

Technical Support Document

Basis for EPA's Approval of Oregon's Withdrawal of Human Health Water Quality Criteria for Iron and Manganese and Revision of Associated Footnote to Table 20 Submitted on January 18, 2011

U.S. EPA Region 10
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I. Background

a. Clean Water Act (CWA) Requirements for Water Quality Standards (WQS)

Section 303(c)(2) of the CWA requires States and authorized Tribes to submit new or revised water quality standards to EPA for review. With respect to new or revised criteria, under Section 303(c) of the CWA and its implementing regulations found at 40 CFR 131.5, EPA is to review these adopted criteria to ensure they protect the designated water uses, and that the State has followed its own procedures for adopting such criteria.

The federal water quality standards regulations at 40 CFR 131.11 state in part that States must adopt "those water quality criteria that protect the designated use." Criteria "must be based on sound scientific rationale and must contain sufficient parameters or constituents to protect the designated use." 40 CFR 122.44 requires that both numeric and narrative criteria be considered when establishing effluent limits in NPDES permits.

b. Oregon's Submission

In 2009 and 2010, the Oregon Department of Environmental Quality (DEQ) worked with a stakeholder workgroup to obtain input on revisions to the human health criteria for iron and manganese. DEQ proposed and adopted revisions to criteria contained in Table 20, Water Quality Criteria Summary, and incorporated them into Oregon's Water Quality Standards regulation by reference in OAR 340-041-0033(2). The rule revisions:

- Withdraw iron human health criterion of 300 µg/L for the protection of human consumption of water and fish.
- Withdraw manganese human health criterion of 50 µg/L for protection of human consumption of water and fish.
- Withdraw manganese human health criterion of 100 µg/L for protection of human consumption of fish in freshwater.
- Revise the footnote associated with the manganese human health criterion for protection of human consumption of fish in Table 20. The revised footnote states that the manganese criterion applies only to saltwater and is for total manganese.

DEQ provided an opportunity for formal public comment on the proposed revisions from August 25 to September 30, 2010 and held two public hearings. The revisions were adopted by the Oregon Environmental Quality Commission (EQC) on December 9, 2010, and filed with the Oregon Secretary of State on December 21, 2010. A letter dated January 10, 2011 from Larry Knudsen, Assistant Attorney General, certifies that the revisions were adopted pursuant to Oregon law.

DEQ submitted these revisions to EPA for review and approval on January 18, 2011. Included in the submission was a memorandum, dated November 15, 2010, to the EQC from Dick Pedersen, Director, DEQ, with the following attachments:

- Attachment A contained the rule revisions. Numeric criteria revisions are presented in Table 20 “Water Quality Criteria Summary” and are located under the main heading “Concentration in Units per Liter for Protection of Human Health” and the subheadings “Water and Fish Ingestion” and “Fish Consumption Only”.
- Attachment B contained a “Summary of Public Comment and Agency Responses”.
- Attachment C contained the Presiding Officer’s report on public hearings.
- Attachment D contained a document entitled, “*Water Quality Standards Review and Recommendations: Iron and Manganese*”, prepared by DEQ. This document provides DEQ’s supporting basis and rationale for revisions to the iron and manganese criteria.

Additionally, in a letter to EPA dated February 15, 2011, from Neil Mullane, Water Quality Division Administrator, DEQ, resubmitted Table 20 and requested EPA disregard the version previously submitted to EPA by letter dated January 10, 2011. This letter corrected the “note” at the top of Table 20 that originally referred to amendments for “arsenic and manganese.” DEQ informed EPA that this note should have referred to amendments to the “iron and manganese” criteria. The resubmitted Table 20 completely removes the note from the table.

EPA has reviewed Oregon’s revised regulations and the supporting basis and rationale for these revisions contained in the document entitled “*Water Quality Standards Review and Recommendations: Iron and Manganese*.” In this document, Oregon states that their narrative criteria could be used, if needed, to address any adverse affects from iron or manganese on taste, odor and aesthetics to drinking water supplies.^{1*} In addition, Oregon notes that the aquatic life criterion for iron also remains in effect for protection of aquatic life uses.

¹ DEQ. 2010. *Water Quality Standards Review and Recommendations: Iron and Manganese*, Oregon Department of Environmental Quality, Attachment D, December 9, 2010 EQC Meeting. P. 4.

II. Withdrawal of the Iron Human Health Criterion for Protection of Human Consumption of Water and Fish

Oregon DEQ reviewed the iron criterion for human health because iron is a naturally occurring earth metal that sometimes exceeds the current criterion due to natural background levels, and because Oregon DEQ believes the criterion does not represent the level needed to protect human health.² Oregon's human health water quality criterion for iron, for the protection of human consumption of water and fish, was identified in Table 20 under "water and fish ingestion." This human health criterion was based on EPA's recommended criterion (300 µg/L), which was derived from data relating to aesthetic (e.g., laundry staining) and organoleptic (i.e., taste) effects, not toxicological effects.³ Oregon has withdrawn the iron "water and fish ingestion" criterion for all surface waters of the State.

