BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
PROPOSED AMENDMENTS TO GROUNDWATER QUALITY (35 ILL. ADM. CODE 620)	)	**R 2022-018 (Rulemaking - Public Water Supply)**

NOTICE OF FILING

To: ALL PARTIES ON THE ATTACHED SERVICE LIST

PLEASE TAKE NOTICE that I have today electronically filed with the Office of the Clerk of the Illinois Pollution Control Board the attached **Pre-filed Responses of Lisa Yost**, and a **Certificate of Service**, copies of which are hereby served upon you.

/s/ Sarah L. Lode
Sarah L. Lode

Dated: November 23, 2022

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NOW COME Dynegy Midwest Generation, LLC; Electric Energy, Inc.; Illinois Power Generating Company; Illinois Power Resources Generating, LLC; and Kincaid Generation, LLC, (collectively, "Dynegy"), by their attorneys, ArentFox Schiff LLP, in response to the Illinois Pollution Control Board's October 27, 2022, prefiled questions and the Illinois Environmental Protection Agency's October 27, 2022, prefiled questions, and pursuant to the Hearing Officer's September, 19, 2022, Order, submit the following.

Lisa Yost Responses to Illinois Environmental Protection Agency October 27, 2022 Questions

1) Is Class I groundwater a potable resource groundwater?

   Answer: Dynegy objects to this question to the extent it calls for a legal opinion or conclusion. Subject to and notwithstanding this objection, Ms. Yost responds as follows.

   The Class I groundwater designation is described by Illinois law (35 Ill. Adm. Code 620) as Potable Resource Groundwater and is more specifically described in 35 Ill. Adm. Code Section 620.210.

2) Should a potable resource water be suitable for non-human use if human health is not as sensitive as other uses?

   Answer: Dynegy objects to this question to the extent it calls for a legal opinion or conclusion. Subject to and notwithstanding this objection, Ms. Yost responds as follows.

   While this is a regulatory and policy question, I note that in certain circumstances it may be appropriate to consider other uses that would require more restrictive standards, but such standards should make sense within the context they are being applied. For example, it would not necessarily be appropriate to base an Illinois groundwater standard on a use that does not exist in Illinois or on an endpoint that does not occur in Illinois.

3) Most of your "d" footnotes to Table 1 directly reference federal drinking water standards and/or MCLs. Are the federal drinking water standards (i.e., MCLs) applicable after treatment?

   Answer: MCLs are the highest level of a contaminant allowed in drinking water. Part of the MCL methodology from the United States Environmental Protection Agency ("US EPA") is technology that can be used to meet the standard. MCLs are applicable after treatment.[1]

[1] US EPA, National Primary Drinking Water Regulations. Available at: https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations.

4) In your experience, what level of treatment is typical at: a) private potable wells? b) irrigation wells? c) livestock watering wells?

Answer: Dynegy objects to this question to the extent it calls for a legal opinion or conclusion. Subject to and notwithstanding this objection, Ms. Yost responds as follows. To the best of my knowledge, private wells are not regulated in Illinois and the degree of treatment of private wells used for drinking water, or for agricultural uses including livestock watering or irrigation, is not monitored. The Illinois Environmental Protection Agency ("IEPA") provides information and guidance to private well owners regarding water treatment.[2] In addition, the Centers for Disease Control provides recommendations for siting, testing, and treating drinking water from private wells.[3,4]

5) If surrounding States have similar agricultural economies to Illinois, wouldn't a groundwater standard that protects livestock when consuming forage irrigated with contaminated water be beneficial to their agricultural economies?

Answer: My analysis of neighboring states was limited to a search of standards in place in states neighboring Illinois, including whether other states have based groundwater standards on livestock consumption of forage. I have not found that to be the practice in the states I reviewed. The necessity and benefit of standards to protect agriculture may vary across the states based on individual circumstances and my testimony does not opine on what standards states other than Illinois should adopt. In my testimony, I described why Class II standards for protection of livestock consuming forage are not needed for selenium or molybdenum. Specifically, both metals are essential nutrients, and no evidence was provided by IEPA or found through my analysis demonstrating that there is an issue in Illinois associated with elevated concentrations of these constituents in forage consumed by livestock. Moreover, for selenium, my testimony identified agricultural resources recommending that Illinois livestock be provided selenium supplements to avoid deficiencies.

