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Paul W. Brandt-Rauf, MD, ScD, DrPH
JOEM Editor, MSPH/Environmental Health Sciences
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Dear Dr. Brandt-Rauf,

The Environmental Working Group (EWG) is a not-for-profit watchdog organization that works to protect environmental and public health as well as scientific integrity. It has come to our attention that the authors of a 1997 paper published by the Journal of Occupational and Environmental Medicine (JOEM) violated basic ethical standards outlined by the Journal and the larger scientific community.

As detailed below, in the documents available at http://ewg.org/reports/chromium/relateddocs.php, and in the Wall Street Journal article published today, it is clear that the paper titled "Cancer mortality in a Chinese population exposed to hexavalent chromium in water" was not written by the stated authors, did not disclose major conflicts of interest or financial support by industry, was submitted to two journals simultaneously despite declaring otherwise, misrepresented data and study design, and failed to meet basic standards of scientific professionalism.

For example:

- The paper was written by the environmental consulting firm ChemRisk – not the stated authors JinDong Zhang and ShuKun Li. The paper gives no indication that ChemRisk or any of its staff was involved in the study.
- The study was funded by the Pacific Gas & Electric company (PG&E) – yet no mention of this support was mentioned anywhere in the article.
- The study was conducted specifically to be used as part of PG&E's litigation defense in several cases involving hexvalent chromium contamination of drinking water – yet this conflict of interest was never disclosed.
- The authors falsely stated in the paper that key data was not available – yet they had the data in-hand.
- The paper was submitted simultaneously to both JOEM and the Archives of Environmental Health –yet this violated the policies of both journals.

EWG notes that JOEM currently requires all authors looking to publish in the Journal sign a form certifying that "all financial and material support for this research are clearly identified in the manuscript," and affirm that their manuscript is "not being submitted for publication elsewhere." Potential authors are also required to disclose

completely to JOEM all "affiliations with or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in [the] manuscript."

Our understanding is that JOEM had similar, if not identical, requirements in 1995 when the paper in question was submitted to the Journal for consideration. More basically, the authors violated a tenet of the American College of Occupational and Environmental Medicine's code of ethical conduct: that is, to "relate honestly and ethically in all professional relationships."

In order to ensure continued faith in the scientific process such serious breaches of ethics cannot be tolerated. We are writing to alert JOEM of this situation and urge the Journal to take prompt action. The scientific community must be notified that a paper circulating in the published literature is fraudulent, the paper must be retracted, and those responsible for the incident must be appropriately disciplined.

Background

In 1959 the JinZhou Alloy Plant, located in a rural area in China's Liao-Ning province, began to process chromium ore on a trial basis and reached full-scale production in 1965. Unfortunately, the plant's poor waste disposal practices very quickly resulted in massive hexavalent chromium pollution problems. The plant not only released chromium-laced wastewater into a neighboring dry riverbed that cut through several nearby villages, it also dumped thousands of tons of solid waste onto bare ground around the plant site. Rainwater percolating through these waste piles subsequently leached hexavalent chromium into the groundwater. [1]

When investigators from the JinZhou Health and Anti-Epidemic Station began sampling well water from nearby villages in early 1965, they discovered that almost a third of the wells in the two villages closest to the plant were contaminated with hexavalent chromium (commonly abbreviated as Cr+6). By the end of the year, the incidence of contamination had risen dramatically in these two villages, and sampling in three more distant villages revealed polluted drinking water and irrigation wells there as well. Further sampling showed that the contamination plume shifted as time went on, with high levels of chromium-6 appearing in wells of more distant villages by the 1970s. [2] The contamination wasn't brought fully under control until the early 1980s when a concrete barrier was installed around the plant. [3]

Health surveys conducted from 1965 through 1974 revealed that residents in all five contaminated villages were suffering from a variety of ailments known to be associated with hexavalent chromium ingestion including mouth ulcers, diarrhea, abdominal pain, and vomiting. During and after this period, two scientists from the Anti-Epidemic Station, published a series of reports and articles in Chinese documenting the health problems found in each of the affected villages. [4] Their work culminated in a 1987 paper (in a Chinese language medical journal) that linked chromium-6 exposure to the high rates of cancer found in the contaminated area. [5]

