Houston Ship Channel: A TMDL Project for Nickel

Fourteen Total Maximum Daily Loads for Nickel in the Houston Ship Channel System
Adopted June 14, 2002
Approved by EPA May 9, 2003

Fourteen TMDLs Withdrawn by This Addendum
Via the October 2020 Update to the Texas Water Quality Management Plan.
Approved by EPA March 8, 2021 (scroll to view or print this addendum)

Withdrawal of Fourteen TMDLs for Nickel in the Houston Ship Channel

Segments 1001, 1005, 1006, 1007, 1013, 1014, 1016, 1017, 2426, 2427, 2428, 2429, 2430, and 2436

Introduction

On August 16, 2000, the Texas Natural Resource Conservation Commission (TNRCC), predecessor agency of the Texas Commission on Environmental Quality (TCEQ), adopted *Fourteen Total Maximum Daily Loads for Nickel in the Houston Ship Channel* (TNRCC 2000). In response to comments received from the U.S. Environmental Protection Agency (EPA) the total maximum daily loads (TMDLs) were revised and re-adopted by the TNRCC on June 28, 2002. The TMDLs were approved by the EPA on May 9, 2003.

This state Water Quality Management Plan update proposes to withdraw the *Fourteen Total Maximum Daily Loads for Nickel in the Houston Ship Channel*. Segments 1005 and 1006 were listed as impaired for nickel in 1996. The other 12 segments were included in the TMDL document because they were considered part of the Houston Ship Channel (HSC) System. Reevaluation of the underlying data determined the designation of the HSC System as impaired for nickel was an artifact of random contamination that occurred during the sample collection process prior to 1993. The sample collection process was revised to correct the sampling problem and post-1993 data is considered reliable. Analysis of past and present water quality data demonstrates that the water bodies were incorrectly placed on the State of Texas 303(d) List. Subsequent information also indicates that the HSC is meeting water quality standards or there are no concerns for nickel. Therefore, based on the reevaluation and analysis of data, the TMDLs are not necessary.

Water Bodies

As shown in Figure 1, the watershed spans 1,186 square miles of industrial area in the City of Houston and Harris County that includes Buffalo Bayou from downtown Houston to its confluence with the San Jacinto River (SJR) and the SJR from below Lake Houston to Galveston Bay and adjacent bays.

Problem Definition

Prior to 1993, there were concerns over apparent high dissolved nickel concentrations in the HSC. However, by 1993, those sample results were suspected to be an artifact of random contamination that occurred during the sample collection process prior to 1993.

The sample collection process was revised to correct the sampling problem and post-1993 data is considered reliable. HSC Segments 1005 (HSC/SJR Tidal) and 1006 (HSC Tidal) were listed as impaired in 1996, but the listing also cautioned the data could be misleading.

Prior to 1993, the approved procedure for sampling metals in water (including nickel) allowed one person to both handle the sample container and to collect the sample itself. Sometimes this procedure contaminated samples, creating the appearance of an impairment. When the potential for sample contamination was discovered, all pre-1993 metals data were invalidated. However, due to the absence of reliable data to assess and determine whether there was an actual impairment, the TMDLs were written as a precaution. The TMDLs clearly state the impairments might be an artifact of random contamination that occurred during the sample collection process prior to 1993, and the corresponding Implementation Plan (I-Plan) (TNRCC 2001) specified a later reevaluation of the TMDLs. Since then, TCEQ has implemented, and uses, a new sampling method, which requires a two-person team to collect the samples, solving the sample contamination problem and providing reliable data.