III. Withdrawal of the Manganese Human Health Criterion for Protection of Human Consumption of Water and Fish

Oregon DEQ reviewed the manganese criterion for human health for protection of consumption of water and fish because manganese is a naturally occurring earth metal in Oregon and because Oregon DEQ believes the criterion does not represent the level needed to protect human health.⁴ Oregon's human health water quality criterion for manganese, for the protection of human consumption of water and fish, was identified in Table 20 under "water and fish ingestion." This human health criterion was based on EPA's recommended criterion (50 µg/L), which was derived from data relating to aesthetic (e.g., laundry staining) and organoleptic (i.e., taste) effects.⁵ Oregon has withdrawn the manganese "water and fish ingestion" criterion for all surface waters of the State.

IV. Withdrawal of the Manganese Human Health Criterion for Protection of Human Consumption of Fish as it Applies to Freshwater

Oregon DEQ reviewed the manganese criterion for human health for the protection of fish consumption from freshwater because manganese is a naturally occurring earth metal in Oregon and because Oregon DEQ believes the criterion does not represent the level needed to protect human health. Their review stated that EPA's manganese human health criterion recommendation for fish consumption was based on "concerns about possible

² DEQ. 2010. Water Quality Standards Review and Recommendations: Iron and Manganese, Oregon Department of Environmental Quality, Attachment D, December 9, 2010 EQC Meeting. p.4

³ EPA. 1986. Quality Criteria for Water ("Gold Book"). U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA 440/5-86-001. Available at <http://www.epa.gov/waterscience/criteria/library/goldbook/pdf>

⁴ DEQ, 2010. Water Quality Standards Review and Recommendations: Iron and Manganese, Oregon Department of Environmental Quality, Attachment D, December 9, 2010 EQC Meeting. p. 5

⁵ EPA. 1986. Quality Criteria for Water ("Gold Book"). U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA 440/5-86-001. Available at <http://www.epa.gov/waterscience/criteria/library/goldbook/pdf>

high bioaccumulation rates among marine mollusks,” not freshwater species. Thus, they determined that a freshwater fish consumption criterion for manganese was not needed.⁶

Oregon’s previous numeric human health water quality criterion for manganese was for the protection of human consumption of fish, as identified in Table 20 under “fish consumption only”. This human health criterion was based on EPA’s recommended criterion of 100 µg/L⁷ that was based on toxicological data from saltwater species. Oregon’s previous criterion did not distinguish between freshwater and saltwater; thus Oregon’s criterion was previously applicable to both freshwater and saltwater. Oregon has withdrawn the manganese “fish consumption only” criterion for all freshwaters of the State and the criterion now applies only to saltwaters of the State.

V. Revised Footnote Associated with the Manganese Human Health Criterion for Protection of Human Consumption of Fish (Footnote 1 to Table 20)

In 2004 Oregon added Footnote K to Table 20. This footnote was applied to the numeric human health water quality criteria for manganese and iron for the protection of “water and fish ingestion” and “fish consumption only.” It specified that the criteria applied to “dissolved manganese” and “dissolved iron”, not “total manganese” or “total iron.”⁸ In June 2010, EPA disapproved this footnote as it applied to the “fish consumption only” criterion for manganese because the supporting documentation did not demonstrate that the expression of the criterion in a dissolved form was protective of the uses.⁹ Oregon has revised the footnote associated with the human health criterion for protection of human consumption of fish and relabeled it as Footnote 1. The new footnote specifies the criterion for manganese applies to saltwater only and is applied to total manganese.

VI. EPA Review and Decision

a. Designated Uses and Criteria for the Protection of Human Health

Oregon’s WQS designate beneficial uses for waters of the State for each basin in OAR 340-041-0101 to 0340 and Tables 101(A) through 340(A), incorporated into Oregon rule by reference. Oregon’s designated uses consist of the following:

- Public Domestic Water Supply
- Private Domestic Water Supply

⁶ DEQ, 2010. Water Quality Standards Review and Recommendations: Iron and Manganese, Oregon Department of Environmental Quality, Attachment D, December 9, 2010 EQC Meeting. p. 5.

⁷ EPA. 1986. Quality Criteria for Water (“Gold Book”). U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA 440/5-86-001. Available at <http://www.epa.gov/waterscience/criteria/library/goldbook/pdf>

⁸ Water samples may be analyzed such that results indicate the total amount of a metal within a sample, including both the soluble and insoluble metal (total) or to only represent the soluble metal (dissolved). Both the dissolved and total values are important in accessing specific affects of a metal on receptors.

⁹ U.S. EPA. Region 10. U.S. EPA Region 10. June 1, 2010. Technical Support Document for Action on the State of Oregon’s New and Revised Human Health Water Quality Criteria for Toxics and Revisions to Narrative Toxics Provisions Submitted on July 8, 2004.

- Industrial Water Supply
- Irrigation
- Livestock Watering
- Fish and Aquatic Life
- Wildlife and Hunting
- Fishing
- Boating
- Water Contact Recreation
- Aesthetic Quality
- Hydro Power
- Commercial Navigation and Transportation

Oregon's human health criteria were developed to protect human health from long term exposure to toxic pollutants in drinking water and through eating fish and shellfish contaminated with toxics. Thus, when DEQ adopted new and revised human health criteria in 2004, DEQ stated that they did not adopt EPA's recommended criteria that were based on organoleptic effects but limited adoption to those criteria derived based solely on toxic endpoints.¹⁰ Oregon's previous numeric human health criteria for iron and manganese were adopted prior to the 2004 rulemaking and were not modified in that revision.

