



Tales from the Lab

Let's get technical....

- By Brian McLean

Tri Nature Director and research chemist.

Well, here we are again – just when it looked like we had the SLS issue nailed, someone comes up with another bunch of rot to confuse people! This “From the Lab” is an excerpt from an article I wrote for the Natural Health & Vegetarian Society Magazine.

The article was a continuation of an enquiry into some of the myths surrounding everyday chemicals and focussed on one narrow but particularly strong recent ‘consumer concern’. Some readers may have no knowledge of the issue but it serves as another example of product propaganda in the safe, healthy & green marketplace!

“The most blatant bit of hogwash I have seen since the original and fraudulent SLS emails is contained on a website that I was recently referred to.

Headed up under “Common Sense Nutrition” and emanating from a site associated with the marketing of personal care products, the fallacies involved are so blatantly erroneous that I wish to use my article in this issue to repudiate them.

1,4-Dioxane is a well-known chemical entity and has been the subject of extensive research and reporting. Throughout this article I will be referring to the 100-page long 1998 Full Public Report of the Australian National Industrial Chemicals Notification and Assessment Scheme (NICNAS) on 1,4-Dioxane.

1,4-Dioxane is a by-product of the ethoxylation process that many surfactants (detergent agents) go through during manufacture. It is present in small amounts (up to 30 parts per million) in shampoos containing *ether sulphates* and in smaller amounts in numerous cleaning products.

The website article begins by listing a range of ingredients that may be ‘contaminated’ with 1,4-Dioxane.

Fair enough. Then everything starts to disintegrate!

The next sentence offers the edifying little snippet that “the male sperm count has dropped 50% between 1938 and 1990”. The author does not specify the demographics used in this alarming statistic. Terrifying if it were true – but it isn’t.

There is no conclusive evidence that male sperm counts are declining. In 1999, researchers reviewed the data of all US studies from 1938 to 1996. Their report, published in the *Journal of Urology* (Feb. 1999;161:460), studied the semen analysis of 9,612 fertile men and concluded that “there appears to be no significant change in sperm counts in the U.S. during the last 60 years”.

Dr. Harry Fisch, director of the Male Reproductive Centre at Columbia-Presbyterian Medical Centre in New York, wrote in an earlier issue of the same publication (J. Urol. Mar. 1997;157:840-843): “Our data revealed that the overall linear trend was an increase in sperm counts from 1971 to 1994”.

He reported that the sperm counts varied from year to year, reaching an all time high in 1980 at an average of 123 million sperm per millilitre of semen and a low in 1974, with an average of 46.5 million sperm per millilitre.

Fisch wrote: “Why sperm counts fluctuate so dramatically from year to year is not known, but heat may have a significant role. It is well known that mild changes in scrotal temperature can decrease sperm counts.”.

So the article starts from a false premise and then asks, “What’s the problem?” The author encapsulates the problem thus: “1,4-Dioxane is a potent carcinogen itself **and** is related to Dioxin, **the** most toxic chemical known. It is a **potent** hormone

disrupter.” (note the lack of clarity that leads the reader to the conclusion that “it” is 1,4-Dioxane, when it certainly is not).

Now, the facts.

FACT 1: 1,4-Dioxane is not a potent carcinogen.

NICNAS concluded that inhalation of high concentrations may cause liver, kidney and nerve fibre damage and there was evidence of increased cancer profiles in animals subjected to high oral doses over an extended period of time. They further concluded that it showed low acute oral, dermal and inhalation toxicity in humans.

Remember that we are discussing high levels of **industrial exposure by ingestion and inhalation** of the **pure chemical**, as used in laboratory analysis, film processing, optical lens and pharmaceutical manufacturing.

In a **worst case** scenario for personal use, NICNAS calculated the level of exposure to 1,4-dioxane to be 7µg/kg/day (7 micrograms per kilogram of body weight per day), mainly due to skin contact (its reported natural occurrence in certain foods no doubt being considered very low and insignificant).

In contrast, the ‘no observed adverse effect level’ (NOAEL) was 10 **milligrams**/kg/day. This means that the highest possible daily exposure outside industry is 1,500 times ‘safer’ than the level at which **no** adverse effects were observed. Given that, further information is almost redundant, however I will note that NICNAS reported that 1,4-Dioxane is not extensively absorbed by the body by any route.

FACT 2: 1,4-Dioxane is not related to dioxin.

DIOXIN is a potent carcinogen and a very toxic chemical (not **the** most toxic chemical known). It does not



Tales from the Lab cont'

share the same manufacturing stream or the same chemistry, physicality, reactivity or toxicity as 1,4-Dioxane. Dioxin is a chlorinated benzene, or chlorinated biphenol. 1,4-Dioxane is a much simpler compound, diethylene oxide. It is not chlorinated and contains no benzene or phenolic structures. The only thing the two chemicals do share is a structural component – a cyclic, oxygenated, diethylene ring (a dioxane ring).

