

**Responses to Major Comments on
Technical Support Document**

**Public Health Goal
For
Beryllium
in Drinking Water**

Prepared by

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INTRODUCTION

The following are the combined responses to major comments received by the Office of Environmental Health Hazard Assessment (OEHHA) on the proposed public health goal (PHG) technical support document for beryllium, based on the pre-release review draft. Changes have already been made in response to these comments, and have been incorporated into the draft posted on the OEHHA website. For the sake of brevity, we have selected the more important or representative comments for responses. Comments appear in quotation marks where they are directly quoted from the submission; paraphrased comments are in italics.

These comments and responses are provided in the spirit of the open dialogue among scientists that is part of the process under Health and Safety Code Section 57003. For further information about the PHG process or to obtain copies of PHG documents, visit the OEHHA Web site at www.oehha.ca.gov. OEHHA may also be contacted at:

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RESPONSES TO MAJOR COMMENTS RECEIVED

Comments from University of California, Davis

Comment 1. “This is a well prepared and well written document. The toxicology of Beryllium (Be) is reviewed with emphasis on studies that mostly are relevant to the overall hazard of Be exposure and in particular to possible ingestion (or inhalation through shower mists) of Be and its compounds from water.”

Response 1: Comments noted.

Comment 2. “Data on toxicity, metabolism, modes of action and exposure are presented in a clear and concise manner. It has been recognized for decades that the biggest hazard of Be exposure is by inhalation of fumes and dusts in industrial processes and, to a lesser but nevertheless not negligible degree in the neighborhoods of such facilities. It also has been recognized that Be is not a major contaminant in water and that absorption of ingested Be compounds is for all practical purposes minimal to negligible. The report correctly points this out and focuses on data that provide information on the latter point.”

Response 2. Comments noted.

Comment 3. “The report focuses on the toxicokinetics and toxicodynamics of ingested Be; there are very few such data available. The relevant literature is covered by report.”

Response 3. Comment noted.

Comment 4. “The key study selected for the development of the PHG is a feeding study in dogs where ingested Be did produce lesions in the gastrointestinal tract. The study also allowed to determine a NOAEL. In view of the fact that some other chronic feeding studies failed to show any effects of toxicity, the selection of the dog study conducted by Morgareidge can be justified.”

Response 4. Comment noted.

Comment 5. “However, there is a drawback. The Morgareidge study has only been delivered as a laboratory report to the Be industry and was never published in the open literature. This raises the question how accessible it will be. As it happened, I reviewed two times the new ATSDR draft toxicological profiles on Be and had access to the Morgareidge study which looks reasonably well done and documented in detail. But how will it be possible for other interested parties to get a hold of the original document, if so desired?”

Response 5. A copy of the report has been obtained by OEHHA. The report can be made available upon request.

Comment 6. "I have no comments on the risk assessment methodology that has been used; it follows fairly standard and accepted procedures."

Response 6. Comment noted.

Comment 7. "[A]s mentioned above, there is a new ATSDR document on Be; in March 2002 I reviewed the post-public comment draft. OEHHA might check whether the document has now been published and update the reference list. By definition, the scope of the toxicological profile on Be written by ATSDR is much more extensible than the present OEHHA document and might serve as a useful additional source of information."

Response 7. The latest ATSDR document on Be was obtained and reviewed for new information. The new ATSDR document is referenced in the PHG document.

Comment 8. "Uncertainties, where there are any, are adequately addressed."

Response 8. Comment noted.

Comment 9. "Be is indeed one of the known human carcinogens in cigarettes and cigarette smoke, but do amounts contribute essentially anywhere to human risk (except perhaps in smokers)?"

Response 9. Although it may be feasible for Be to contribute to human risk, the issue of Be in cigarettes and cigarette smoke was not addressed or evaluated in this document since it would be not pertinent in the context of the PHG evaluation for Be in drinking water.

