0.0013	770
ETO-3 EtO Source	1.12E-01	107	1.20E+01	1.05E-03	9.86E-06	0.0002	"5,200.00"
ETO-14 EtO Source	1.11E-01	158	1.75E+01	1.54E-03	9.75E-06	0.0021	470
ETO-1 EtO Source	7.85E-02	322	2.53E+01	2.22E-03	6.91E-06	0.0004	"2,700.00"
ETO-9 EtO Source	7.60E-02	2	1.52E-01	1.34E-05	6.69E-06	0.0012	840
ETO-44 EtO Source	6.74E-02	6	4.05E-01	3.56E-05	5.93E-06	0.0003	"2,900.00"
ETO-36 EtO Source	6.72E-02	153	1.03E+01	9.05E-04	5.91E-06	0.0005	"2,100.00"
ETO-48 EtO Source	5.92E-02	22	1.30E+00	1.15E-04	5.21E-06	0.0002	"6,400.00"
ETO-35 EtO Source	5.40E-02	3	1.62E-01	1.43E-05	4.76E-06	0.0005	"1,800.00"
ETO-15 EtO Source	5.40E-02	1	5.40E-02	4.75E-06	4.75E-06	0.0027	370
ETO-23 EtO Source	4.37E-02	111	4.85E+00	4.27E-04	3.85E-06	0.0002	"4,300.00"
ETO-7 EtO Source	4.11E-02	171	7.03E+00	6.19E-04	3.62E-06	0.0004	"2,600.00"
ETO-67 EtO Source	3.92E-02	185	7.25E+00	6.38E-04	3.45E-06	<0.0001	"43,000.00"
ETO-20 EtO Source	3.66E-02	92	3.37E+00	2.96E-04	3.22E-06	0.0003	"3,700.00"
ETO-21 EtO Source	2.69E-02	343	9.23E+00	8.13E-04	2.37E-06	0.001	"1,000.00"
ETO-61 EtO Source	2.51E-02	28	7.04E-01	6.20E-05	2.21E-06	0.0003	"3,100.00"
ETO-37 EtO Source	2.47E-02	53	1.31E+00	1.15E-04	2.17E-06	0.0007	"1,400.00"
ETO-26 EtO Source	2.28E-02	3	6.85E-02	6.03E-06	2.01E-06	0.0008	"1,200.00"
ETO-59 EtO Source	2.09E-02	926	1.94E+01	1.71E-03	1.84E-06	0.0001	"9,200.00"
ETO-62 EtO Source	2.02E-02	3	6.06E-02	5.33E-06	1.78E-06	<0.0001	"26,000.00"
ETO-49 EtO Source	1.76E-02	9	1.59E-01	1.40E-05	1.55E-06	0.0003	"3,300.00"
ETO-33 EtO Source	1.69E-02	48	8.10E-01	7.12E-05	1.48E-06	<0.0001	"54,000.00"
ETO-45 EtO Source	1.67E-02	35	5.85E-01	5.15E-05	1.47E-06	<0.0001	"22,000.00"
ETO-58 EtO Source	1.58E-02	51	8.07E-01	7.10E-05	1.39E-06	0.0001	"9,200.00"
ETO-38 EtO Source	1.29E-02	25	3.23E-01	2.84E-05	1.14E-06	0.0002	"5,100.00"
ETO-55 EtO Source	1.17E-02	9	1.05E-01	9.24E-06	1.03E-06	<0.0001	"73,000.00"
ETO-56 EtO Source	1.12E-02	"1,050"	1.18E+01	1.03E-03	9.85E-07	0.0001	"10,000.00"
ETO-60 EtO Source	1.08E-02	71	7.64E-01	6.73E-05	9.47E-07	0.0001	"16,000.00"
ETO-51 EtO Source	9.42E-03	11	1.04E-01	9.12E-06	8.29E-07	<0.0001	"28,000.00"
ETO-2 EtO Source	8.16E-03	4	3.27E-02	2.87E-06	7.18E-07	0.0002	"5,300.00"
ETO-52 EtO Source	7.35E-03	8	5.88E-02	5.17E-06	6.46E-07	<0.0001	"220,000.00"
ETO-41 EtO Source	7.22E-03	11	7.94E-02	6.99E-06	6.35E-07	0.0003	"3,600.00"
ETO-75 EtO Source	7.04E-03	19	1.34E-01	1.18E-05	6.20E-07	<0.0001	"37,000.00"
ETO-47 EtO Source	6.44E-03	462	2.97E+00	2.62E-04	5.67E-07	<0.0001	"28,000.00"
ETO-40 EtO Source	6.21E-03	70	4.35E-01	3.82E-05	5.46E-07	0.0002	"6,200.00"