6) Are there any soils in Illinois that have a pH above 7.0 SU?

Answer: Yes, however such soils appear to be the minority. The pH of soils is relevant because the US EPA Water Quality Criteria Document (1972)[5] reference relied on by IEPA states that the 0.02 mg/L irrigation standard for selenium is appropriate for "use on *neutral and alkaline* fine textured soils *until greater information is obtained* on soil reactions" [emphasis added]. As indicated in my testimony, exhaustive analysis of soils in Illinois is beyond the scope my testimony. However, data I reviewed indicate that many agricultural soils in Illinois have particle sizes that are relatively fine textured, but most soils in Illinois are not neutral or alkaline.[6] (See also Section 2.2.2 of my testimony.)

The lack of applicability of the US EPA (1972) standard to Illinois soils is also supported by the fact that studies cited by US EPA (1972) to support the proposed 0.02 mg/L standard were conducted

[2] IEPA, Treating Contaminated Well Water. Available at: https://www2.illinois.gov/epa/topics/drinking-water/private-well-users/Pages/treating-contaminated-well-water.aspx.
[3] CDC, Private Groundwater Wells. Available at: https://www.cdc.gov/healthywater/drinking/private/wells/index.html.
[4] CDC, Treatment of Well Water. Available at: https://www.cdc.gov/healthywater/drinking/private/wells/treatment.html.
[5] Water Quality Criteria 1972. Prepared by the National Academy of Sciences for the US EPA. Washington, D.C. 1972 (Hereafter "US EPA (1972)").
[6] Illinois State Water Survey, Alternative Crop Suitability Maps. Available at: https://www.isws.illinois.edu/data/altcrops/gisoils.asp.

in Oregon,[7] Wyoming,[8] New Zealand,[9] and Denmark,[10] with a focus on "range plants" and thus do not reflect Illinois agriculture. As one consideration, while the level of irrigation in these areas was not identified in the studies, irrigation in arid areas of eastern Oregon and in Wyoming would be expected to be much higher than in Illinois. Given these considerations, IEPA has not established the applicability of the US EPA (1972) irrigation standard for selenium to Illinois soil.

7) If yes, isn't it appropriate for a Selenium groundwater standard to be protective of those soils even if they have a limited extent?

Answer: See my response to question 6, above. In addition to the lack of applicability to the soil types in Illinois, IEPA also has not established the need for the Class II standard to protect foraging livestock from selenium in groundwater. Specifically, selenium is an essential nutrient and the agricultural extension office publications in Illinois[11] focus on the lack of selenium in forage rather than noting any issues with elevated selenium.

8) Would the same rational hold true for Molybdenum?

Answer: As indicated in my testimony, IEPA has proposed a Class II standard of 0.05 mg/L for molybdenum, identified as protective of livestock that forage on irrigated crops, as proposed in US EPA (1972), which relies on earlier studies.[12] US EPA (1972) identifies the 0.05 mg/L irrigation advisory as recommended for "*short-term use on soils that react with this element*." [Emphasis added]

IEPA did not provide further information regarding the applicability of this standard for Illinois agriculture, e.g., whether soils would be expected to react to molybdenum, and a review of studies relied on by US EPA (1972) and other data indicate that molybdenum is unlikely to be an issue for forage by livestock in Illinois. Specifically, as indicated on Page 18 of my testimony, my review of Illinois agricultural extension publications did not indicate settings where adverse effects were noted in plants or animals and some publications noted settings where molybdenum deficiencies occur.[13] Further, the fact that molybdenum is an essential nutrient is an important consideration in standard setting. (See also Section 4.2.3 of my testimony.)[14]

The studies used as a basis for the proposed Class II molybdenum standard are not based on areas representative of Illinois agriculture. Given the differences in soil conditions in Illinois in comparison

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[7] Allaway, W. H., P. D. Moore, J. E. Oldfield, and 0. H. Muth (1966), Movement of physiological levels of selenium from soil through plants to animals. J. Kutr. 88:411-418.

[8] Hamilton, J. W. and 0. A. Beath (1963), Uptake of available selenium by certain range plants. Range Manage. 16(5):261-264.

[9] Grant, A. B. (1965), Pasture top-dressing with selenium. New Zeal. Agr. Res. 8(3):681-690.