Comment 10. "[W]hat is the evidence for the statement that 'some absorbed Be is excreted in the feces'? Is there evidence for biliary excretion or how otherwise would absorbed Be get back into the feces?"

Response 11. Data from Finch *et al.* (1990) was included in the document to support the biliary excretion.

Comment 12. "The study of Furchner needs to be described in more detail (as on page 7, last para), because it makes a notable difference in absorption whether carrier free Be⁷ is administered or whether larger amounts are given."

Response 12. The text was revised to provide more detail.

Comment 13. “The issue of low fired and high fired Be oxide is also an old one and it might be appropriate to mention that the two calcined forms do have different solubilities that might impact on absorption and toxicity.”

Response 13. The text was revised accordingly.

Comment 14. “[W]hile it is true that Be compounds are not metabolized, Be compounds inasmuch take part in metabolic reactions as they seem to interfere in a rather specific way with the activity of certain enzymes. Furthermore, Be compounds also form insoluble complexes with phosphate in the serum, a fact that may impinge on their distribution to different organs.”

Response 14. Comment noted.

Comment 15. “[A]ny need to discuss in somewhat more detail the significance that lymphocytes proliferated in the presence of Be compounds? After all, the lymphocyte proliferation test was or, in one form or other, remains a widely used diagnostic tool for the human disease.”

Response 15. Comment noted. However, it did not seem warranted to provide further details in the context of the PHG document.

Comment 16. “[S]hould individual studies, summarized by IARC, be referenced so they could be looked up directly, without having to go to the IARC document?”

Response 16. Many additional studies summarized by IARC are not referenced in the PHG document. Readers are encouraged to go to the IARC document if they are interested in the additional material covered by IARC.

Comment 17. “I am very pleased and gratified by the last para of this section on page 14 (Interpretation of in vitro tests....). The insolubility of Be phosphates was recognized long before 1979 and, whenever work in vitro was attempted, in those times, many tricks were used to keep the metal in solution. With the advent of the mutagenesis tests and the apparent ease with which they could be performed, this knowledge was conveniently overlooked and Be was thrown indiscriminately at whatever system was available. Probably most, if not all in vitro mutagenesis tests are artefacts, not so much perhaps because Be would deprive bioavailable phosphate, as Rosenkranz and Poirier suggest, but because insoluble Be phosphate prevents the Be ion from interacting with critical cellular targets.”

Response 17. Comment noted.

Comment 18. *Several editorial comments were provided.*

Response 18. Changes were made to the document, where appropriate.

Comments from Health and Ecological Criteria Division, U.S. Environmental Protection Agency.

Comment 1. “The MCL and MCLG for Beryllium are 4 ppb (U.S. EPA, 1992). The MCL was based on a RfD of 0.005 mg/kg/day from Schroeder *et al.*, (1975) study, in which no adverse effects were seen in rats given beryllium at 0.5 mg/kg-day. In calculating the MCLG, a rsc of 20% was used, and an additional factor of 10 was used for possible carcinogenic potential. U.S. EPA has revised the RfD to be 0.002 mg/kg/day, based on BMD10 of 0.46 mg/kg-day for small intestinal lesions from Morgareide *et al.* (1976) dog dietary study.

California EPA proposed a public health goal for beryllium of 1 ppb based on a NOAEL of 0.15 mg/kg-day for ulcerative and inflammatory lesions of the intestine in male and female dogs in Morgareidge *et al.* (1975) study. An rsc of 0.2, and an uncertainty factor of 1000 (3 for interspecies extrapolation, 10 for intraspecies variation, 3 for database deficiencies, and 10 for possible carcinogenic potential).”

Response 1: Comment noted.

REFERENCES

Finch GL, Mewhinney JA, Hoover MD, *et al.* (1990). Clearance, translocation and excretion of beryllium following acute inhalation of beryllium oxide by beagle dogs. *Fundam Appl Toxicol* 15:231-241.