From: Dykema, Linda D. (DHHS)
To: Shekter Smith, Liane (DEQ)
Subject: RE: phosphorus intake
Date: Friday, October 09, 2015 9:39:18 AM

Thanks Liane. We'll crunch the numbers to be sure we're delivering the right message if/when the question is asked.

From: Shekter Smith, Liane (DEQ)
Sent: Friday, October 09, 2015 9:10 AM
To: Dykema, Linda D. (DHHS)
Subject: FW: phosphorus intake

Linda – I asked Pat to provide some information that could be helpful for your staff to evaluate and hopefully confirm that the proposal to add phosphate will not contribute to other health concerns/issues.

Liane

From: Cook, Pat (DEQ)
Sent: Friday, October 09, 2015 9:07 AM
To: Shekter Smith, Liane (DEQ)
Cc: Busch, Stephen (DEQ)
Subject: RE: phosphorus intake

Liane - the average *total phosphate* dosage at each of the DWSD plants is about 1.1 mg/L. They are required to maintain at least 0.9 mg/L dosage and a 0.8 mg/L residual (as total phosphate) at the plant taps. These feed rates result in a 0.3 – 0.4 mg/l *phosphorus* concentration in the distribution system. For the phosphates DWSD is currently feeding, the NSF Standard 60 maximum dose rate is in the 12 - 27 mg/l range, so the dosage rates are well below any level of concern according to the NSF standard 60 protocol.

Hopefully DHHS staff can use these numbers to verify their calculations.

pat

From: Shekter Smith, Liane (DEQ)
Sent: Thursday, October 08, 2015 3:12 PM
To: Cook, Pat (DEQ)
Cc: Busch, Stephen (DEQ); Benzie, Richard (DEQ)
Subject: FW: phosphorus intake

Pat – can you take a look at the e-mail below and verify that the anticipated feed rates won't exceed health recommendations as noted. Thanks.

From: Dykema, Linda D. (DHHS)

Sent: Thursday, October 08, 2015 2:33 PM
To: Shekter Smith, Liane (DEQ)
Subject: FW: phosphorus intake

FYI

From: Groetsch, Kory J. (DHHS)
Sent: Thursday, October 08, 2015 2:22 PM
To: Dykema, Linda D. (DHHS)
Cc: Gray, Jennifer (DHHS)
Subject: FW: phosphorus intake

Linda,

FYI – Per Jen's research.
It would be worth knowing the estimated phosphorus concentrations in the finished water. Infants less than 1 year old with too much phosphorus can have hypocalcemia which can lead to other problems.

From: Gray, Jennifer (DHHS)
Sent: Thursday, October 08, 2015 1:21 PM
To: Groetsch, Kory J. (DHHS)
Subject: phosphorus intake

The Tolerable Upper Intake Levels for phosphorus is 3000 mg/d or higher for humans older than 1 year old. The Recommended Daily Allowance is 460 mg/d or higher for humans older than 1 year old.

Depending on how high the levels are, there may be some questions about infant exposure. See below.

Info on high phosphorus intake for infants out of **Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride** Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board, Institute of Medicine ISBN: 0-309-52130-0, 448 pages, 6 x 9, (1997)

Normal, healthy, term-born infants, like adults, can adjust to a relatively wide range of dietary Ca:P ratios as provided in contemporary infant formulas. However, as a result of developmental immaturity in renal handling of phosphorus by infants, ECF [Ca^{2+}] and P_i concentrations are closer to saturation in infancy, and infants are, therefore, more at risk of developing hypocalcemia as a consequence of hyperphosphatemia (DeVizia and Mansi, 1992). However, in the first month of life, some infants exhibit unusual sensitivity to phosphorus intakes above those associated with human milk. In the past, the clinical syndrome of late neonatal hypocalcemic tetany was observed when infants were fed whole evaporated cow milk with a very high phosphorus content (DeVizia and Mansi, 1992). Surprisingly,

even with the introduction of modified cow milk formulas with phosphorus content reduced to one-half or less than that of evaporated whole milk, the syndrome of hypocalcemia has still been observed in young infants (Specker et al., 1991b; Venkataraman et al., 1985). However, the phosphorus content of such formulas is still substantially higher than that of human milk (Specker et al., 1991b). If such hyperphosphatemia is allowed to persist during early infancy, parathyroid hyperplasia, ectopic calcifications, and low serum calcitriol may occur (Portale et al., 1986). In such cases, the compensatory mechanisms for handling phosphate loads, mainly renal excretion, must be overwhelmed, leading to excessive phosphorus retention and the other metabolic consequences.

It has also been suggested that a high content of phosphorus and calcium in an infant's diet may be a predisposing factor for the development of retention acidosis (Manz, 1992). It is not possible to identify, in advance, infants at risk for these syndromes unless they have renal dysfunction. Based on the data of Specker et al. (1991b), the risk of hypocalcemia (serum calcium less than 1.1 mmol/liter [4.4 mg/dl]) is 30 out of 10,000 neonates fed such formulas. Human milk with its low phosphorus content is both safer and better suited to the growth needs of the infant than cow milk (Manz, 1992). Finally, one report associates high intakes of phosphoric acid-containing cola beverages with slight reductions of serum calcium in Mexican children (Mazariegos-Ramos et al., 1995), but it is not clear to what extent the effect is due to the acid load of the colas, the associated low intake of calcium-rich beverages, or the phosphorus itself.

Except as noted in very young infants, none of these adjustments in calcium-regulating hormones is clearly adverse in its own right, particularly if calcium intake is adequate. Hence these effects do not provide a useful basis for estimating the Tolerable Upper Intake Level (UL).