ETO-71 EtO Source	5.15E-03	6	3.09E-02	2.72E-06	4.53E-07	<0.0001	"150,000.00"
ETO-39 EtO Source	4.47E-03	104	4.65E-01	4.09E-05	3.94E-07	0.0001	"8,600.00"
ETO-50 EtO Source	3.97E-03	535	2.13E+00	1.87E-04	3.50E-07	0.0001	"12,000.00"
ETO-25 EtO Source	2.58E-03	22	5.67E-02	4.99E-06	2.27E-07	0.0001	"12,000.00"
ETO-119 EtO Source	2.06E-03	2	4.12E-03	3.62E-07	1.81E-07	<0.0001	"170,000.00"
ETO-80 EtO Source	9.28E-04	23	2.13E-02	1.88E-06	8.17E-08	<0.0001	"290,000.00"
ETO-70 EtO Source	3.20E-04	522	1.67E-01	1.47E-05	2.82E-08	<0.0001	"82,000.00"
ETO-32 EtO Source	1.07E-04	5	5.35E-04	4.70E-08	9.41E-09	<0.0001	**********
ETO-46 EtO Source	5.39E-05	28	1.51E-03	1.33E-07	4.74E-09	<0.0001	**********
ETO-54 EtO Source	3.31E-05	1	3.31E-05	2.91E-09	2.91E-09	<0.0001	**********
ETO-117 EtO Source	1.00E-38	"49,300"	4.93E-34	4.33E-38	8.80E-43	<0.0001	

*** END OF REPORT ***

Attachment 11: Noncancer HEM-Screen output file for major sources

HUMAN EXPOSURE MODEL
STANDARD SUMMARY REPORT

Date: 12/15/2004 Time: 08:30
Chemical Name: Ethylene Oxide Unit Risk: 3.33E-02

REPORT DESCRIPTION

MODELING OPTIONS
Input File Name: c:\program files\hem_vb_wrapper_v3\input\eoncmj.hem
Radii Set: " 0.1, 0.5, 1.0, 2.0, 5.0,10.0,20.0,30.0,40.0,50.0"
Census Data: 2000
Atmospheric Decay: No

HEM-SCREEN EXPOSURE RESULTS

	Concentration	Population	Exposure
MAX:	1.68E+00	94	1.58E+02
MIN:	1.00E-38	"91,300,000"	3.23E+04

Level	Concentration	Population	Exposure
1	4.14E+00		0.00E+00
3	1.00E+00	285	3.66E+02
4	5.00E-01	"1,350"	1.11E+03
5	2.50E-01	"3,160"	1.69E+03
6	1.00E-01	"8,350"	2.39E+03
7	5.00E-02	"22,600"	3.40E+03
8	2.50E-02	"74,900"	5.17E+03
9	1.00E-02	"292,000"	8.44E+03
10	5.00E-03	"681,000"	1.11E+04
11	2.50E-03	"1,720,000"	1.47E+04
12	1.00E-03	"6,040,000"	2.11E+04
13	5.00E-04	"13,700,000"	2.64E+04
14	2.50E-04	"20,600,000"	2.89E+04
15	1.00E-04	"32,600,000"	3.08E+04
16	5.00E-05	"43,500,000"	3.16E+04
17	2.50E-05	"54,300,000"	3.20E+04
18	1.00E-05	"69,500,000"	3.22E+04
19	5.00E-06	"77,600,000"	3.23E+04
20	2.50E-06	"83,800,000"	3.23E+04
21	1.00E-06	"85,700,000"	3.23E+04
22	5.00E-07	"87,500,000"	3.23E+04
23	2.50E-07	"89,200,000"	3.23E+04
24	1.00E-07	"90,400,000"	3.23E+04