Oregon's "water and fish ingestion" criteria were established to limit the pollutant to levels that protect the safe consumption of drinking water and fish, including shellfish. These criteria are applied where Oregon has designated public or private domestic water supply, and fishing as beneficial uses. The "fish consumption only" criteria apply where Oregon has designated a fishing use but not a domestic or private water supply use.¹¹

Oregon's application of human health criteria is consistent with EPA's guidance to States and the methodology inherent in developing the criteria. EPA's *Water Quality Standards Handbook* recommends that States adopt human health criteria to protect waters designated for public water supply. In addition, for waters where fish ingestion is considered an important activity, EPA recommends that the criterion applicable to fish consumption be applied to protect the use.¹² Oregon's human health criteria are applied consistent with this recommendation.

EPA has published criteria development guidelines for protecting human health endpoints and separate criteria development guidelines for protecting aquatic life endpoints.

¹⁰ DEQ. 2004. TSD for Toxics Agenda Item B, Rule Adaptation: Water Quality Standards, Toxics Criteria. May 20-21, 2004 EQC Meeting. Attachment H. p. H-17 and 18

¹¹ DEQ. 2010b. Final Draft Human Health Criteria Issue Paper, December 29, 2010. p.10. Also described in DEQ. 2004. TSD for Toxics. Agenda Item B, Rule Adaptation: Water Quality Standards, Toxics Criteria. May 20-21, 2004 EQC Meeting. Attachment H. H-14, H-17.

¹² EPA. 1994. Water Quality Standards (WQS) Handbook: Second Edition. August 1994. United States Environmental Protection Agency, Office of Water. EPA-823-B-94-005a. p. 3-15. Available at <http://water.epa.gov/scitech/swguidance/standards/handbook/index.cfm>

Consistent with the science used to derive the criteria, EPA recommends that human health criteria be applied to uses where human health could be affected by exposure from consumption of aquatic life and that aquatic life criteria be applied to uses associated with the protection of aquatic life. Thus, most states, including Oregon, have adopted two sets of criteria for pollutants, one to address the effects to human health and the other to address the effects to aquatic life. For some pollutants, this results in a state having multiple criteria for a pollutant being applied to a single waterbody segment. Human health criteria are developed pursuant to methods presented in EPA's 2000 Human Health Methodology.¹³ These criteria take into consideration the cancer potency or systemic toxicity of a pollutant, the exposure related to surface water exposure and a risk characterization. The criteria generated pursuant to the Human Health Methodology protect humans from toxicological effects from chronic exposure to a pollutant through drinking water or from eating fish living in a water body to which the criteria apply.

EPA's guidelines for developing aquatic life criteria recommend that such criteria use toxicity information for aquatic life, establishing pollutant levels necessary for protection of aquatic life from both short and long term effects of the pollutant.¹⁴ Toxicity tests are used to evaluate pollutant effects on survival, growth and reproduction of aquatic organisms.

EPA has reviewed Oregon's new and revised human health criteria for iron and manganese, to assess whether they are sufficient to protect Oregon's designated uses from human health impacts associated with iron and manganese. Other endpoints, relating solely to other criteria that were not revised and submitted to EPA as a part of this action (e.g., toxicity to aquatic life), are not before the Agency for review under § 303(c)(3) of the CWA.

b. Withdrawal of Iron Human Health Criterion for Protection of Human Consumption of Water and Fish

Oregon's previous human health criterion for iron was based on EPA's recommended human health criterion as published in 1973¹⁵ and updated in 1976.¹⁶ The 1976 criterion was republished in 1986¹⁷ and continues to be included as a non-priority pollutant on

¹³ EPA. 2000. *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health*. EPA-822-B-00-004. Available at:

<http://www.epa.gov/waterscience/criteria/humanhealth/method/complete.pdf>

¹⁴ EPA. 1985. *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection Of Aquatic Organisms and Their Uses*. Available at:

<http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/upload/85guidelines.pdf>

¹⁵ EPA. 1973. U.S. EPA. 1973. *Water Quality Criteria (Blue Book)* 1972. EPA-R3-73-033. p. 69

¹⁶ EPA. 1976. *Quality Criteria for Water (Red Book)*. 1976. EPA 440-9-76-023, July, 1976. p.152

Available at

http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/upload/2009_01_13_criteria_redbook.pdf

¹⁷ EPA. 1986. *Quality Criteria for Water ("Gold Book")*. U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA 440/5-86-001. Available at

<http://www.epa.gov/waterscience/criteria/library/goldbook/pdf>

EPA's current table of National Recommended Water Quality Criteria.¹⁸ The criterion was developed based on data relating to effects on taste, staining of plumbing fixtures, spotting of laundered clothes and accumulation of deposits in distribution systems in public water supplies. Neither the 1973 nor the 1976 recommendations are based on data relating to toxic endpoints. The 1976 document states that the iron criterion "constitutes only a small fraction of the iron normally consumed and is of aesthetic rather than toxicological significance."

Prior to proposing this revision, Oregon reviewed EPA's criteria recommendations identified above, the secondary MCL (maximum contaminant level) for iron established under the Safe Drinking Water Act and information associated with recent revisions to the iron criterion in other states. Based on this review, Oregon withdrew its numeric iron criterion for the protection of human health, associated with the consumption of water and fish, because they found that the criterion was not based on human health effects and was not necessary to protect human health.