[10] Gissel-Nielson, G. and B. Bisbjerg (1970), The uptake of applied selenium by agricultural plants. II. Utilization of various selenium compounds. Plant Sozl 32(2):382-396.

[11] Meteer 2017. Orr Agricultural R&D Center. University of Illinois at Urbana-Champaign. College of ACES. Preparing for Calving Season. Available at: https://extension.illinois.edu/blogs/cattle-connection/2017-01-23-preparing-calving-season.

[12] Lesperance, A. L. and V. R. Bohman (1963), Effect of inorganic molybdenum and type of roughage on the bovine. Amm. Scz. 22(3):686-694; Dye, W. B. and J. L O'Hara (1959), Molybdosis. Nevada Agr. Exp. Sta. Bull. 208, 32 pp.; Jensen, E. H. and A. L. Lesperance (1971), Molybdenum accumulation by forage plants. Agron. J. 63(2):201-204; Kubota, J., E. R. Lemon, and W. H. Allaway (1963), The effect of soil moisture content upon the uptake of molybdenum, copper, and cobalt by alsike clover. Sozl Scz. Soc. Amer. Proc. 27(6):679-683; Bingham, F. T., R. J. Arkley, N. T. Coleman, and G. R. Bradford (1970), Characteristics of high boron soils in western Ken County. Hilgardia 40(7):193-204.

[13] University of Illinois Extension 2016. Fruit and Vegetable News. Available at: http://ipm.illinois.edu/ifvn/contents.php?id=6; University of Illinois Urbana-Champaign. College of Agricultural, Consumer & Environmental Sciences. A short course in secondary macronutrients and micronutrients. Available at: https://aces.illinois.edu/news/short-course-secondary-macronutrients-and-micronutrients.

[14] MSD Manual Veterinary Manual. Etiology of Molybdenum Toxicity in Animals. Available at: https://www.merckvetmanual.com/toxicology/molybdenum-toxicity/molybdenum-toxicity-in-animals

with locations where molybdenum has been identified as a problem in irrigated forage consumed by livestock, using those studies as a basis for setting a standard in Illinois is inappropriate.

9) Is the Fluoride MCL set at 4 mg/L due to increased risk of skeletal fluorosis?

Answer: The US EPA indicates that the MCL for fluoride is set to prevent long-term exposures to greater than 4 mg/L. The US EPA fact sheet on the fluoride MCL indicates that the MCL of 4 mg/L is set to prevent skeletal fluorosis.[15] In addition, on the US EPA website for the Fluorine MCL, under the column entitled "Potential Health Effects from Long-Term Exposure Above the MCL (unless specified as short-term)," US EPA notes that effects for fluoride are "Bone disease (pain and tenderness of the bones) and children may get mottled teeth."[16]

10) What are the symptoms of skeletal fluorosis?

Answer: ATSDR states the following regarding skeletal fluorosis:

> **"**Skeletal fluorosis can be caused by eating, drinking, or breathing very large amounts of fluorides. This disease only occurs after long-term exposures and can cause denser bones, joint pain, and a limited range of joint movement. In the most severe cases, the spine is completely rigid. Skeletal fluorosis is extremely rare in the United States; it has occurred in some people consuming greater than 30 times the amount of fluoride typically found in fluoridated water. It is more common in places where people do not get proper nutrition."[17]

11) Does Fluoride have a distinctive taste or odor at 4 mg/L?

Answer: No.

12) Has USEPA established a Fluoride Secondary MCL of 2 mg/L, to protect children from tooth discoloration and pitting?

Answer: Dynegy objects to this request to the extent that it calls for information outside the scope of IEPA's rulemaking proposal and testimony[18] and, therefore, Dynegy's testimony. Subject to and notwithstanding this objection, Ms. Yost responds as follows. Yes, US EPA has identified a secondary MCL of 2 mg/l to protect against "objectionable dental fluorosis" in children, which US EPA identifies as "a cosmetic effect and not a toxic and/or adverse health effect." (50 Fed. Reg. 47,142.) Unlike MCL's, which the Illinois Pollution Control Board has relied upon for setting Class I groundwater standards, secondary MCLs from US EPA are not federally enforceable and contaminants are not considered to present a risk to human health at their secondary MCLs. Additionally, IEPA's proposed standard of 2 mg/L for fluoride does not reference children's dental fluorosis. Instead IEPA's proposed standard is based on protection of livestock consuming groundwater as drinking water and is intended to be protective against tooth mottling,[19] a cosmetic dental effect in livestock.