25	5.00E-08	"91,000,000"	3.23E+04
26	2.50E-08	"91,200,000"	3.23E+04
27	1.00E-08	"91,300,000"	3.23E+04
28	5.00E-09	"91,300,000"	3.23E+04
29	2.50E-09	"91,300,000"	3.23E+04
30	1.00E-09	"91,300,000"	3.23E+04
31	5.00E-10	"91,300,000"	3.23E+04
32	2.50E-10	"91,300,000"	3.23E+04
33	1.00E-10	"91,300,000"	3.23E+04
34	5.00E-11	"91,300,000"	3.23E+04
35	2.50E-11	"91,300,000"	3.23E+04
36	1.00E-11	"91,300,000"	3.23E+04
37	5.00E-12	"91,300,000"	3.23E+04
38	2.50E-12	"91,300,000"	3.23E+04
39	1.00E-12	"91,300,000"	3.23E+04
40	5.00E-13	"91,300,000"	3.23E+04
41	2.50E-13	"91,300,000"	3.23E+04
42	1.00E-13	"91,300,000"	3.23E+04
43	5.00E-14	"91,300,000"	3.23E+04
44	2.50E-14	"91,300,000"	3.23E+04
45	1.00E-14	"91,300,000"	3.23E+04
46	5.00E-15	"91,300,000"	3.23E+04
47	2.50E-15	"91,300,000"	3.23E+04
48	1.00E-15	"91,300,000"	3.23E+04
49	5.00E-16	"91,300,000"	3.23E+04
50	2.50E-16	"91,300,000"	3.23E+04
51	1.00E-16	"91,300,000"	3.23E+04
52	5.00E-17	"91,300,000"	3.23E+04
53	2.50E-17	"91,300,000"	3.23E+04
54	1.00E-17	"91,300,000"	3.23E+04
55	5.00E-18	"91,300,000"	3.23E+04
56	2.50E-18	"91,300,000"	3.23E+04
57	1.00E-18	"91,300,000"	3.23E+04
58	5.00E-19	"91,300,000"	3.23E+04
59	2.50E-19	"91,300,000"	3.23E+04
60	1.00E-19	"91,300,000"	3.23E+04
61	5.00E-20	"91,300,000"	3.23E+04
62	2.50E-20	"91,300,000"	3.23E+04
63	1.00E-20	"91,300,000"	3.23E+04
64	5.00E-21	"91,300,000"	3.23E+04
65	2.50E-21	"91,300,000"	3.23E+04
66	1.00E-21	"91,300,000"	3.23E+04
67	5.00E-22	"91,300,000"	3.23E+04
68	2.50E-22	"91,300,000"	3.23E+04
69	1.00E-22	"91,300,000"	3.23E+04
70	5.00E-23	"91,300,000"	3.23E+04
71	2.50E-23	"91,300,000"	3.23E+04
72	1.00E-23	"91,300,000"	3.23E+04
73	5.00E-24	"91,300,000"	3.23E+04
74	2.50E-24	"91,300,000"	3.23E+04
75	1.00E-24	"91,300,000"	3.23E+04
76	5.00E-25	"91,300,000"	3.23E+04