EPA's regulations at 40 CFR 131.11(b) provide that criteria may be either numeric or narrative. For non-priority pollutants such as iron, EPA recommends that, in evaluating whether chemical-specific numeric criteria are needed, States consider whether other approaches will ensure full protection of designated uses.¹⁹ Attachment D of Oregon's submittal documents Oregon's evaluation of readily available information relative to the potential effects of consuming iron in water and fish. A draft of this document was made available to the public during the public notice and comment period. Following consideration of all the information gathered during their review, including the public comment, the State decided to withdraw the numeric criterion and rely on their narrative criterion for protection of any aesthetic or organoleptic impacts to the water supply and fishing uses. If adverse human health effects are identified at a later date, Oregon may either address these through the narrative criterion or by adopting a new human health criterion for iron.

Oregon has a number of narrative criteria that may be applied to protect human health, the most relevant of which is promulgated at OAR 340-041-0033(1). While the application is not limited to addressing human health concerns, Oregon may use of this narrative on a case-by-case basis to address potential human health effects.

OAR 340-041-0033 (1) Toxic substances may not be introduced above natural background levels in waters of the state in amounts, concentrations, or combinations that may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life

¹⁸ EPA. 2009. National Recommended Water Quality Criteria. Available at <http://www.epa.gov/ost/criteria/wqctable/>

¹⁹ EPA. 1994. Water Quality Standards (WQS) Handbook: Second Edition. August 1994. United States Environmental Protection Agency, Office of Water. EPA-823-B-94-005a. p. 3-24. Available at <http://water.epa.gov/scitech/swguidance/standards/handbook/index.cfm>

or wildlife to levels that adversely affect public health, safety, or welfare or aquatic life, wildlife, or other designated beneficial uses.

Guidance for developing regulatory limits for pollutants for which numeric criteria are not contained in the WQS is provided in OAR 340-041-0033(1)(B)(3).

To establish permit or other regulatory limits for toxic substances for which criteria are not included in Tables 20, 33A or 33(B) the department may use the guidance values in Table 33C, public health advisories, and other published scientific literature. The department may also require or conduct bioassessment studies to monitor the toxicity to aquatic life of complex effluents, other suspected discharges, or chemical substances without numeric criteria.

When translating the narrative, DEQ may use numbers established outside of the Oregon WQS as guidance, use information contained in health advisories and/or use other published scientific literature. EPA maintains a publically accessible database where Oregon can find updated toxicological information for use when applying the narratives. If a problem is suspected, Oregon's narratives provide that they may require monitoring and other testing to provide a better understanding of the pollutant concentrations present and their potential affect on designated uses, thus allowing them to obtain the information necessary to address the problem.

EPA has evaluated whether it is reasonable for Oregon to interpret and use the narrative criterion, as opposed to a numeric criterion, on a case-by-case basis where there is a need to address human health impacts from iron in surface waters of the State of Oregon as needed to protect the water supply and fishing uses. While Oregon notes that iron occurs naturally in many waters of the State at or above the previous criterion value, there is no indication that iron poses a widespread water quality problem leading to adverse human health effects. EPA has reviewed all data for dissolved iron collected between January 1, 2000 and December 31, 2010 that had been entered into Oregon DEQ's LASAR database²⁰ and the USGS water quality database²¹ as of February 14, 2011. (EPA also reviewed data entered into the EPA STORET database²² but found that all data was for total iron, not dissolved iron and thus could not be directly compared to Oregon's previous criterion.) Less than two percent of the samples recorded (41 of the 2256 entries in LASAR and five of 419 entries in the USGS database) exceeded Oregon's previous criterion of 300 ug/L. These samples were collected from six waterbodies in the state and resulted in ten 303(d) listings (based on DEQ's 2010 Listing Methodology²³). Data

²⁰ ODEQ, LASAR. Laboratory Analytical Storage and Retrieval (LASAR) database. Oregon DEQ. 1/1/2000-12/31/2010. February 14, 2011. <http://deq12.deq.state.or.us/lasar2/>

²¹ USGS Database. National Water Information System (NWIS). Department of the Interior. U.S. Geological Survey. 1/1/2000-12/31/2010. February 14, 2011. <http://waterdata.usgs.gov/nwis/>

²² EPA, STORET database. Storage and Retrieval Data Warehouse (STORET). Environmental Protection Agency. Office of Water. 1/1/2000-12/31/2010. February 14, 2011. <http://www.epa.gov/storet/>

²³ Oregon Department of Environmental Quality, May 2011, Methodology for Oregon's 2010 Water Quality Report and List of Water Quality Limited Waters. 5/12/2011. Pursuant to Clean Water Act Sections 303(d) and 305 (b) and OAR 340-041-0046)

at only three sites indicate dissolved iron at levels above 1000 ug/L. EPA's *Red Book*²⁴ indicates the daily nutritional requirement for iron is 1000 to 2000 ug/L but that much larger quantities are required as a result of poor absorption. Thus, since almost all sampling data for iron indicate levels of iron far below the daily minimum intake value, there should be minimal instances where levels are elevated such that they would cause human health concerns. Thus, the situations where Oregon may need to apply its narrative criterion to protect against human health impacts from dissolved iron would be extremely limited.

In many circumstances, narrative criteria can be an effective tool for protecting designated uses, particularly when the scope and nature of the environmental problem is easily and clearly defined and derivation of appropriate control measures can be effectively and expeditiously accomplished. In the case of iron, the secondary MCL of 50 ug/L is a readily available value that may be used by DEQ to control impacts from iron. In addition, as discussed above, the potential scope of application in this case is likely very limited. Based on this information, EPA finds it reasonable for Oregon to utilize its narrative criterion on a case-by-case basis to address human health effects from iron in State waters, should it need to do so.