13) Does Fluoride have a distinctive taste or odor at 2 mg/L?

Answer: No.

14) Is there any requirement in Illinois to sample private wells for Fluoride?

Answer: Dynegy objects to this question to the extent it calls for a legal opinion or conclusion. Subject to and notwithstanding this objection, Ms. Yost responds as follows.

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[15] www.epa.gov/sites/default/files/2015-10/documents/2011_fluoride_questionsanswers.pdf.
[16] US EPA National Primary Drinking Water Regulations. Available at: https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations.
[17] ATSDR 2003. Toxicological Profile for Fluorides, Hydrogen Fluoride, and Fluorine. Available at: https://www.atsdr.cdc.gov/toxprofiles/tp11.pdf.
[18] IEPA's Motion for Acceptance, Statement of Reasons, and Proposed Amendments (Dec. 7, 2021), R2022-018, *In the Matter of: Proposed Amendments to Groundwater Quality (35 Ill. Adm. Code 620)*.
[19] *Id.* at 4932 and review of GWC 1972 reference cited by IEPA.

The IEPA website[20] indicates the following:

> "Community drinking water systems are inspected and monitored under the supervision of the Illinois EPA, while non-community drinking water systems are the responsibility of the Illinois Department of Public Health (IDPH). In addition, IDPH reviews water well installation plans, issues permits for new well construction, and inspects wells. However, **private water well owners themselves have the primary responsibility to test well water for potential contaminants."**

However, IEPA does provide information regarding potential contamination of private water wells.[21] Private wells are not regulated and the degree of treatment of private wells used for drinking water is not monitored. The Centers for Disease Control provides recommendations for siting, testing, and treating private wells.[22,23]

15) Is a community water supply required to notify its customers if the drinking water it serves exceeds 2 mg/L of Fluoride?

Answer: There is a notice requirement for community water systems with fluoride exceeding 2 mg/L; however, 2 mg/L is a secondary standard and is not the limit for fluoride that applies to community water systems in Illinois. The MCL of 4.0 mg/L for fluoride is the legally enforceable standard for community water systems in Illinois.

16) If a child were drinking untreated water, for example from a private well, would their dental health be better protected by a groundwater quality standard of 2 mg/L or 4 mg/L?

Answer: Dynegy objects to this request to the extent that it calls for information outside the scope of IEPA's rulemaking proposal and testimony[24] and, therefore, Dynegy's testimony. Subject to and notwithstanding this objection, Ms. Yost responds as follows. The MCL of 4 mg/L is the legally enforceable drinking water standard in Illinois and in the United States. It is also the current groundwater standard in Illinois. IEPA has proposed a standard of 2 mg/L based on cosmetic effects in livestock and has not provided anything in the record related to children's dental health.

17) If forage was irrigated with groundwater containing a high Molybdenum concentration from an anthropogenic source, could that impact livestock health?

Answer: Yes. Molybdenum in groundwater used as irrigation water can impact livestock foraging on irrigated areas if the molybdenum concentrations are high enough, if the irrigation continues for a sufficient time, and if the soil conditions are such that molybdenum can accumulate in soils and plants. However, the studies used as the basis for identifying IEPA's proposed Class II standard for molybdenum are not based on areas representative of Illinois agriculture. Given the differences in soil conditions in Illinois in comparison with locations where molybdenum has been identified as a problem in irrigated forage consumed by livestock, it is inappropriate to use that as a basis for setting an Illinois standard.

18) Please provide copies of the data reviewed suggesting that soils in Illinois are typically acidic.

Answer: As indicated in my testimony, exhaustive review of soil types in Illinois was beyond the scope of my evaluation. The reference to soils being typically acidic as provided in my testimony is

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[20] IEPA, Private Well Users. Available at: https://www2.illinois.gov/epa/topics/drinking-water/private-well-users/Pages/default.aspx.
[21] IEPA, Notices to Private Well Users about Public Water Supply-related Groundwater Contamination. Available at: https://www2.illinois.gov/epa/topics/drinking-water/private-well-users/notices/Pages/default.aspx.
[22] CDC, Private Ground Water Wells available at: https://www.cdc.gov/healthywater/drinking/private/wells/index.html.
[23] CDC, Well Treatment. Available at https://www.cdc.gov/healthywater/drinking/private/wells/treatment.html
[24] IEPA's Motion for Acceptance, Statement of Reasons, and Proposed Amendments (Dec. 7, 2021), R2022-018, *In the Matter of: Proposed Amendments to Groundwater Quality (35 Ill. Adm. Code 620)*.