77	2.50E-25	"91,300,000"	3.23E+04
78	1.00E-25	"91,300,000"	3.23E+04
79	5.00E-26	"91,300,000"	3.23E+04
80	2.50E-26	"91,300,000"	3.23E+04
81	1.00E-26	"91,300,000"	3.23E+04
82	5.00E-27	"91,300,000"	3.23E+04
83	2.50E-27	"91,300,000"	3.23E+04
84	1.00E-27	"91,300,000"	3.23E+04
85	5.00E-28	"91,300,000"	3.23E+04
86	2.50E-28	"91,300,000"	3.23E+04
87	1.00E-28	"91,300,000"	3.23E+04
88	5.00E-29	"91,300,000"	3.23E+04
89	2.50E-29	"91,300,000"	3.23E+04
90	1.00E-29	"91,300,000"	3.23E+04
91	5.00E-30	"91,300,000"	3.23E+04
92	2.50E-30	"91,300,000"	3.23E+04
93	1.00E-30	"91,300,000"	3.23E+04
94	5.00E-31	"91,300,000"	3.23E+04
95	2.50E-31	"91,300,000"	3.23E+04
96	1.00E-31	"91,300,000"	3.23E+04
97	5.00E-32	"91,300,000"	3.23E+04
98	2.50E-32	"91,300,000"	3.23E+04
99	1.00E-32	"91,300,000"	3.23E+04
100	5.00E-33	"91,300,000"	3.23E+04
101	2.50E-33	"91,300,000"	3.23E+04
102	1.00E-33	"91,300,000"	3.23E+04
103	5.00E-34	"91,300,000"	3.23E+04
104	2.50E-34	"91,300,000"	3.23E+04
105	1.00E-34	"91,300,000"	3.23E+04
106	5.00E-35	"91,300,000"	3.23E+04
107	2.50E-35	"91,300,000"	3.23E+04
108	1.00E-35	"91,300,000"	3.23E+04
109	5.00E-36	"91,300,000"	3.23E+04
110	2.50E-36	"91,300,000"	3.23E+04
111	1.00E-36	"91,300,000"	3.23E+04
112	5.00E-37	"91,300,000"	3.23E+04
113	2.50E-37	"91,300,000"	3.23E+04
114	1.00E-37	"91,300,000"	3.23E+04
115	5.00E-38	"91,300,000"	3.23E+04
116	2.50E-38	"91,300,000"	3.23E+04
117	1.00E-38	"91,300,000"	3.23E+04

HEM-SCREEN RISK RESULTS

	Risk Level	Population	Exposure * Risk
MAX:	5.60E-02	47	2.63E+00
MIN:	3.33E-40	"91,300,000"	1.08E+03

Level	Risk Level	Population	Exposure * Unit Risk
1	1.38E-01		0.00E+00
3	5.00E-02	94	5.26E+00
4	2.50E-02	401	1.54E+01

5	1.00E-02	"2,100"	4.67E+01
6	5.00E-03	"4,210"	6.27E+01
7	2.50E-03	"14,700"	9.73E+01
8	1.00E-03	"56,800"	1.56E+02
9	5.00E-04	"166,000"	2.30E+02
10	2.50E-04	"423,000"	3.19E+02
11	1.00E-04	"1,340,000"	4.55E+02
12	5.00E-05	"3,390,000"	5.95E+02
13	2.50E-05	"8,690,000"	7.78E+02
14	1.00E-05	"18,900,000"	9.49E+02
15	5.00E-06	"26,500,000"	1.00E+03
16	2.50E-06	"37,000,000"	1.04E+03
17	1.00E-06	"51,400,000"	1.06E+03
18	5.00E-07	"64,200,000"	1.07E+03
19	2.50E-07	"73,100,000"	1.08E+03
20	1.00E-07	"82,900,000"	1.08E+03
21	5.00E-08	"84,900,000"	1.08E+03
22	2.50E-08	"86,300,000"	1.08E+03
23	1.00E-08	"88,800,000"	1.08E+03
24	5.00E-09	"90,000,000"	1.08E+03
25	2.50E-09	"90,600,000"	1.08E+03
26	1.00E-09	"91,100,000"	1.08E+03
27	5.00E-10	"91,200,000"	1.08E+03
28	2.50E-10	"91,300,000"	1.08E+03
29	1.00E-10	"91,300,000"	1.08E+03
30	5.00E-11	"91,300,000"	1.08E+03
31	2.50E-11	"91,300,000"	1.08E+03
32	1.00E-11	"91,300,000"	1.08E+03
33	5.00E-12	"91,300,000"	1.08E+03
34	2.50E-12	"91,300,000"	1.08E+03
35	1.00E-12	"91,300,000"	1.08E+03
36	5.00E-13	"91,300,000"	1.08E+03
37	2.50E-13	"91,300,000"	1.08E+03
38	1.00E-13	"91,300,000"	1.08E+03
39	5.00E-14	"91,300,000"	1.08E+03
40	2.50E-14	"91,300,000"	1.08E+03
41	1.00E-14	"91,300,000"	1.08E+03
42	5.00E-15	"91,300,000"	1.08E+03
43	2.50E-15	"91,300,000"	1.08E+03
44	1.00E-15	"91,300,000"	1.08E+03
45	5.00E-16	"91,300,000"	1.08E+03
46	2.50E-16	"91,300,000"	1.08E+03
47	1.00E-16	"91,300,000"	1.08E+03
48	5.00E-17	"91,300,000"	1.08E+03
49	2.50E-17	"91,300,000"	1.08E+03
50	1.00E-17	"91,300,000"	1.08E+03
51	5.00E-18	"91,300,000"	1.08E+03
52	2.50E-18	"91,300,000"	1.08E+03
53	1.00E-18	"91,300,000"	1.08E+03
54	5.00E-19	"91,300,000"	1.08E+03
55	2.50E-19	"91,300,000"	1.08E+03
56	1.00E-19	"91,300,000"	1.08E+03