Because iron is a non-priority pollutant, the issue for EPA's review on the criterion withdrawal is whether Oregon's existing narrative criterion (OAR 340-041-0033(1)) is sufficient to protect Oregon's designated uses, with respect to the human health endpoints that the withdrawn numeric "water and fish" human health criterion previously protected. For the reasons stated above, EPA concludes that Oregon's narrative criterion is sufficient to protect Oregon's designated uses from the potential human health impacts of iron relating to the consumption of drinking water and fish.

Based on the above evaluation of human health protectiveness, EPA approves the withdrawal of Oregon's previously adopted numeric iron criterion for protection of human consumption of water and fish, consistent with 40 C.F.R. 131.11(a)(1).

Although EPA's § 303(c) CWA analysis is based on the protection of human health uses, EPA acknowledges that EPA's recommended criteria were developed using data based on organoleptic effects. To the extent that concerns arise over the protection of these aesthetic effects, Oregon has a number of narrative criteria that can be used to address these concerns including OAR 340-041-0007 (11) and (14); OAR 340-041-0007 (1); and OAR 340-041-0033(1).

c. Withdrawal of the Manganese Human Health Criterion for Protection of Human Consumption of Water and Fish

Oregon's previous human health criterion for manganese in water (addressing human consumption of water and fish) was based on EPA's recommended human health

²⁴ EPA. 1976. Quality Criteria for Water (Red Book). 1976. EPA 440-9-76-023, July, 1976. Available at http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/upload/2009_01_13_criteria_redbook.pdf

criterion as published in 1973²⁵ and updated in 1976.²⁶ The 1976 criterion was republished in 1986²⁷ and continues to be included as a non-priority pollutant on EPA's current table of National Recommended Water Quality Criteria.²⁸ A footnote to EPA's recommended "water + organism" human health criterion for manganese states that "the criterion is not based on toxic effects, but rather is intended to minimize objectionable qualities such as laundry stains and objectionable tastes in beverages." This same information is also provided in EPA's criteria document (EPA, 1976).

Prior to proposing this revision, Oregon reviewed EPA's criteria recommendations identified above, the secondary MCL for manganese established under the Safe Drinking Water Act, scientific information provided in a World Health Organization document and information associated with recent revisions to the manganese criterion in the state of Missouri. Based on this review, Oregon withdrew its manganese criterion for protection of human health, associated with the consumption of water and fish, because the EPA recommended criterion was not based on human health effects and thus they believed it was not necessary to protect designated uses from potential human health impacts of manganese related to the consumption of drinking water and fish.

EPA's regulations at 40 CFR 131.11(b) provide that criteria may be either numeric or narrative. For non-priority pollutants such as manganese, EPA recommends that, in evaluating whether chemical-specific numeric criteria are needed, States consider whether other approaches will ensure full protection of designated uses.²⁹ Attachment D of Oregon's submittal documents Oregon's evaluation of readily available information relative to the potential health effects of consuming manganese in water and fish. A draft of this document was made available to the public during the public notice and comment period. Following consideration of all the information gathered during their review, including the public comment, the State decided to withdraw the numeric criterion. If adverse human health effects are identified at a later date, Oregon may either address these through a narrative criterion or by adopting a new human health criterion for manganese.

Oregon has a number of narrative criteria that may be applied to protect human health, the most relevant of which is promulgated at OAR 340-041-0033(1). While the application is not limited to addressing human health concerns, Oregon may use of this narrative on a case-by-case basis to address potential human health effects.

²⁵ EPA. 1973. EPA. 1973. U.S. EPA.1973.Water Quality Criteria (Blue Book) 1972. EPA-R3-73-033.

²⁶ EPA. 1976. Quality Criteria for Water (Red Book). 1976. EPA 440-9-76-023, July, 1976. Available at http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/upload/2009_01_13_criteria_redbook.pdf

²⁷ EPA. 1986. Quality Criteria for Water ("Gold Book"). U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA 440/5-86-001. Available at <http://www.epa.gov/waterscience/criteria/library/goldbook/pdf>

²⁸ EPA. 2009. National Recommended Water Quality Criteria. Available at <http://www.epa.gov/ost/criteria/wqctable/>

²⁹ EPA. 1994. Water Quality Standards (WQS) Handbook: Second Edition. August 1994. United States Environmental Protection Agency, Office of Water. EPA-823-B-94-005a. p. 3-24. Available at <http://water.epa.gov/scitech/swguidance/standards/handbook/index.cfm>

Guidance for developing regulatory limits for pollutants for which numeric criteria are not contained in the WQS is provided in OAR 340-041-0033(1)(B)(3) (provided above). DEQ may use numbers established outside of the Oregon WQS as guidance, use information contained in health advisories and/or use other published scientific literature. EPA maintains a publically-accessible database (IRIS)³⁰ where Oregon can find updated toxicological information for use when applying the narratives. If a problem is suspected, Oregon may also require monitoring and other testing to provide a better understanding of the pollutant concentrations present and their potential effect on designated uses, thus allowing them to obtain the information necessary to address the problem.