In April of 1997 JOEM published a paper titled "Cancer mortality in a Chinese

population exposed to hexavalent chromium in water," in which the authors –listed as Drs. JinDong Zhang and ShuKun Li –appear to reverse their conclusions. [6] Whereas the 1987 study concluded that exposure to contaminated water was linked to an increase in cancer, the new study found no such link. The abstract, which explains this reversal, is copied below in full:

> This report is a clarification and further analysis of our previously published mortality study regarding groundwater contamination with hexavalent chromium (Cr+6) in the JinZhou area of China between 1965 and 1978. In our previous report, we stated that a significant excess of overall cancer mortality was observed (P = 0.04) in five Cr+6-contaminated villages combined. Further analysis revealed no clear statistical increase in cancer mortality in the three villages adjacent to the source of the contamination (P = 0.25), where 57% of the wells exceeded the European Community safe drinking water standard of 0.05 ppm Cr+6. These results do not indicate an association of cancer mortality with exposure to Cr+6-contaminated groundwater, but might reflect the influence of lifestyle or environmental factors not related to Cr+6. Further follow-up of this cohort is recommended.

Although it is well established that hexavalent chromium causes cancer when inhaled, you may be aware that there has been significant controversy over whether the compound is carcinogenic when ingested orally. This 1997 paper appears to provide evidence that Cr+6 does not cause cancer when consumed via drinking water even at high levels. Currently, JOEM readers have no reason to question the veracity of this study's findings beyond the normal scrutiny scientists give to any published article. Indeed, the editors of JOEM had no reason to question the paper's authenticity when the Journal decided to publish it eight years ago.

Things have changed: Over the past several years EWG, the California Environmental Protection Agency, the Wall Street Journal, and the California legislature, among others have uncovered extensive evidence showing that the paper is essentially fraudulent. The following paragraphs outline the serious ethical violations committed by the study's real authors.

Authorship misrepresented, conflicts of interest not disclosed

In the early 1990s the Pacific Gas & Electric Company (PG&E) was in the midst of a major suit brought against the company for chromium-6 contamination in Hinkley, California. The judges presiding over the negotitations told the company's lawyers that the 1987 Zhang study was an important piece of evidence showing that chromium-6 was harmful to human health. PG&E, in turn, hired the environmental consulting firm ChemRisk (then a subsidiary of McLaren/Hart Environmental Engineering) to help PG&E with this issue. [7]

ChemRisk understood the importance of the 1987 Zhang and Li study. Not only was it cited by the Agency for Toxic Substances and Disease Registry (ATSDR) as evidence that hexavalent chromium might be an oral carcinogen, ChemRisk's Principal Health Scientist at the time – Brent Kerger –would later explain in court documents that "it's really the

only epidemiology treatment that's out there in the literature of a groundwater contamination plume and its potential cancer effects in a population." [8]

In 1995 ChemRisk tracked down the elderly JianDong Zhang at his home. Given that Dr. Zhang spoke no English, had no computer, and was then retired from his post with the JinZhou Health and Anti-Epidemic Station in China, this was no simple matter. [9] Yet in April 1995, Zhang signed a contract with McLaren/Hart. His task –according to documents obtained by EWG –was to provide "document review and consultation regarding epidemiology, groundwater contamination and health effects of chromium" in exchange for a small monthly stipend. [10]

It's unclear whether ChemRisk ever told Zhang about its relationship to PG&E: In a court deposition, Brent Kerger first testified that he didn't recall if they had informed Zhang but Kerger didn't think this information "would be of particular interest" to him in any case. Kerger later changed his answer to say that he did disclose this information "when there was a query." [11]

Court documents show that although it is true that ChemRisk and Zhang worked on the 1997 paper together, the major author was really ChemRisk – not Zhang. In an August 1995 memo to Kerger, for example, fellow ChemRisk employee Bill Butler describes his role in the 1997 study as such: "Project coordination; Requests to Zhang; Interpret Data; Write reports." As for Dr. Zhang's role, Butler writes simply: "Research assistance." [12] In that same memo, Butler complains that: "It is at times difficult to convince Dr. Zhang of the importance to us of the specific details of his studies so that we can execute our own analyses."