Illinois State Water Survey, Alternative Crop Suitability Maps. Available at: https://www.isws.illinois.edu/data/altcrops/gisoils.asp.

19) What is the selenium irrigation value listed on page 4,832 of the December 7, 2021, initial filing under the column, "For use up to 20 years on fine textured soils of pH 6.0 to 8.5"?

Answer: I assume here that IEPA is referring to pdf page 4,832 of its Motion for Acceptance, Appearances, Certificate of Origination, Statement of Reasons, and Proposed Amendments to 35 Ill. Adm. Code 620 Groundwater Quality Standards filing in R2022-018 made on December 7, 2021. This page is from US EPA (1972) and refers to the 0.02 mg/L irrigation standard recommendation for selenium. Page 4,834 of the same document further explains the 0.02 mg/L irrigation standard for selenium is appropriate for "use on *neutral and alkaline* fine textured soils *until greater information is obtained."*

20) Are recommended maximum concentrations of trace elements in irrigation water has separate recommendations for water used continuously on all soil and for use up to 20 years on fine textured soils of pH 6.0 to 8.5?

Answer: This question is unclear, and I am, therefore, unable to respond.

21) Did the testimony heard at the March 9, 2021, hearing discuss the basis for the selenium irrigation value being for use up to 20 years on fine textured soils, and not for water used continuously on all soils?

Answer: Yes. On March 9, 2022, IEPA indicated that its proposed selenium irrigation standard is based on the following:

> "[T]he use up to 20 years on fine texture soils, not for water used continuously on all soils."[25]

As noted in my testimony, this differs from IEPA's previous reliance upon the same US EPA document in previous rulemakings.

22) Does RSL use the same methodology to calculate noncancer tap water screening levels as Part 620?

Answer: I assume that the use of the term "RSL" is a reference to "Regional Screening Level," which are risk-based concentrations for water. The US EPA RSLs are derived to be protective of risks associated with use as residential drinking water and do not use a relative source contribution factor but otherwise generally apply the same methodology, i.e., they are based on ingestion of water by a young child.

23) Are the methods in Part 620, Appendix A, required to be used to calculate a potable resource standard?

Answer: Dynegy objects to this question as calling for a legal opinion or conclusion and as falling outside the scope of the witness's testimony. 35 Ill. Adm. Code Part 620, Appendix A, speaks for itself.

24) When developing the IRIS toxicity value, did IRIS rely on human or animal studies as the basis for its oral reference dose (RfD)?

Answer: Because molybdenum was the only chemical in my testimony that relied on an Integrated Risk Information System ("IRIS") value, I am inferring that this question and questions 25, 27, 28, 30, 34, 35, below, refer to and are being asked regarding molybdenum.

[25] Hearing Transcript at 150:13–15 (Mar. 9, 2022), R2022-018, *In the Matter of: Proposed Amendments to Groundwater Quality (35 Ill. Adm. Code 620)*.

In general, IRIS evaluates all relevant evidence from available studies and has the intent of selecting the best available evidence from animal studies or studies in people as the basis for its toxicity value. The IRIS value for molybdenum relied on epidemiological studies (Koval'skiy et al. 1961, US EPA 1979), but the Koval'skiy et al. (1961),[26] a small study in a human population, was the primary study and the source of the numerical data used to derive the RfD.[27] Studies in experimental animals were also considered, but the Murray et al. (2014)[28] study was not available at the time of the US EPA 1992 IRIS review.

25) Was the Koval'skiy et al. 1961 study the only study relied upon by IRIS when developing its RfD? If the above is "No", were the additional studies human or animal studies?

Answer: See response to question 24, above. The US EPA IRIS analysis relied on available data at that time, including animal studies and studies in human populations. Since the time of the 1991 IRIS review, additional, more reliable studies have been conducted and can serve as a more technically robust basis for the regulation of molybdenum.