For manganese, this provision would allow DEQ to evaluate new toxicological data as it becomes available and use it, where appropriate, in making water quality management decisions. EPA's IRIS database provides some guidance for assessing exposure to manganese present in drinking water. While this information identifies several studies that raise "some concern for possible adverse health effects associated with a lifetime consumption of water containing about 2 mg/L of manganese" and "some evidence" related to potential effects due to exposure to manganese in infant formula, EPA's analysis stops short of recommending a quantitative limitation on manganese but rather "warrant[s] caution until more definitive data are available." Furthermore, Oregon may use information contained in EPA's health advisory³¹ for manganese when interpreting the narrative criterion. Since manganese is a non-priority pollutant, the State has the discretion whether to utilize this information to develop a numeric criterion or for use in interpreting its narrative criterion. In this case, Oregon has chosen to rely on its narrative criterion.

EPA has evaluated whether it is reasonable for Oregon to interpret and use the narrative criterion, as opposed to a numeric criteria, on a case-by-case basis where there is a need to address human health impacts from manganese in surface waters of the State of Oregon as needed to protect the water supply and fishing uses. While Oregon notes that manganese occurs naturally in many waters of the State at or above the previous criterion value, there is no indication that manganese poses a widespread water quality problem leading to adverse human health effects. EPA has reviewed all data for dissolved manganese collected between January 1, 2000 and December 31, 2010 that had been entered into Oregon DEQ's LASAR database and the USGS water quality database as of February 14, 2011. (EPA also reviewed data entered into the EPA STORET database but found that all data was for total manganese, not dissolved manganese and thus could not be directly compared to Oregon's previous criterion.) While approximately 15% of the measurements for dissolved manganese exceeded Oregon's previous criterion of 50 ug/L (215 of the 1856 entries in LASAR and 138 of 399 entries in the USGS database), the 353 samples that exceeded the previous criterion were taken from only 26 sites, several of which occurred on the same waterbody (e.g. the 138 exceedences reported in the USGS database came from a total of five sites, located on three waterbodies in the same

³⁰ EPA. Integrated Risk Information System (IRIS). Available at: www.epa.gov/iris.

³¹ EPA. 2004. Drinking Water Health Advisory for Manganese. Available at: http://water.epa.gov/action/advisories/drinking/upload/2004_02_03_support_cc1_magnese_dwreport.pdf

watershed). Thus, the data suggests that elevated manganese may be limited in geographic scope.

EPA reviewed the limited BCF data for manganese available in IRIS³² relative to freshwater species. The only data available was for trout and indicated a BCF of 17.8 L/kg. Using this value in EPA's recommended equation for development of human health criteria would result in a value of 136 ug/L³³. However, only nine measurements recorded in the LASAR database and 8 in the USGS database (all but two from the same sampling site) exceed this value. Thus limiting the situations where Oregon may need to apply its narrative criteria to protect against human health impacts from dissolved manganese.

In many circumstances, narrative criteria can be an effective tool for protecting designated uses, particularly when the scope and nature of the environmental problem is easily and clearly defined and derivation of appropriate control measures can be effectively and expeditiously accomplished. In the case of manganese, some limited BCF data are readily available from EPA's IRIS database and could be readily applied to develop a reasonable value to use in controlling impacts associated with manganese. Information contained in EPA's health advisory for manganese and the secondary MCL of 50 ug/L is also available and may be used by DEQ. As discussed above, the potential scope of application in this case is fairly limited. Based on this information, EPA finds it reasonable for Oregon to utilize its narrative criterion on a case-by-case basis to address human health effects from manganese in State waters, should it need to do so.

Because manganese is a non-priority pollutant, the issue for EPA's review on the criterion withdrawal is whether Oregon's existing narrative criterion (OAR 340-041-0033(1)) is sufficient to protect Oregon's designated uses, with respect to the human health endpoints that the withdrawn numeric "water and fish" human health criterion previously protected. For the reasons stated above, EPA concludes that Oregon's narrative criterion is sufficient to protect Oregon's designated uses from the potential human health impacts of manganese relating to the consumption of drinking water and fish.

Based on the above evaluation of human health protectiveness, EPA approves the withdrawal of Oregon's previously adopted numeric manganese criterion for protection of human consumption of water and fish, consistent with 40 C.F.R. 131.11(a)(1).

Although EPA's § 303(c) CWA analysis is based on the protection of human health uses, EPA acknowledges that EPA's recommended criteria were developed using data based on organoleptic effects. To the extent that concerns arise over the protection of these aesthetic effects, Oregon has a number of narrative criteria that can be used to address these concerns including OAR 340-041-0007 (11) and (14); OAR 340-041-0007 (1); and OAR 340-041-0033(1).

³² EPA. Integrated Risk Information System (IRIS). Available at: www.epa.gov/iris.

