

Letter to the Editor

The Valdez Air Health Study

**Yoram Cohen, Gerald E. Anderson, Lyle R. Chinkin,
Gary Pascoe, Charles E. Schmidt, and Arthur Winer,
Members of the RCAC Valdez Air Study Review Committee**

In a recent "Perspective,"⁽⁸⁾ Dr. Bernard Goldstein has expressed the opinion that personal exposure monitoring such as the total exposure assessment methodology (TEAM) developed by Dr. Lance Wallace and his colleagues have not received the acceptance by environmental policy decision makers that it should. He notes the recent Valdez Air Health Study (VAHS),^(5,6) which was funded by the Alyeska Pipeline Service Company, as an example of a case where the conclusions from a TEAM study have met with skepticism. The purpose of this letter is to point out that the TEAM component of the VAHS was not rejected by the Valdez population and the various reviewers of the VAHS; rather, it is the VAHS conclusion regarding the contribution of the Alyeska Marine Terminal emissions to total population exposure that remains controversial.

The VAHS was undertaken by the Alyeska Pipeline Service Company ("Alyeska") to determine (i) the health risk to the residents of Valdez, Alaska, resulting from indoor and outdoor inhalation exposure to certain VOCs, such as benzene, ethylbenzene, toluene, xylenes (BETX), *n*-hexane, and styrene, and (ii) the portion of that exposure and health risk attributable to emissions from the Alyeska Marine Terminal. The study included the assessment of outdoor/indoor air and personal exposure using state-of-the-art monitoring methods.

The VAHS was used to determine the total personal and indoor exposure to a number of volatile hydrocarbons (including benzene). However, in order to determine the percentage contribution of emissions from the Alyeska Marine Terminal to the exposure of the residents of Valdez to selected VOCs, the VAHS relied on a gas tracer study. In this tracer study SF₆ was released from a specific location at the terminal. The tracer was released from a single-point source on a mountain side away from the actual broad shoreline area occupied by

the major emission sources at the terminal, i.e., the mast risers of the tankers. In other words, the tracer release point was not colocated with the major terminal emission sources. Nonetheless, based on tracer monitoring at Valdez and at the tracer release point, and assuming that the tracer pathway was identical to the pathway of emissions from the tankers, the VAHS concludes that benzene emissions from the Alyeska Marine Terminal contribute only about 25% of the ambient benzene and 11% to personal exposure to benzene. We do not believe that such conclusions can be drawn from the VAHS tracer study.

There were large uncertainties in the tracer study, as pointed out in EPA and RCAC reviews of the VAHS.^(3,4,7) One should note, in addition, that in Port Valdez the Alyeska terminal emissions of benzene (approximately 500 tons/year) comprise about 99% of the total benzene emissions. Also, the emission estimates for benzene, toluene, ethylbenzene, and xylenes appear to be corroborated by mass balance calculations and the ambient monitoring of these compounds at Port Valdez.⁽²⁾ Given the above information, reviewers of the VAHS were reluctant to accept Alyeska's conclusions that the terminal is a minor contributor to exposure to benzene and other petroleum VOCs at Valdez. It was even more difficult to accept the VAHS conclusion that the major contribution to cancer health risks due to exposure of Valdez residents to benzene is due to "other sources," despite the fact that over 99% of the total benzene emissions in Port Valdez are from the Alyeska Marine Terminal.^(5,6) Another difficulty was in accepting the VAHS conclusion that exposure of Valdez residents to hydrocarbons emitted from the Alyeska Marine Terminal will cease by the year 2015. This exposure period was determined based on the assumption that petroleum production will decrease rapidly with time (according to

unverified estimates) and that the terminal will be in operation only until the year 2015.