26) Does U.S. EPA continue to use the IRIS RfD instead of the ATSDR toxicity value when calculating health-based screening levels in RSL?

Answer: US EPA continues to use the RfD in the RSL screening table. However, the RSL screening values are not regulatory standards and are instead a first level means to determine whether further evaluation is needed.[29]

27) When developing the ATSDR toxicity value, did ATSDR rely on human or animal studies as the basis for its dose minimal risk level?

Answer: ATSDR (2020) reviewed epidemiological data (studies in people) including the Koval'skiy et al. (1961) and US EPA (1979) studies relied on by US EPA and determined that "[n]o reliable dose response data were available for humans." (ATSDR (2020).)[30] ATSDR then performed a careful analysis of studies in animals available at that time and derived the subchronic minimal risk level value from a study by Murray et al. (2014) which demonstrated a No Observed Adverse Effect Level ("NOAEL") of 17 mg/kg-day for effects on the kidney. ATSDR selected this study based on a thorough and comprehensive evaluation of data including many studies that were not available to US EPA for the 1992 IRIS evaluation. The Murray et al. (2014) study, which was well controlled and complete, and the ATSDR intermediate MRL derived from that study are the most representative basis to consider human health risk.

28) Were the studies conducted for development of the ATSDR toxicity values chronic or subchronic studies?

Answer: The ATSDR derived a subchronic MRL from the Murray et al. (2014) study. However, as noted in my testimony, an analysis by the European Chemicals Agency ("ECHA") [31] determined that no further adjustment was needed to use a subchronic study as the basis of evaluating chronic exposures because there were no further effects observed following additional exposure.

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[26] Koval'skiy, V.V., G.A. Yarovaya and D.M. Shmavonyan. 1961. Changes of purine metabolism in man and animals under conditions of molybdenum biogeochemical provinces. Zh. Obshch. Biol. 22:179-191. (Russian trans.) Not seen as reported in US EPA.

[27] US EPA 1992. Integrated Risk Information System (IRIS) file on Molybdenum CASRN 7439-98-7 | DTXSID1024207. Available at: https://iris.epa.gov/ChemicalLanding/&substance_nmbr=425.

[28] Murray FJ, Sullivan FM, Tiwary AK, et al. 2014a. 90-Day subchronic toxicity study of sodium molybdate dihydrate in rats. Regul Toxicol Pharmacol 79:579-588. Available at: https://europepmc.org/article/med/24041747.

[29] US EPA Regional Screening Level Users Guide. Available at: https://www.epa.gov/risk/regional-screening-levels-rsls-users-guide#understanding ("This document does not establish binding rules.").

[30] ATSDR 2020 Toxicological Profile for Molybdenum. Available at: https://www.atsdr.cdc.gov/ToxProfiles/tp212.pdf.

[31] European Chemicals Agency (ECHA) Molybdenum EC number: 231-107-2 | CAS number: 7439-98-7. Available at: https://echa.europa.eu/registration-dossier/-/registered-dossier/15524/7/1.

Specifically, ECHA noted that the National Toxicology Program ("NTP") 1997[32] inhalation study demonstrated no increase in systemic toxicity for 13 weeks or two years.

29) When conducting toxicity assessments, is human or animal data more relevant in assessing risks to human?

Answer: In evaluating toxicity, the quality and representativeness of the studies are critical. Both studies in animals and studies in human populations are useful and are carefully considered. Ultimately the intent is to select the best available data as the basis for toxicity values that are protective of human health.

30) Does ATSDR's toxicity assessment consider the potential for increased toxic effects in humans and animals with mineral deficiencies in the diet, specifically, copper?

Answer: Yes, the ATSDR subchronic MRL did consider potential for increased toxic effects in humans and animals with copper deficiencies in the diet. ATSDR (2020)[33] stated the following regarding copper:

> "The MRL is based on a NOAEL of 17 mg molybdenum/kg/day, a total uncertainty factor of 100 (10 for extrapolation from animals to humans, and 10 for human variability), *and a modifying factor of 3 (to address concern that reproductive/developmental alterations may be sensitive outcomes in populations with marginal copper intakes).*" [Emphasis Added]

ATSDR (2020) also noted that the average copper intake of the US population exceeds the minimum required amount.

