IODINE

CAS # 7553-56-2

ORAL RISK ASSESSMENT DOCUMENT

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EXECUTIVE SUMMARY

Iodine – Oral Risk Assessment			
PARAMETER	**LEVEL**	**UNITS**	**CALCULATED FOR:**
NOAEL (no-observed-adverse-effect level)	0.03	mg/kg-day	70 kg Adult
Oral RfD (oral reference dose)	0.01	mg/kg-day	
TAC (total allowable concentration)	0.3	mg/L	70 kg Adult
SPAC (single product allowable concentration)	0.1	mg/L	70 kg Adult
STEL (short term exposure level)	0.3	mg/L	10 kg Child

KEY STUDY	Freund et al. 1966. Effect of iodinated water supplies on thyroid function. J Clin Endocrinol Metab 26: 619-624.
CRITICAL EFFECT	Non-adverse decreases in radioactive iodine uptake (RAI) and increases in serum protein-bound iodine (PBI) by the thyroid.
UNCERTAINTY FACTORS	Factors applied in calculating the oral RfD: 1x for interspecies extrapolation 3x for intraspecies extrapolation 1x for short-term to long-term exposure extrapolation 1x for extrapolation from a LOAEL to a NOAEL 1x for database deficiencies The total uncertainty factor is therefore 3x.
TOXICITY SUMMARY	Longer-term exposure to excess iodine shows little visible effect on thyroid function in the normal individual due to the highly effective regulatory mechanisms, although excess iodine may induce some degree of thyroid dysfunction in susceptible individuals. Tolerance to iodine is highly variable, with the vast majority of the population able to handle exposure to large quantities of iodine without adverse responses (Dunn, 1998). While individuals with preexisting thyroid conditions, including goiter, Hashimoto's thyroiditis, and cancer, as well as children and aged individuals can be significantly more susceptible to elevated iodine levels, the presence of underlying thyroid disease and/or the age of an individual does not guarantee that the individual will react adversely to elevated iodine concentrations. Likewise, a clinically euthyroid individual may respond atypically to iodine levels at which the general population does not respond.
CONCLUSIONS	Because the response to excess iodine is highly individual, it is necessary for risk managers to consider the risk versus benefit of adding iodine to the water supply in any given region of the country or world. Consequently, it is suggested that the calculated risk values be used with caution and only after consideration of the environment into which the iodine supplementation is being introduced.

1.0 INTRODUCTION

This document has been prepared to allow toxicological evaluation of the unregulated contaminant **iodine** in drinking water, as an extractant from one or more drinking water system components tested under NSF/ANSI 61 (2002) or as a contaminant in a drinking water treatment chemical under NSF/ANSI 60 (2002). Iodine has also been evaluated as a drinking water treatment chemical for direct addition to water under NSF/ANSI 60 (2002). Both non-cancer and cancer endpoints have been considered, and risk assessment methodology developed by the U.S. Environmental Protection Agency (U.S. EPA) has been used.

Non-cancer endpoints are evaluated using the reference dose (RfD) approach (Barnes and Dourson, 1988; Dourson, 1994; U.S. EPA/IRIS, 1993), which assumes that there is a threshold for these endpoints that will not be exceeded if appropriate uncertainty factors (Dourson et al., 1996) are applied to the highest dose showing no significant effects. This highest dose is derived from human exposure data when available, but more often is derived from studies in laboratory animals. Either the no-observed-adverse-effect level (NOAEL) taken directly from the dose-response data, or the calculated lower 95% confidence limit on the dose resulting in an estimated 10% increase in response (the LED_{10} or BMDL from benchmark dose programs) can be used (U.S. EPA, 2001). The lowest-observed-adverse-effect level (LOAEL) can also be used, with an additional uncertainty factor, although the benchmark dose approach is preferred in this case. The RfD is expressed in mg/kg-day. It is defined by the U.S. EPA as "an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime" (Barnes and Dourson, 1988; U.S. EPA/IRIS, 1993; U.S. EPA, 1999a).

NSF uses the RfD to derive three product evaluation criteria for non-cancer endpoints. The total allowable concentration (TAC), generally used to evaluate the results of extraction testing normalized to static at-the-tap conditions, is defined as the RfD multiplied by the 70 kg weight of an average adult assumed to drink 2 liters of water per day. A relative source contribution (RSC), to ensure that the RfD is not exceeded when food and other non-water sources of exposure to the chemical are considered, is also applied in calculating the TAC. The relative source contribution should be data derived, if possible. Alternately, a 20% default contribution for water can be used (U.S. EPA, 1991a). The TAC calculation is then as follows:

$$\text{TAC (mg/L)} = \frac{[\text{RfD (mg/kg-day)} \times 70\text{ kg}] - [\text{total contribution of other sources (mg/day)}]}{2\text{L/day}}$$

or

$$\text{TAC (mg/L)} = \frac{\text{RfD (mg/kg-day)} \times 70\text{ kg}}{2\text{L/day}} \times 0.2\text{ (RSC)}$$

The single product allowable level (SPAC), used for water treatment chemicals and for water contact materials normalized to flowing at-the-tap conditions, is the TAC divided by the estimated total number of sources of the substance in the drinking water treatment and