This is far from the only evidence that ChemRisk was the real author of the 1997 Zhang and Li study. When asked during a court deposition how the article was written, for example, Brent Kerger responded: "I would say that all of the numerical analyses that were done with respect to the rate ratios or the cancer – the cancer death rates and the – the dose-response relationship relating to distance from the facility versus cancer death rate, all of that numerical epidemiological data was – was the responsibility of Bill Butler as a principal." [13]

Other deposition testimony revealed the fact that all of the drafts of the article were typed in English on ChemRisk computers and changes were made by a ChemRisk word processing program. [14] More than ten early drafts of the paper show handwritten changes made by ChemRisk employees and the cover pages of two early drafts of the article actually state that it was "by ChemRisk." [15] Notably, there is evidence that Zhang and ChemRisk had different opinions of how the data should be interpreted: On September 6, 1995 Tony Ye –a ChemRisk scientist and translator for Dr. Zhang –sent a note to Butler stating that he "made some edit [sic] according to my conversation with Brent Kerger and Dr. Zhang. Dr. Zhang did not totally agree with us with the conclusion section. I have to make a little compromise." [16]

No attempts were made to get the study published in a Chinese-language journal. In fact, it is unclear as to whether a Chinese version of the final article ever existed or if the final JOEM article was ever sent to Zhang. [17] On the other hand, in May 1996 Brent Kerger sent a memo to a PG&E lawyer listing the Zhang and Li study as one of

eight "ChemRisk Chromium Manuscripts in Peer-Reviewed Scientific Journals." (Notably, the Zhang and Li article – which was in-press at JOEM at the time –was the only one listed that did not include the name of at least one ChemRisk employee as a study author.) [18]

And then there is the issue of money: All told, Zhang received less than $2,000 for his involvement in the "update" of his 1987 study. ChemRisk, on the other hand, received somewhere between $20,000 and $30,000 for its work. And all of this money came directly from PG&E'. [19] Possibly most revealing, however, is the fact that ChemRisk actually misspelled Zhang's name on all of its drafts of the manuscript, on the cover letters sent to journals, and in the final published article itself. While the reference section of the early drafts cites two of Zhang's earlier papers and correctly states his first name as JianDong, ChemRisk repeatedly dropped the "a" and incorrectly spelled his name as JinDong. [20]

In December of 1995, ChemRisk completed a final draft of its paper and proceeded to make a series of unethical decisions to ensure that no one would discover its relationship to the Zhang and Li study: Although very early drafts of the paper mentioned ChemRisk's involvement and a draft cover letter directed correspondence to Zhang c/o ChemRisk, neither the final article nor the final cover letter included any mention of ChemRisk. [21] Rather, the JOEM cover letter was typed on ChemRisk computers but printed on plain white paper and directed correspondence to be sent to the home address of Tony Ye – a ChemRisk employee. [22] (When asked under oath whether this was an unusual procedure, Kerger responded "I guess it wasn't standard practice.") [23]

On June 5, 1996 Gwen Corbett (an Associate Health Scientist at ChemRisk) sent a letter to several PG&E lawyers to alert them to the "Acceptance of China Paper." The entire text of the letter was as follows:

> "We are pleased to inform you that the short communication regarding clarification of Dr. Zhang's previous work on cancer mortality in a Chinese population exposed to Cr(VI) in water was accepted with no revisions in the Journal of Occupations and Environmental Medicine. Dr. Zhang's previous paper (which is cited by ATSDR) states that total cancer and stomach cancer mortality was significantly elevated in populations living along the Cr(VI)-contaminated groundwater plume. This short communication clarifies that the cancer death rates (both total and stomach cancers) "were not correlated with the degree of exposure to Cr+6 and that 'neither stomach nor lung cancer indicated a positive association with Cr+6 concentration in well water.' You will be receiving a copy of the accepted paper for your files by mail. If you have any questions regarding this paper, please call Brent Kerger at [phone number]." [24]