31) Can increased levels of molybdenum be related to possible copper deficiencies, through increased copper excretion?

Answer: The main concern with molybdenum and copper is increased molybdenum toxicity in people or animals who have inadequate copper intake. There was an early study that showed increased urinary excretion of copper in people consuming high amounts of molybdenum (500 µg/day and 1,500 µg/day) from sorghum that had increased urinary copper excretion. (Deosthale and Gopalan (1974).)[34] In contrast, a well-designed study conducted in 2000 indicated that very high dietary molybdenum intakes (up to 1,500 µg/day) did not adversely affect copper nutritional status in eight, healthy young men. (Turnland and Keys (2000).)[35] This issue was thoroughly evaluated by ASTDR (2020)[36] toxicological profile for molybdenum and in the derivation of the intermediate MRL.

32) Can copper deficiencies resulting from increased intakes of molybdenum cause adverse effects in sensitive populations?

Answer: Yes, as indicated in the responses to questions 30 and 31 above, this mode of action was considered by ATSDR (2020) in the derivation of the intermediate MRL, by US EPA (1992)[37] in

[32] NTP 1997. Toxicology and carcinogenesis studies of molybdenum trioxide in F344/N rats and B6C3F1 mice (inhalation studies). Research Triangle Park, NC: National Toxicology Program. TR263. Available at: https://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr462.pdf.
[33] ATSDR 2020 Toxicological Profile for Molybdenum. Available at: https://www.atsdr.cdc.gov/ToxProfiles/tp212.pdf.
[34] Deosthale, Y.G. and C. Gopalan. 1974. The effect of molybdenum levels in sorghum (Sorghum vulgare Pers.) on uric acid and copper excretion in man. Br. J. Nutr. 31:351-355.
[35] Turnlund JR, Keyes WR. Dietary molybdenum: Effect on copper absorption, excretion, and status in young men. In: Roussel AM, ed. Trace Elements in Man and Animals. Vol 10. New York: Kluwer Academic Press, 2000:951-953.
[36] ATSDR 2020 Toxicological Profile for Molybdenum. Available at: https://www.atsdr.cdc.gov/ToxProfiles/tp212.pdf.
[37] US EPA 1992. Integrated Risk Information System (IRIS) file on Molybdenum CASRN 7439-98-7 | DTXSID1024207. Available at: https://iris.epa.gov/ChemicalLanding/&substance_nmbr=425.

derivation of the IRIS value, and by ECHA[38] in the derivation of a chronic oral derived no effect level for the general population.

33) Does the RfD developed by IRIS take into account the potential for mineral imbalance, specifically copper deficiencies that may result from increased intake of molybdenum?

Answer: The IRIS RfD did consider potential interactions between molybdenum intake and copper metabolism in individuals with adequate or inadequate copper intake. The ASTDR MRL also considered potential interaction with copper in setting an MRL for molybdenum.

34) Does U.S. EPA utilize the IRIS toxicity value for development of its screening levels?

Answer: I assume use of the term "screening levels" here is a reference to US EPA's "Regional Screening Levels." Yes, the Regional Screening Level table uses the US EPA IRIS value for molybdenum. However, as identified above, the RSL table does not provide enforceable numeric values. Further, the US EPA (1992) IRIS value does not consider the more robust data considered by ATSDR (2020).

35) Is the IRIS toxicity value protective for the critical effect of decreased body weight gain utilized by ATSDR in the development of its toxicity value?

Answer: Yes. The IRIS chronic RfD value of 0.005 mg/kg-day would be protective of the decreased body gain endpoint identified by ATSDR (2020)[39] in developing the intermediate MRL because the IRIS RfD is much lower than doses at which this effect occurred. Specifically, ATSDR (2020) identified a NOAEL of 17 mg/kg-day for several critical effects, including lower body weight gain, and derived an intermediate MRL of 0.06 mg/kg-day through application of an uncertainty factor of 100 and a modifying factor of 3. Thus, the IRIS RfD is 3,400-fold lower than the NOAEL where no effects, including lower body weight gain, were observed and is 12 times lower than the ATSDR intermediate MRL. Thus, the ATSDR subchronic MRL provides an adequate margin of safety regarding this endpoint and the US EPA IRIS RfD is much lower than needed to address this and other relevant endpoints of concern.