57	5.00E-20	"91,300,000"	1.08E+03
58	2.50E-20	"91,300,000"	1.08E+03
59	1.00E-20	"91,300,000"	1.08E+03
60	5.00E-21	"91,300,000"	1.08E+03
61	2.50E-21	"91,300,000"	1.08E+03
62	1.00E-21	"91,300,000"	1.08E+03
63	5.00E-22	"91,300,000"	1.08E+03
64	2.50E-22	"91,300,000"	1.08E+03
65	1.00E-22	"91,300,000"	1.08E+03
66	5.00E-23	"91,300,000"	1.08E+03
67	2.50E-23	"91,300,000"	1.08E+03
68	1.00E-23	"91,300,000"	1.08E+03
69	5.00E-24	"91,300,000"	1.08E+03
70	2.50E-24	"91,300,000"	1.08E+03
71	1.00E-24	"91,300,000"	1.08E+03
72	5.00E-25	"91,300,000"	1.08E+03
73	2.50E-25	"91,300,000"	1.08E+03
74	1.00E-25	"91,300,000"	1.08E+03
75	5.00E-26	"91,300,000"	1.08E+03
76	2.50E-26	"91,300,000"	1.08E+03
77	1.00E-26	"91,300,000"	1.08E+03
78	5.00E-27	"91,300,000"	1.08E+03
79	2.50E-27	"91,300,000"	1.08E+03
80	1.00E-27	"91,300,000"	1.08E+03
81	5.00E-28	"91,300,000"	1.08E+03
82	2.50E-28	"91,300,000"	1.08E+03
83	1.00E-28	"91,300,000"	1.08E+03
84	5.00E-29	"91,300,000"	1.08E+03
85	2.50E-29	"91,300,000"	1.08E+03
86	1.00E-29	"91,300,000"	1.08E+03
87	5.00E-30	"91,300,000"	1.08E+03
88	2.50E-30	"91,300,000"	1.08E+03
89	1.00E-30	"91,300,000"	1.08E+03
90	5.00E-31	"91,300,000"	1.08E+03
91	2.50E-31	"91,300,000"	1.08E+03
92	1.00E-31	"91,300,000"	1.08E+03
93	5.00E-32	"91,300,000"	1.08E+03
94	2.50E-32	"91,300,000"	1.08E+03
95	1.00E-32	"91,300,000"	1.08E+03
96	5.00E-33	"91,300,000"	1.08E+03
97	2.50E-33	"91,300,000"	1.08E+03
98	1.00E-33	"91,300,000"	1.08E+03
99	5.00E-34	"91,300,000"	1.08E+03
100	2.50E-34	"91,300,000"	1.08E+03
101	1.00E-34	"91,300,000"	1.08E+03
102	5.00E-35	"91,300,000"	1.08E+03
103	2.50E-35	"91,300,000"	1.08E+03
104	1.00E-35	"91,300,000"	1.08E+03
105	5.00E-36	"91,300,000"	1.08E+03
106	2.50E-36	"91,300,000"	1.08E+03
107	1.00E-36	"91,300,000"	1.08E+03
108	5.00E-37	"91,300,000"	1.08E+03