This letter clearly indicates the true purpose of ChemRisk's work: to support PG&E's litigation defense without alerting the scientific community about either company's involvement. Nowhere in the 1997 Zhang and Li article will you find the names of Brent Kerger, Bill Butler, Tony Ye, Gwen Corbett, ChemRisk itself, or any other of the firm's employees that were intimately involved in writing the paper. Nor will you find the name of Pacific Gas and Electric company (PG&E), or any note that this "reanalysis" was

done to defend the company in litigation. [25]

EWG could not find any records as to exactly what JOEM required its authors to disclose in 1995. However, given the flagrant misrepresentation of authorship and non-disclosure of major conflicts of interest, it is hard to imagine how ChemRisk could *not* have violated the Journal's policies in place at the time.

Paper submitted to two journals simultaneously

ChemRisk committed a further ethical violation by submitting the Zhang and Li paper to two journals simultaneously – JOEM and the Archives of Environmental Health (AEH) – despite the fact that this violated both journals' policies against simultaneous submissions. This situation is amply documented. For example, on January 24th 1996 Tony Ye (who by then had left ChemRisk to work for another environmental consulting firm) sent a fax to Gwen Corbett of ChemRisk that included a page titled "Description of Tony Ye's Work for PG&E during December, 1995." This sheet clearly notes that Ye submitted the Zhang paper both to AEH on December 11th and to JOEM on December 13th. [26]

A few months later, Ye called both journals on April 19th to check on the status of the paper. Not getting any firm answers, he called them again on May 20th only to find out that the paper appeared to have been accepted by both JOEM and AEH. Ye quickly sent a memo to Kerger and Butler informing them of the situation and recommending that they "continue to pursue publication on one journal as early as possible." [27] In court depositions various ChemRisk employees claimed not to know of the journals' policies against double submissions, but this seems doubtful. Such policies are standard in the academic world and ChemRisk almost certainly had to sign forms promising the study was not being considered anywhere else.

Compared to the gross ethical violations described earlier, submitting an article for review to two journals simultaneously is a relatively minor offense. Nevertheless, it underscores two important points: (1) PG&E/ChemRisk was clearly extremely anxious to get the Zhang and Li article published, and (2) ChemRisk clearly leaned towards having lax ethical standards across the board.

Questionable scientific conclusions

California's Office of Environmental Health Hazard Assessment (OEHHA) within the state Environmental Protection Agency has been looking at the health effects of hexavalent chromium for the last several years. In the process of reviewing the relevant literature, OEHHA scientist Jay Beaumont examined the 1997 Zhang and Li paper and sent around an analysis to his colleagues summarizing the paper' major findings. In the first paragraph of his August 7, 2001 email, Beaumont explains:

> "Zhang and Li in 1997 published an update to their previous analysis of cancer rates in five villages with varying levels of Cr+6 contamination of drinking water from a chromium ore processing facility. Their previous analysis, printed in a

> Chinese medical journal in the Chinese language (Zhang 1987), concluded that there was a 'significant excess of overall cancer mortality in five Cr+6 contaminated villages combined' (Zhang 1997). However, in the updated analysis the authors conclude that the additional analyses 'do not indicate an association of cancer mortality with exposure to Cr+6 contaminated groundwater.'" [28]

Although most of his email focuses on the paper's various conclusions, Beaumont also pointed "several notable limitations and oddities" with the study. He notes, for example, that although actual chromium-6 concentrations were available for each of the villages and even presented in a table in the study, the authors chose to use distance from the industrial source as "a surrogate for exposure." Beaumont thought that "the measured Cr+6 levels would be a better measure of dose than distance from the source," yet the authors provided no "reasons for not using the Cr+6 levels" in the paper.