³³ This value was calculated using a fish consumption rate of 175 grams per day, based on EQC's October 2008 directive and proposed revisions by DEQ.

d. Withdrawal of the Manganese Human Health Criterion for Protection of Human Consumption of Fish as it Applies to Freshwaters

Oregon's previous human health criterion for manganese in water (addressing human consumption of fish) was based on EPA's recommended human health criterion as published in 1976³⁴ and republished in 1986.³⁵ This recommendation continues to be included as a non-priority pollutant on EPA's current table of National Recommended Water Quality Criteria.³⁶

EPA's *Quality Criteria for Water* (1976, 1986) identifies that the "major problem with manganese may be concentration in the edible portions of mollusks." "In order to protect against a possible health hazard to humans by manganese accumulation in shellfish, a criterion of 100 µg/L is recommended for marine water."³⁷ The document does not discuss the need for a similar criterion for protection from potential human health effects from consuming freshwater organisms. However, a review of bioconcentration data for manganese contained in Ecotox³⁸ indicates that limited data are now available for freshwater organisms and suggests that bioconcentration rates in freshwater trout are substantially less than that experienced in saltwater mussels.³⁹

Prior to proposing to remove this criterion for fresh waters, Oregon reviewed the same information as the manganese evaluation for water and fish, described in the previous subsection. Based on this review and in consideration of comments received on its proposal, Oregon withdrew its manganese criterion for the protection of human health, associated with the consumption of fish from fresh waters in Oregon, because they found that no information was contained in EPA's "fish only" manganese criteria documents relating to the toxicity of freshwater species. Oregon concluded that a numeric "fish only" human health criterion for manganese was not necessary to protect humans from adverse health effects from manganese when eating fish from Oregon's freshwaters.

EPA's regulations at 40 CFR 131.11(b) provide that criteria may be either numeric or narrative. For non priority pollutants such as manganese, EPA recommends that, in evaluating whether chemical-specific numeric criteria are needed, States consider

³⁴ EPA. 1976. *Quality Criteria for Water* (Red Book). 1976. EPA 440-9-76-023, July, 1976. Available at http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/upload/2009_01_13_criteria_redbook.pdf

³⁵ EPA. EPA. 1986. *Quality Criteria for Water* ("Gold Book"). U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA 440/5-86-001. Available at <http://www.epa.gov/waterscience/criteria/library/goldbook/pdf>

³⁶ EPA. 2009. *National Recommended Water Quality Criteria*. Available at <http://www.epa.gov/ost/criteria/wqctable/>

³⁷ EPA. 1986. *Quality Criteria for Water* ("Gold Book"). U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA 440/5-86-001. Available at <http://www.epa.gov/waterscience/criteria/library/goldbook/pdf>

³⁸ EPA. Ecotox database. Available at: http://cfpub.epa.gov/ecotox/quick_query.htm

³⁹ BCF data, E-mail, from Heidi Bethel to Lisa Macchio on 3/06/2011. Includes evaluation of water organism criteria and organism criteria for Oregon with conclusions.

whether other approaches will ensure full protection of designated uses.⁴⁰ Attachment D of Oregon's submittal, documents Oregon's evaluation of readily available information relative to the potential effects of consuming manganese in fish caught in State waters. A draft of this document was made available to the public during the public notice and comment period. Following consideration of all the information gathered during their review, including the public comment, the State decided to withdraw the numeric criterion for freshwaters and retain the current criterion for saltwater.

Oregon has a number of narrative criteria that may be applied to protect human health, the most relevant of which is promulgated at OAR 340-041-0033(1). While the application is not limited to addressing human health concerns, Oregon may use of this narrative on a case-by-case basis to address potential human health effects.

EPA has evaluated whether it is reasonable for Oregon to interpret and use the narrative criterion, as opposed to a numeric criterion, on a case-by-case basis where there is a need to address human health impacts from manganese in surface waters of the State of Oregon as needed to protect the fishing uses. While Oregon notes that manganese occurs naturally in many waters of the State at or above the previous criterion value, there is no indication that manganese poses a widespread water quality problem leading to adverse human health effects. EPA has reviewed all data for dissolved manganese collected between January 1, 2000 and December 31, 2010 that had been entered into Oregon DEQ's LASAR database and the USGS water quality database as of February 14, 2011. (EPA also reviewed data entered into the EPA STORET database but found that all data was for total manganese, not dissolved manganese and thus could not be directly compared to Oregon's previous criterion.) Approximately 1.7% of the measurements for dissolved manganese exceeded Oregon's previous criterion of 100 ug/L (eight of the 1856 entries in LASAR and 30 of 399 entries in the USGS database). These samples were taken from eight streams within Oregon and thus are limited in geographic scope.

EPA reviewed the limited BCF data for manganese available in IRIS⁴¹ relative to freshwater species. The only data available was for trout and indicated a BCF of 17.8 L/kg. Using this value in EPA's recommended equation for development of human health criteria, would result in a value of 629 ug/L⁴². However, only one measurement found in these databases exceeded 629 ug/L. Thus this would limit the situations where Oregon may need to apply its narrative criteria to freshwaters to address human health concerns from manganese.

In many circumstances, narrative criteria can be an effective tool for protecting designated uses, particularly when the scope and nature of the environmental problem is easily and clearly defined and derivation of appropriate control measures can be

⁴⁰ EPA. 1994. Water Quality Standards (WQS) Handbook: Second Edition. August 1994. United States Environmental Protection Agency, Office of Water. EPA-823-B-94-005a. p. 3-24. Available at <http://water.epa.gov/scitech/swguidance/standards/handbook/index.cfm>

⁴¹ EPA. Integrated Risk Information System (IRIS). Available at: www.epa.gov/iris.

⁴² This value was calculated using a fish consumption rate of 175 grams per day, based on EQC's October 2008 directive and proposed revisions by DEQ.

effectively and expeditiously accomplished. In the case of manganese, some limited BCF data are readily available from EPA's IRIS database and could be readily applied to develop a reasonable value to use in controlling impacts associated with manganese. In addition, the secondary MCL of 50 ug/L is also available and may be used by DEQ. As discussed above, the potential scope of application in this case is fairly limited. Based on this information, EPA finds it reasonable for Oregon to utilize its narrative criterion on a case-by-case basis to address human health effects from manganese in freshwaters in Oregon, should it need to do so.