109	2.50E-37	"91,300,000"	1.08E+03
110	1.00E-37	"91,300,000"	1.08E+03
111	5.00E-38	"91,300,000"	1.08E+03
112	2.50E-38	"91,300,000"	1.08E+03
113	3.33E-40	"91,300,000"	1.08E+03

HEM-SCREEN RESULTS

Source	Max Concentration	People	Max Exposure	Lifetime Incidence	Max Risk	Annual Incid.	Repeat Interval
ETO-18 EtO Source	1.68E+00	94	1.58E+02	5.26E+00	5.60E-02	0.91	1.1
ETO-19 EtO Source	1.06E+00	3	3.19E+00	1.06E-01	3.55E-02	0.55	1.8
ETO-8 EtO Source	8.38E-01	3	2.51E+00	8.38E-02	2.79E-02	0.56	1.8
ETO-27 EtO Source	7.51E-01	39	2.93E+01	9.76E-01	2.50E-02	0.5	2
ETO-4 EtO Source	6.96E-01	49	3.41E+01	1.14E+00	2.32E-02	1.6	0.63
ETO-5 EtO Source	6.90E-01	54	3.72E+01	1.24E+00	2.30E-02	0.43	2.3
ETO-24 EtO Source	2.67E-01	1	2.67E-01	8.91E-03	8.91E-03	0.42	2.4
ETO-11 EtO Source	2.53E-01	26	6.58E+00	2.19E-01	8.43E-03	0.12	8.5
ETO-22 EtO Source	2.43E-01	65	1.58E+01	5.27E-01	8.11E-03	0.32	3.1
ETO-12 EtO Source	1.88E-01	4	7.54E-01	2.51E-02	6.28E-03	1.5	0.68
ETO-118 EtO Source	1.86E-01	28	5.21E+00	1.74E-01	6.21E-03	0.38	2.6
ETO-13 EtO Source	1.70E-01	7	1.19E+00	3.97E-02	5.68E-03	0.7	1.4
ETO-57 EtO Source	1.49E-01	15	2.23E+00	7.43E-02	4.95E-03	0.034	29
ETO-91 EtO Source	1.40E-01	17	2.38E+00	7.93E-02	4.66E-03	0.26	3.9
ETO-10 EtO Source	1.35E-01	3	4.05E-01	1.35E-02	4.50E-03	1.4	0.71
ETO-29 EtO Source	1.28E-01	28	3.58E+00	1.19E-01	4.26E-03	0.49	2
ETO-3 EtO Source	1.12E-01	107	1.20E+01	4.00E-01	3.73E-03	0.073	14
ETO-14 EtO Source	1.11E-01	158	1.75E+01	5.84E-01	3.69E-03	0.81	1.2
ETO-1 EtO Source	7.85E-02	322	2.53E+01	8.43E-01	2.62E-03	0.14	7.1
ETO-9 EtO Source	7.60E-02	2	1.52E-01	5.07E-03	2.53E-03	0.45	2.2
ETO-44 EtO Source	6.74E-02	6	4.05E-01	1.35E-02	2.25E-03	0.13	7.6
ETO-36 EtO Source	6.72E-02	153	1.03E+01	3.43E-01	2.24E-03	0.18	5.5
ETO-48 EtO Source	5.92E-02	22	1.30E+00	4.34E-02	1.97E-03	0.059	17
ETO-15 EtO Source	5.40E-02	1	5.40E-02	1.80E-03	1.80E-03	1	0.98
ETO-35 EtO Source	5.40E-02	3	1.62E-01	5.40E-03	1.80E-03	0.21	4.9
ETO-23 EtO Source	4.37E-02	111	4.85E+00	1.62E-01	1.46E-03	0.088	11
ETO-7 EtO Source	4.11E-02	171	7.03E+00	2.34E-01	1.37E-03	0.15	6.8
ETO-67 EtO Source	3.92E-02	185	7.25E+00	2.42E-01	1.31E-03	0.0089	110
ETO-20 EtO Source	3.66E-02	92	3.37E+00	1.12E-01	1.22E-03	0.1	9.9
ETO-21 EtO Source	2.69E-02	343	9.23E+00	3.08E-01	8.97E-04	0.38	2.6
ETO-61 EtO Source	2.51E-02	28	7.04E-01	2.35E-02	8.38E-04	0.12	8.2
ETO-37 EtO Source	2.47E-02	53	1.31E+00	4.36E-02	8.23E-04	0.26	3.8
ETO-26 EtO Source	2.28E-02	3	6.85E-02	2.28E-03	7.61E-04	0.31	3.3
ETO-59 EtO Source	2.09E-02	926	1.94E+01	6.46E-01	6.98E-04	0.041	24
ETO-62 EtO Source	2.02E-02	3	6.06E-02	2.02E-03	6.73E-04	0.015	67
ETO-49 EtO Source	1.76E-02	9	1.59E-01	5.29E-03	5.88E-04	0.12	8.7
ETO-33 EtO Source	1.69E-02	48	8.10E-01	2.70E-02	5.62E-04	0.0071	140
ETO-45 EtO Source	1.67E-02	35	5.85E-01	1.95E-02	5.57E-04	0.018	57
ETO-58 EtO Source	1.58E-02	51	8.07E-01	2.69E-02	5.27E-04	0.041	24
ETO-38 EtO Source	1.29E-02	25	3.23E-01	1.08E-02	4.31E-04	0.074	14
ETO-55 EtO Source	1.17E-02	9	1.05E-01	3.50E-03	3.89E-04	0.0052	190