In addition, Beaumont noticed that the authors had used three different epidemiological terms incorrectly and had also failed to explain how they had calculated distance from the pollution source –an important detail since some of the villages are more than a kilometer in width. Although these were all important criticisms of the Zhang and Li '97 paper, by and large they were pretty mild. But as they started to look into whether there might be a connection between chromium-6 and stomach cancer, things quickly began to look a little fishy.

While the study looked at stomach cancer death rates, it didn't compare them to the rates of the surrounding province as it had done for the rates of total cancer. Rather, the authors compared the various stomach cancer death rates amongst the affected villages themselves. Explaining this choice, the authors stated in their paper that they couldn't do a provincial comparison of stomach cancer death rates because of a "lack of appropriate rate information." [29] But this wasn't what OEHHA found when it decided to do its own analysis of the Chinese cancer data. As Jay Beaumont explained in an October 5th email he sent to OEHHA head Joan Denton:

> "According to the paper, the investigators couldn't compare the stomach cancer rate in the contaminated area to the surrounding province because stomach cancer rates weren't available for the province. However, I checked to see whether the rates should have been available, and in fact they were available from the same source from which the investigators obtained other rates. The age-adjusted stomach cancer mortality rate in the province was 20.9 per 100,000 per year, while the rate in the contaminated villages was 37.1." [30]

Overall, OEHHA's analysis showed that the stomach cancer rates in the contaminated villages were 87 percent higher than found in the surrounding Liao-Ning province –and this increase was highly statistically significant. "I wouldn't call this negative!" was how Jay Beaumont described the results to another OEHHA scientist on September 10th, referring to the study's supposedly negative finding with respect to chromium-6 exposure and cancer. [31]

After reviewing the final 1997 Zhang and Li study, the original 1987 Zhang and Li

study, translations of Zhang's earlier work published in China, as well as earlier drafts of the 1997 manuscript, court depositions, and internal ChemRisk documents obtained through independent litigation, OEHHA drew up a list of thirteen different "Scientific Issues" regarding the 1997 study. [32] Falling into categories such as "Misrepresentation of data and study design", "Professional standards" and "Epidemiologic design", OEHHA's 2003 list includes the following critiques:

- Non-disclosure of who wrote the manuscript.
- Non-disclosure of study funding.
- Simultaneous submission to two journals, including signing form(s) stating that the manuscript has not been submitted elsewhere.
- Falsely stated in the published paper that the site-specific cancer rates weren't available for the province (the authors has the rates in-hand).
- May not have disclosed finding of excess stomach of lung cancer risk, which would have been important for public health.
- Evaluated the pattern of chromium contamination detected in wells in 1965 knowing that by the end of the year the picture of contamination in the wells had dramatically changed.
- Ignored useful data that were available, e.g. stomach cancer rates for Liaoning province and Tanghezi village.
- Misrepresented the epidemiologic design as a higher quality cohort study by describing "follow-up" of the populations and calling it a "retrospective mortality study."
- The 13-year observation period after the first exposure was relatively short for a study of human cancer, because many cancers could occur after the end of the observation period.

Although OEHHA's critique of the 1997 Zhang and Li paper has not been published or peer reviewed, we present it here as it raises important questions about the validity of the study's conclusions and points out additional ethical lapses.

Request for formal action

The clear ethical violations outlined above, in conjunction with the study's questionable scientific conclusions, would be enough to warrant action by JOEM. But it is also important to note that a number of official hexavalent chromium risk assessments have cited the 1997 Zhang and Li paper. The California Department of Health Services, for example, stated that "studies in the People's Republic of China did not find consistent associations between cancer and exposures from an alloy plant that smelted chromium" in a 2002 Health Consultation for a Los Angeles-area community

dealing with hexavalent chromium contamination. [33]

The Environmental Protection Agency considered both the 1987 and the 1997 Zhang papers in its decision to re-register a pressure treated wood chemical containing chromium. In its summary of the two papers, the agency states that although subjects were first observed to have "higher per capita rates of cancers . . . [f]urther statistical analysis revealed no clear association of cancer mortality with exposure to Cr(VI) – contaminated groundwater." [34]

And while ATSDR's 1993 Toxicological Profile for Chromium cited the 1987 Zhang study as evidence supporting hexavalent chromium as a oral carcinogen, the agency's 2000 Profile noted that a "follow-up study reevaluated this cohort." [35] ATSDR goes on to describe that this more recent study concluded that "lifestyle or environmental factors rather than exposure to chromium(VI)" were probably responsible for the increased rates of cancer in the region. [36] Would these three government agencies take the conclusions of Zhang and Li's 1997 study at face value if they knew the full story behind how this paper came to be? In our opinion, this is doubtful.