The assertion or acceptance of a relationship between these two substances because of the presence of this simple structure would be similar to accepting a relationship between, say, any chemicals that had a benzene ring in their structure. **Petroleum solvents, herbal flavonoids and essential oils would all be bundled together using this argument!**

FACT 3: 1,4-Dioxane is not a hormone disrupter – potent or otherwise.

This is where the whole article gets rather devious. You see, Dioxin has been identified scientifically as a hormone disruptor and, from this point on, the article attributes the effects of *dioxin* to 1,4-dioxane.

Even if the whole paper was set up to educate the reader on the dangers of dioxin, it would still be a crock of rubbish. It is full of generalisations, unsubstantiated and unsupported claims. It contains no references to the research upon which its claims are supposedly based. It lies somewhere between bad and non-science.

Consider this paragraph: “It takes only a tiny amount of certain chemicals to shift the hormone balance. How much? Imagine a 6-mile long (10km) tanker train full of water and one drop of chemical: That’s all it takes.” (note that there is no mention of *which* chemicals).

Whilst this succeeds in creating a very powerful word picture, it is

nonsense and certainly has nothing to do with 1,4-Dioxane.

My quick calculation tells me that one drop in a 10km long tanker train full of water with a very conservative end dimension of 1.6x1.6 metres would amount to around 1:600,000,000,000 (1 in 600 billion). It is an absurd pronouncement.

The author continues: “What’s worse, it’s considered a ‘single hit’ problem: a single hit can create irreversible damage. The effect depends on **when** that droplet hits.”

What on earth does that mean?! The article takes further quantum leaps to talk about the results of hormone disruption and the effects it may have over three generations. However, the foregoing inaccuracies do not imbue me with any confidence regarding the veracity of these statements.

What I am absolutely sure about is that none of this has anything to do with 1,4-Dioxane, with which this article was purported to deal.

Here is a summary of the facts:

- 1,4-Dioxane is not ‘related’ in any way to DIOXIN, which is a vastly more toxic chemical and which is not present in ANY surfactant compound.
- 1,4-Dioxane is present as a by-product (or impurity) in small amounts in some ethoxylated detergent agents like SLES. The NICNAS report considered the range in a formulated shampoo or similar product to be between 1-30 parts per million.
- 1,4-Dioxane is classified by the NOHSC (National Occupational Health and Safety Council) as a 3.1 dangerous goods product **only** because of its flammability. It has **not** been given a subsidiary risk category for toxicity. This rating is, of course, for the pure, 100% active material and bears no resemblance to the trace amounts in surfactants.
- The presence of these small levels of 1,4-Dioxane in shampoo and cleaning agents will have absolutely no detrimental effect on your health, or that of your

- children, and will not contribute in any way to the lowering of male sperm counts.
- In the environment, 1,4-Dioxane is particularly benign. NICNAS has determined that it is not expected to bio-concentrate in fish but is expected to degrade slowly in soil or water. It degrades quickly in the atmosphere, with half-lives measured as low as 3.4 hours. “From the results obtained, 1,4-Dioxane can be classified as practically non-toxic to aquatic micro-organisms, plants, invertebrates and fish”.

In our range of hair care products we use no lauryl ether sulphates. We use SLES in our Chamomile Dishwashing Liquid as a replacement for the petroleum-based dodecylbenzene compounds used in most commercial products. The grade we use is based on vegetable-sourced lauryl alcohol and has undergone a vacuum stripping process to reduce the 1,4 Dioxane to a very tiny level.

This is not about defending our products. It is about correcting misinformation. You see, in nature there are toxins in many of the things we eat – including very low levels of naturally-occurring 1,4-Dioxane in some foods.

You may remember the Granny Smith apple exercise presented in a previous issue. From that long list of ‘ingredients’ isolated from this natural food, there are at least 5 substances that have been designated as dangerous goods by the NOHSC: propionaldehyde, acetone, valeraldehyde, butyl alcohol and butyric acid.

*You will probably recognise acetone. It is used as an industrial solvent and in cheaper quality nail polish removers. All five are dangerous goods in their **pure**, 100% active form – but their existence in very tiny amounts does not impact on the healthiness or flavour of the fruit.*

The gentleness of any personal care or cleaning product relies on the skill of the formulator in crafting and balancing a wide range of ingredients.

Within the scope of gentle and naturally-based formulations, I assure you that your life expectancy will not decrease by even a millisecond and that you, your family and your descendants will achieve a quality of life that is entirely independent of whatever ethoxylated ingredient may be present in the products you choose to use”.