ETO-56 EtO Source	1.12E-02	"1,050"	1.18E+01	3.92E-01	3.73E-04	0.037	27
ETO-60 EtO Source	1.08E-02	71	7.64E-01	2.55E-02	3.59E-04	0.024	42
ETO-51 EtO Source	9.42E-03	11	1.04E-01	3.45E-03	3.14E-04	0.013	74
ETO-2 EtO Source	8.16E-03	4	3.27E-02	1.09E-03	2.72E-04	0.072	14
ETO-52 EtO Source	7.35E-03	8	5.88E-02	1.96E-03	2.45E-04	0.0017	570
ETO-41 EtO Source	7.22E-03	11	7.94E-02	2.65E-03	2.41E-04	0.11	9.5
ETO-75 EtO Source	7.04E-03	19	1.34E-01	4.46E-03	2.35E-04	0.01	98
ETO-47 EtO Source	6.44E-03	462	2.97E+00	9.91E-02	2.15E-04	0.013	74
ETO-40 EtO Source	6.21E-03	70	4.35E-01	1.45E-02	2.07E-04	0.061	16
ETO-71 EtO Source	5.15E-03	6	3.09E-02	1.03E-03	1.72E-04	0.0025	400
ETO-39 EtO Source	4.47E-03	104	4.65E-01	1.55E-02	1.49E-04	0.044	23
ETO-50 EtO Source	3.97E-03	535	2.13E+00	7.09E-02	1.32E-04	0.03	33
ETO-25 EtO Source	2.58E-03	22	5.67E-02	1.89E-03	8.59E-05	0.031	33
ETO-119 EtO Source	2.06E-03	2	4.12E-03	1.37E-04	6.86E-05	0.0022	460
ETO-80 EtO Source	9.28E-04	23	2.13E-02	7.11E-04	3.09E-05	0.0013	760
ETO-70 EtO Source	3.20E-04	522	1.67E-01	5.57E-03	1.07E-05	0.0046	220
ETO-32 EtO Source	1.07E-04	5	5.35E-04	1.78E-05	3.56E-06	0.0002	"5,200.00"
ETO-46 EtO Source	5.39E-05	28	1.51E-03	5.03E-05	1.80E-06	0.0003	"3,400.00"
ETO-54 EtO Source	3.31E-05	1	3.31E-05	1.10E-06	1.10E-06	0.0001	"18,000.00"
ETO-117 EtO Source	1.00E-38	"49,300"	4.93E-34	1.64E-35	3.33E-40	<0.0001	

*** END OF REPORT ***