The ethical misconduct we describe is serious, and must be treated accordingly. EWG asks JOEM to review the allegations we present in this letter, the supporting documentation at http://ewg.org/reports/chromium/relateddocs.php, and the Wall Street Journal article describing the paper's independent investigation into the matter. We urge JOEM to retract the 1997 Zhang and Li paper, alert the scientific community of the ethical breaches, bar all those who were involved from publishing in JOEM in the future, and bar all studies either conducted by ChemRisk or funded by PG&E from appearing in the Journal.

Thank you for your attention to this important matter.

Sincerely,

Richard Wiles

Richard Wiles
Senior Vice President
Environmental Working Group

References

[1] Zhang, JinDong and ShuKun Li. 1997. Cancer mortality in a Chinese population exposed to hexavalent chromium in water. JOEM 39(4):315-319.

[2] Office of Environmental Health Hazard Assessment. 2003. Draft Public Health Goal for Hexavalent Chromium in Drinking Water. California Environmental Protection Agency. December, 2003.

[3] Zhang, JinDong and ShuKun Li. 1997. Cancer mortality in a Chinese population exposed to hexavalent chromium in water. JOEM 39(4):315-319.

[4] Office of Environmental Health Hazard Assessment. 2003. Draft Public Health Goal for Hexavalent Chromium in Drinking Water. California Environmental Protection Agency. December, 2003.

[5] Zhang J. XiLin L. 1987. Chromium pollution of soil and water in JinZhou. J Chinese Prevent Med. 21:262-264.

[6] Zhang, JinDong and ShuKun Li. 1997. Cancer mortality in a Chinese population exposed to hexavalent chromium in water. JOEM 39(4):315-319.

[7] Kerger Deposition 1, page 166, line 7; Kerger Deposition 2, page 328, line 12; Kerger Deposition 1, page 44, line 19.

[Note: page numbers for the depositions are placed on the bottom of the page –not immediately obvious in a text file.]

[8] Kerger Deposition 1, page 166, line 3.

[9] Ye Deposition 1, page 45, line 21; Kerger Deposition 2, page 515, line 8; Ye Depostion 2, page 517, line 21; Ye Deposition 1, page 244, line 10; Kerger Deposition 2, page 288, line 14.

[10] McLaren/Hart Environmental Engineering Corporation. 1995. Authorization letter/Task Order. September 11, 1995. Contract between PG&E and Jian Dong Zhang. Faxed to Tony Ye at ChemRisk. Bates stamps: TY-0459 and TY-0460.

[Note: Bates stamps are found in the lower right hand corner of court documents.]

[11] Kerger Deposition 1, page 217, line 18.

[12] Memo from Bill Butler to Brent Kerger. August 7, 1995. Bates stamps: WB-0117 to WB-0117. See page 2 of memo.

[13] Kerger Deposition 1, page 161, line 3.

[14] Ye Depostion 2, page 517, line 21; Kerger Deposition 2, page 515, line 8.

[15] See draft papers with the following Bates stamps: TY-0102 to TY-0112; TY-0089 to TY-0097; TY-0469 to TY-0476; WB-0215 to WB-0220/WB-0204 to WB206; WB-0207 to WB-0209; WB-0200 to WB-0203; WB-0181 to WB-0184; WB-0175 to WB-0179; WB-0164 to WB-0167; WB-0062 to WB-0070; TY-0113 to TY-0119.

[16] Memo from Tony Ye to Brent Kerger. Septmeber 6, 1995. Bates stamps: WB-0173 to WB-0179. See page 1 of memo.