The VAHS was indeed an ambitious study that quantified the level of total exposure of selected subsets of the Valdez community to a number of VOCs, with benzene being the chemical of most concern. Although the validity of the total exposure assessment, as carried out in the VAHS, was accepted and praised as a unique achievement, the validity of the VAHS conclusions regarding the source apportionment of health risks has been questioned by two independent review groups.^(3,4,7)

The first review of the VAHS was conducted by the Valdez Air Study Review (VASR) Committee, and the other by the EPA staff. The review by the VASR Committee was commissioned by the Prince William Sound Regional Citizens' Advisory Council (RCAC) to provide an independent peer review of the VAHS.^(3,4) The RCAC is a regional council which was established by federal law passed after the Exxon Valdez oil spill, an event that affected approximately 20 communities along about 1000 mi of coastline. The independent review of the VAHS by the VASR Committee found, in contrast to the impression given by Goldstein,⁽⁸⁾ that the VAHS made use of modeling, a tracer gas study, and TEAM-type monitoring data to estimate emissions and to apportion the contribution of the Alyeska terminal to the total human exposure to selected hydrocarbons.

Clearly, the above major components that led to the VAHS estimate of cancer health risk were not based solely on the TEAM component of the VAHS. Thus, the use of the VAHS as an example of the rejection of the conclusions of a TEAM study, as implied by Goldstein,⁽⁸⁾ is not convincing. In fact, the results of the TEAM study in Valdez have not been disputed by reviewers of the VAHS study. However, the interpretation of the results of the TEAM study and their use in connection with a questionable tracer study have cast doubts on Alyeska's conclusion that the terminal's contribution to health risk due to benzene exposure is insignificant. It is important to note that the second substantive outside review of the VAHS by EPA also identified the shortcomings noted in the VASR peer-review in addition to other areas of concern.

The regulatory practices in the United States at the federal, state, and local level have always been to consider maximum individual risk in cases of exposure to carcinogens. It has also been policy to consider the emission and risk potential of the installed capacity of a facility (as pointed out in reviews of the VAHS), absent any demonstrable physical and binding legal limitations as to the full operation of the facility. This policy seems prudent considering that no contractual limitation is

present for the shut down of the Alyeska Marine Terminal. There is substantial reserve potential in the North Slope oil fields, and historically there have been vagaries in any petroleum reserve estimates. It is also interesting to note that the state of Alaska North Slope oil production forecasts through the years 2010 have been replaced with higher subsequent estimates. Projections prepared by the Department of Natural Resources in 1992 forecast a production rate of 6.86 billion barrels of crude oils during the years 1992 through 2010—a 68.7% increase over the Department's 1985 projection for the same period. Thus, it appears that in the case of the Alyeska terminal, using an exposure period shorter than the commonly accepted 70 years would be a significant deviation from the common metric used in health risk assessments. It is also of interest to note that the Alyeska Marine Terminal is the largest single source emitter of VOCs in the United States. Given that the terminal is a single stationary source, emissions from the terminal should be more easily controllable (e.g., using a vapor recovery system) than mobile sources typical of most urban environments.

In two recent articles,^(9,10) Dr. Lance Wallace notes that the TEAM study at Valdez appears to support the claim that indoor sources and personal activities outweigh outdoor sources in contributing to personal exposure. The above conclusions by Wallace, however, relied on the conclusion of the VAHS tracer gas study, whose validity has been questioned by two independent review groups.

It is interesting to note that, if one ignores the faulty tracer study, one could equally conclude from the VAHS that people spend more time indoors while they are still exposed to outdoor air which infiltrates their indoor environment. In a recent critique of the TEAM approach, Rosebrook and Worm⁽¹¹⁾ argued that there are uncertainties regarding the true impact of proximity to industrial sources as well as other issues of concern that need to be resolved before results from the TEAM approach are accepted for risk analysis.

Despite the shortcomings of the VAHS, and concerns that others have expressed regarding the universal validity or acceptability of the TEAM approach for regulatory purposes, we believe that the TEAM approach, when designed and used properly, along with modeling and other monitoring studies to bridge missing data gaps, may indeed prove to be an increasingly useful component in the regulatory process. The controversy regarding the validity of the VAHS conclusions is still ongoing. However, it is hoped that with a new comprehensive and conclusive tracer study, it will be possible to conduct a definitive analysis regarding the contribu-

tion of the Alyeska Marine Terminal to health risks at Valdez.

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