Additional Comments to Clarify Findings of Schoof, et al. 1998 (cited in USEPA "Toxicological Review of Inorganic Arsenic: In Support of the Summary Information on the Integrated Risk Information System (IRIS)". (EPA/635/R–10/001) February 2010)

Prepared by:
Dr. Rosalind A. Schoof
ENVIRON International Corporation
Seattle, WA

April 20, 2010

Support for Dr. Schoof's time to prepare these comments provided by:
Atlantic Richfield Company, a subsidiary of BP America Inc

These comments pertinent to EPA's draft ''Toxicological Review of Inorganic Arsenic: In Support of the Summary Information on the Integrated Risk Information System (IRIS)'' (EPA/635/R–10/001) are submitted to the in accordance with the Federal Register Vol. 75, No. 33, February 19, 2010 notice.

I previously submitted comments dated March 29, 2010 and made verbal comments at the EPA Science Advisory Board work group meeting April 6, 2010 noting that EPA's baseline assumption that non-water (dietary) inorganic arsenic intake is 10 µg/day in the exposed and reference Taiwanese population is incorrect. As I have described previously, Schoof et al. (1998) supports a Taiwanese dietary intake estimate of 50 µg/day. It was apparent during the SAB work group deliberations that many aspects of our 1998 study were not understood by either the work group members or the EPA staff in attendance at the SAB meeting. For that reason, I summarize below critical aspects of our study and findings.

Rice and yam samples were collected both within and outside the endemic areas. Schoof et al. (1998) reported the results of analyses of yam and rice samples collected in Taiwan during 1993 and 1995. During 1993 (August), 3 rice samples, 4 yam samples, and 4 soil samples were collected from locations in Taiwan that had historically had high arsenic concentrations in artesian well water (i.e., the endemic area). Two polished rice samples and two of the yam samples were purchased at local markets, while one rice grain sample and two yam samples were collected at farms. During 1995 (April and May) five polished rice samples were purchased at markets or warehouses, with one of these from the endemic area and four from outside the endemic area. Thirteen yam samples were collected in a variety of districts in the endemic area, and two additional samples were purchased outside the endemic area.

Average daily intake of inorganic arsenic from rice and yams in Southwest Taiwan was estimated to be 50 µg/day. The samples were analyzed for total and inorganic arsenic, and monomethyl- and dimethlyarsenic. Average inorganic arsenic concentration in uncooked rice samples was 0.085 mg/kg fresh weight (0.093 mg/kg dry weight with average moisture content of uncooked rice of 9.1%). Average fresh weight inorganic arsenic concentration of yams was 0.019 mg/kg. Average inorganic arsenic concentration in oven-dried yam samples was 0.077 mg/kg (yams were oven-dried in a manner to simulate the sun-dried form of yams used historically by the population in the endemic area to preserve yams for consumption throughout the year). Daily intakes of rice and yams were based on reports from visits to Taiwan during the 1980s by Drs Irgolic and Abernathy. Intake of uncooked rice was 225 grams/day. Yam intake was reported to be 500 grams/day, with some consumed fresh and some being sun-dried. For that reason, Schoof et al. (1998) assumed that 75% of yams were consumed as sun-dried and 25% were consumed as fresh. Based on these analyses, Schoof et al. (1998) calculated that average daily intakes of inorganic arsenic from yams was 31 µg/day, while daily intake from rice as 19 µg. An average daily intake of inorganic arsenic was calculated to be 50 µg/day, with a range of 15 µg/day to 211 µg/day based on minimum and maximum concentrations, respectively, of rice and yams.

Non-water dietary arsenic intake is not expected to differ between endemic and nonendemic areas. No differences were noted in inorganic arsenic concentrations of rice and yam samples collected within or outside the endemic areas. Additionally, it was noted that some food consumed within the endemic area would have been sourced outside that area. Soil arsenic concentrations (ranging from 7 to 8 mg/kg) were not elevated in areas where yams were collected; suggesting that high arsenic drinking well water had not affected fields from which the yam samples were collected. Consequently, we conclude that the arsenic intake estimates from our study should be applied to both exposed and reference populations.

As I noted in my earlier comments, subsequent studies of world-wide arsenic concentrations in rice (for example, Zavala et al. 2008, Meharg and Rahman 2003, Williams et al. 2006, Williams et al. 2007 – see reference list in prior comments) are consistent with data reported by Schoof et al. (1998), and show that high rice consumption rates will be associated with high inorganic arsenic intake regardless of location. The estimate of Schoof et al. (1998) is also consistent with dietary intake studies conducted in other areas Southeast Asia. Notably, Kile et al. (2007 – see prior comment reference list) conducted a duplicate diet study in Bangladesh and report average background dietary intake of 46 µg/d total arsenic (with 82% of total arsenic being inorganic arsenic) in areas without elevated drinking water arsenic.

Cooking water likely added significantly to inorganic arsenic intake due to water consumption in the endemic areas. Our non-water dietary intake estimates do not include contribution to arsenic intakes from cooking water. Because sundried yams were frequently soaked in water and then cooked, cooking water intakes were likely higher than those that would be attributable only to cooking rice.

Conclusions. Taken together the data presented in Schoof et al. (1998) and supporting studies indicate that EPA's baseline assumption of 10 µg/day non-water inorganic arsenic intake in the endemic and reference populations is not consistent with **any** information in the scientific literature. EPA should revise their dose response assessment to use baseline values of 50 µg/day non-water intake for the exposed population. As I commented earlier, the reference population should be dropped from the analysis for a variety of reasons, but if it is retained the only reason to use a different value for non-water intake in that population would be if they were demonstrated to have a substantially different diet than that of the exposed population.

References

Schoof, R.A., L.J. Yost, E. Crecelius, K. Irgolic, H.-R. Guo, and H.L. Greene. 1998. Dietary arsenic intake in Taiwanese districts with elevated arsenic in drinking water. Hum. Ecol. Risk Assess. 4(1):117-136.

USEPA. 2010. Toxicological review of inorganic arsenic: In support of summary information on the Integrated Risk Information System. Draft. EPA/635/R-10/001.