[17] Ye Depostion 2, page 331, line 23; Ye Depostion 2, page 362, line 2.

[18] Letter from Brent Kerger to Steven Hoch, Esq. May 20, 1996. Also faxed to Mike Whelan, PG&E May 20, 1996. Bates stamps: BRP 0331 to BRP 0335.

[19] Letter from to Guang Zhu to Chris Daniels, McLaren Hart International. November 21, 1995. Bates stamp Ty-100. Kerger Deposition 1, page 43, line 23. Kerger Deposition 1, page 48, line 6. Ye Deposition 2, page 370, line 4.

[20] See draft papers with the following Bates stamps: TY-0102 to TY-0112; TY-0089 to TY-0097; TY-0469 to TY-0476; WB-0215 to WB-0220/WB-0204 to WB206; WB-0207 to WB-0209; WB-0200 to WB-0203; WB-0181 to WB-0184; WB-0175 to WB-0179; WB-0164 to WB-0167. Also see Ye Deposition 2, page 333, line 22.

[21] See draft papers with the following Bates stamps: TY-0102 to TY-0112; TY-0089 to TY-0097; TY-0469 to TY-0476; WB-0215 to WB-0220/WB-0204 to WB206; WB-0207 to WB-0209; WB-0200 to WB-0203; WB-0181 to WB-0184; WB-0175 to WB-0179; WB-0164 to WB-0167; WB-0062 to WB-0070; TY-0113 to TY-0119.

[22] See page 8 of draft paper with Bates stamps TY-0102 to TY-0112; page 1 of draft paper with Bates stamps TY-0089 to TY-0097; page 1 of draft paper with Bates stamps TY-0469 to TY-0476; page 1 of draft paper with Bates stamps WB-0215 to WB-0220/WB-0204 to WB206; Ye Deposition 1, page 65, line 24; Ye Deposition 1, page 67, line 16; Kerger Deposition 2, page 403, line 13.

[23] Kerger Deposition 1, page 265, line 4.

[24] Memo from Gwen Corbett to Greg Read et al. June 5, 1996. Re: Acceptance of China Paper. Copied to Brent Kerger.

[25] Zhang, JinDong and ShuKun Li. 1997. Cancer mortality in a Chinese population exposed to hexavalent chromium in water. JOEM 39(4):315-319.

[26] Fax from Tony Ye to Gwen Corbett. January 24, 1996. Bates stamps TY-0529 to TY-0530. Also, Ye Deposition 1, page 68, line 17.

[27] Fax from Tony Ye to Gwen Corbett. January 24, 1996. Bates stamps TY-0540 and TY-0541.

[28] Email from Jay Beaumont to George Alexeef. August 7, 2001.

[29] Zhang, JinDong and ShuKun Li. 1997. Cancer mortality in a Chinese population exposed to hexavalent chromium in water. JOEM 39(4):315-319.

[30] Email from Jay Beaumont to Joan Denton. August 7, 2001.

[31] Email from Jay Beaumont to Richard Sedman. September 10, 2001.

[32] Internal OEHHA memo dated March 28, 2003. Scientific issues regarding Zhang and Li, 1997.

[33] California Department of Health Services. 2003. Health Consultation. Review of Cancer Rates in the Vicinity of Chrome Crankshaft Company and J and S Chrome Plating Company. Prepared by DHS under cooperative agreement with the Agency for Toxic Substances and Disease Registry. Available at: http://www.atsdr.cdc.gov/HAC/PHA/chromecrankshaft/jsc_toc.html

[34] Environmental Protection Agency. 2001. Inorganic Chromium - Report of the Hazard Identification Assessment Review Committee. Available at: http://www.epa.gov/oscpmont/sap/2001/october/arsenicgraphdata.pdf

[35] Agency for Toxic Substances and Disease Registry. 1993. Toxicological Profile for Chromium. US Department of Health and Human Services.

[36] Agency for Toxic Substances and Disease Registry. 2000. Toxicological Profile for Chromium. US Department of Health and Human Services. Available at: http://www.atsdr.cdc.gov/toxprofiles/tp7.html