Lisa Yost Responses to Illinois Pollution Control Board October 27, 2022 Questions

5. On pages 2 and 3, you summarize your opinion by stating that the proposed standards for selenium, fluoride, and molybdenum are not appropriate for adoption based upon several reasons.

    a. Please comment on whether you are aware of selenium, fluoride, and molybdenum levels in Illinois groundwater like the cobalt and vanadium data mentioned in Dr. Hahn's testimony.

    b. If so, would it be possible provide that information into the record to show if compliance with the proposed standards would also be a concern.

Answer: I did not review selenium, fluoride, and molybdenum concentrations in Illinois groundwater as part of my research for my testimony.

6. In Table 1, your comparison of the proposed selenium standard with standards in neighboring states indicates that our neighbor states have standards based on US EPA MCL of 0.05 mg/L. Are you aware of Minnesota's selenium Health Risk Limit of 0.03 mg/L? If so, please comment on why Minnesota chose to set a limit lower than the federal MCL.

[38] European Chemicals Agency (ECHA) Molybdenum EC number: 231-107-2 | CAS number: 7439-98-7. Available at: https://echa.europa.eu/registration-dossier/-/registered-dossier/15524/7/1.
[39] ATSDR 2020 Toxicological Profile for Molybdenum. Available at: https://www.atsdr.cdc.gov/ToxProfiles/tp212.pdf.

Answer: I am aware the Minnesota Department of Health ("MDH") derives Health Risk Limits ("HRL") as guidance values used for water monitoring and risk-management purposes.[40] I note that I am not testifying in this proceeding as a legal expert and I cannot speak to the policy decisions of MDH. However, I understand these HRLs, unlike Part 620 standards, are non-enforceable limits and that they consider health impact only. In contrast, enforceable MCLs consider health impact, cost, and technology of prevention and/or treatment. The documentation provided at the MDH website clearly indicate that the Minnesota HRL value for selenium was not based on protection of livestock consuming forage irrigated with groundwater.[41]

The MDH does not appear to have readily available information regarding the inputs used to derive the HRL of 0.03 mg/L (30 µg/L) for selenium on its website, which is a value derived by MDH in 1993.[42,43] However, I requested the 1993 documentation from MDH. I received a reply from Dr. Helen Goeden, a Senior Toxicologist/Risk Assessor for MDH, who provided the following algorithm,

$$HRL = \frac{(RfD)(70)(RSC)(1,000)}{(2)}$$

and the following inputs, which were used to derive the HRL for selenium: the RfD of 0.005 mg/kg-day; a relative source contribution of 0.2; consumption of 2 liters of water; and a 70 kilogram body weight. Application of these inputs results in a value of 0.035 mg/L (35 µg/L). Dr. Goeden noted that it is MDH's approach to round to one significant figure. Again, my understanding is "MDH does not enforce or regulate the use of health-based guidance. MDH provides recommended values for use by risk assessors and risk managers in making decisions and evaluating health risks."[44]

[40] https://www.health.state.mn.us/communities/environment/risk/guidance/gw/index.html ("HBVs and HRLs are guidance used by the public, risk managers, and other stakeholders to make decisions about managing the health risks of contaminants in groundwater and drinking water.").
[41] https://www.health.state.mn.us/communities/environment/risk/guidance/gw/index.html.
[42] https://www.health.state.mn.us/communities/environment/risk/docs/rules/summary.pdf.
[43] https://www.health.state.mn.us/communities/environment/risk/rules/water/methods.html.
[44] *In The Matter of the Proposed Rules of the Department of Health Relating to the Health Risk Limits for Groundwater, Minnesota Rules, Chapter 4717, part 7860 and part 7500*; Reviser's ID Number R4396, Office of Administrative Hearings Docket No. 82-9000-34834, Statement of Need and Reasonableness at 66 (2018), https://www.leg.mn.gov/archive/sonar/SONAR-04396.pdf#page=2.

CERTIFICATE OF SERVICE

I, the undersigned, certify that on this 23rd day of November, 2022, I have electronically served the attached **Pre-filed Responses of Lisa Yost** upon the individuals on the attached service list. I further certify that my email address is Sarah.Lode@afslaw.com; the number of pages in the email transmission is 14; and the email transmission took place before 5:00 p.m.

/s/ Sarah L. Lode
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