Because manganese is a non-priority pollutant, the issue for EPA's review on the criterion withdrawal is whether Oregon's remaining narrative criterion is sufficient to protect Oregon's designated uses, with respect to the human health endpoints that the withdrawn numeric human health criterion previously protected. For the reasons stated above, EPA concludes that Oregon's narrative criterion is sufficient to protect Oregon's designated uses from the potential human health impacts of manganese relating to the consumption of fish.

Based on the above evaluation of human health protectiveness, EPA approves the withdrawal of Oregon's previously adopted numeric manganese criterion for protection of human consumption of fish, consistent with 40 C.F.R. 131.11(a)(1).

e. Manganese Human Health Criterion for Protection of Human Consumption of Fish as it Applies to Saltwaters

Oregon did not revise the manganese criterion for protection of human consumption of fish applicable to saltwater. The criterion was 100 µg/L and applied to both saltwater and freshwater. The "*fish consumption only*" manganese criterion of 100 µg/L still applies to saltwater. Oregon did not revise this criterion and EPA has previously approved it, therefore EPA review under 303(c)(2)(A) of the Clean Water Act is not required. EPA is taking no action with respect to this existing criterion.

f. Revised Footnote Associated with the Manganese Human Health Criterion for Protection of Human Consumption of Fish (Footnote 1 to Table 20)

Oregon revised the footnote associated with the manganese human health criterion for protection of human consumption of fish to specify that the criterion applied only to saltwater and to total manganese. The previous footnote specified that the criterion would apply to dissolved manganese. Because both of these components of the footnote directly affect how the criterion is applied with respect to both location and form, EPA considers the revised footnote to be a revised WQS requiring action under CWA § 303(c).

The first element of the footnote specifies that the criterion only applies to saltwater. As noted above, Oregon withdrew this criterion for freshwaters while retaining their current criterion for saltwater. This footnote documents that withdrawal of the criterion for freshwaters, as discussed above.

The second element of the footnote specifies that the criterion is to be applied to the total, as opposed to the dissolved or soluble, form of manganese. As stated in EPA's *Technical Support Document for Action on the State of Oregon's New and Revised Human Health Water Quality Criteria for Toxics and Revisions to Narrative Toxics Provisions Submitted on July 8, 2004* (June 1, 2010), the human health criterion for protection of human consumption of fish (referred to as the 'organism only' human health criterion for manganese in the June 1, 2010 action) is based on human health toxicity endpoints related to the consumption of marine mollusks.⁴³ EPA's 1972 "Blue Book" specifies that the "water + organism" criteria for manganese are for the "soluble" (i.e., dissolved) form of the metal, while the "organism only" criterion for manganese is for total manganese.⁴⁴ EPA's policy is to express metals criteria in the dissolved form only for aquatic life criteria where a total-to-dissolved translator is available.⁴⁵ In the case of manganese, neither of these conditions apply therefore Oregon's application of this criterion to total manganese is consistent with EPA's recommendations and ensures that the criterion is sufficient to protect human health through the consumption of fish from saltwater.

Based on the above evaluation, EPA hereby approves Oregon's footnote associated with the manganese criterion for protection of human consumption of fish. This revision is consistent with the federal requirements contained at 40 C.F.R. 131.11(a)(1) which requires States to adopt criteria that protect the designated use and contain sufficient parameters or constituents to protect the designated use.

g. Response to EPA's June 1, 2010 Disapproval of Footnote K

On June 1, 2010, EPA disapproved footnote K to Table 20 insofar as it applies to the "organism only" human health criterion for manganese.⁴⁶ The basis for EPA's disapproval of footnote K was that expressing the metals criteria for organism only should not be in the dissolved form but rather in the total form and that Oregon had not provided information that expressing it as dissolved is protective of Oregon's uses.

As part of the revisions submitted on January 18, 2011, Oregon revised the footnote associated with the human health criterion for protection of human consumption of fish (referred to as the 'organism only' human health criterion for manganese in the June 1, 2010 action) to specify that the criterion applied to total manganese. This change addresses the deficiency identified in the June 1, 2010 disapproval action relative to this

⁴³ U.S. EPA Region 10. U.S. EPA Region 10. June 1, 2010. Technical Support Document for Action on the State of Oregon's New and Revised Human Health Water Quality Criteria for Toxics and Revisions to Narrative Toxics Provisions Submitted on July 8, 2004.

⁴⁴ EPA. 1973. U.S. EPA. 1973. Water Quality Criteria (Blue Book) 1972. EPA-R3-73-033. p. 71

⁴⁵ USEPA. October 1, 1993. Memorandum from Martha G. Prothro, Acting Assistant Administrator for Water, to Water Management Division Directors and Environmental Services Division Directors, Regions I-X. Re: Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria.

⁴⁶ U.S. EPA. Region 10. U.S. EPA Region 10. June 1, 2010. Technical Support Document for Action on the State of Oregon's New and Revised Human Health Water Quality Criteria for Toxics and Revisions to Narrative Toxics Provisions Submitted on July 8, 2004.

footnote. Therefore, both EPA and DEQ have completed their CWA obligations stemming from EPA's June 1, 2010 disapproval action regarding this footnote.