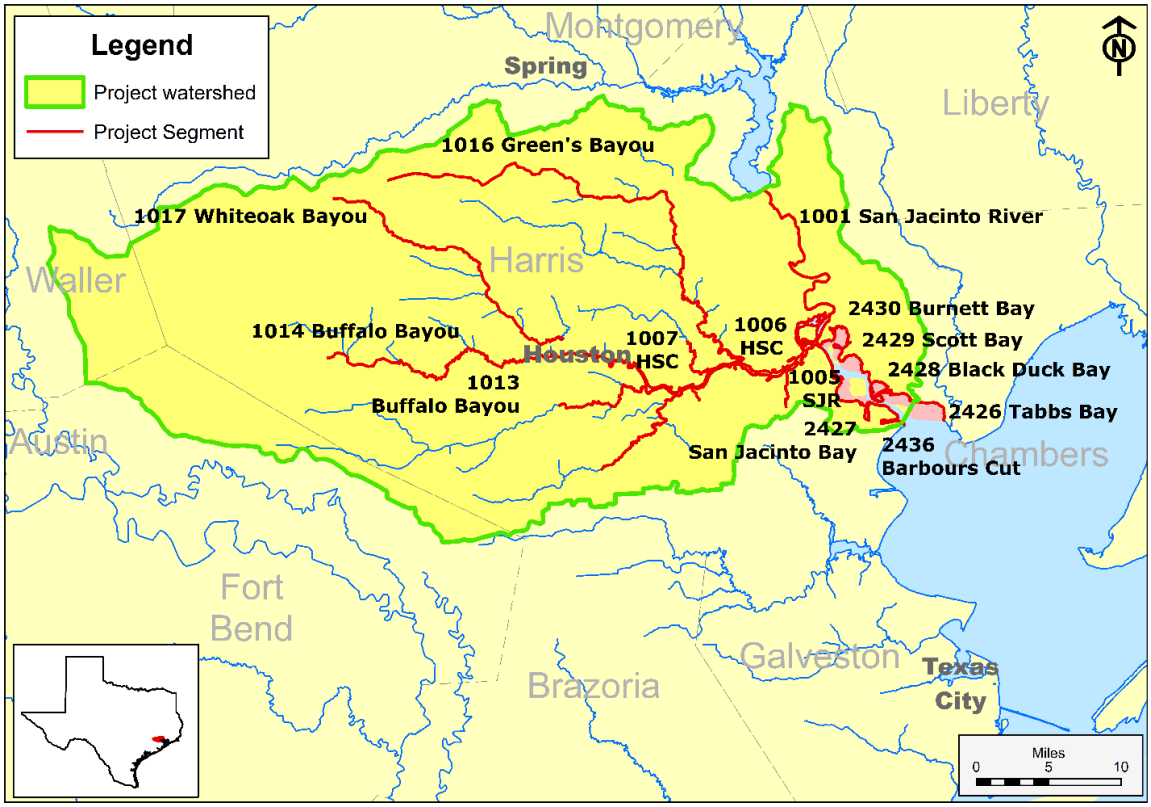

Figure 1. HSC Watershed and Segments

Permitting

TCEQ implements the Texas Pollutant Discharge Elimination System (TPDES) Program to control discharges of pollutants to surface waters. TCEQ staff evaluate available information and determine appropriate uses and criteria for each permit action for discharge into surface water in the state. New permit applications, permit renewals, and permit amendments are reviewed to ensure that permitted effluent limits will maintain instream criteria.

Limitations

The I-Plan (TNRCC 2001) based upon these TMDLs specifies that when the sum of the permitted nickel load from point sources reaches a reopener limit, these TMDLs must be revised as appropriate. Since the sum of allocated nickel loads is approaching the reopener limit, and almost all facilities are presumed to discharge traces of nickel, this limitation affects most new and many amended municipal and industrial permits.

TMDL Reevaluation

Development of the TMDLs was a precautionary response taken in the absence of reliable data; therefore, when the TMDL document (TNRCC 2000) was written, it included the following caveat and stated that the impairment might not exist:

> … clean methods for sampling and analyses have alleviated the initial concern, and verified that the pre-1993 data are unsuitable for determining attainment. … criteria are being met in the HSC system … there is significant doubt that any exceedances ever truly existed.

The TMDLs were modeled using QUAL-TX and TEXTOX and used conservative methods to estimate discharges, assumed discharges from every facility that might possibly discharge nickel, set the TMDLs to a fraction of the modeled capacity, and set a reopener limit. The reopener limit is a screening level to revise the TMDLs and is the sum of wasteload allocation (WLA) and allowance for future growth (AFG) for both permitted nickel discharges and other facilities presumed to discharge traces of nickel. The AFG was taken from the unallocated loading capacity but represents only a small part of it. The reopener limit is currently set at 147.9374 pounds/day.

However, the water quality standards and criteria for dissolved nickel can be maintained even if permitted loading exceeds the reopener limit, because of the large margin of safety implicitly embodied in the allocation via unallocated loading capacity and conservative analytical methods. In fact, as stated in the TMDL document, “the unallocated loading capacity is much greater than the total load allocated in this TMDL report.”

The results of this reevaluation are summarized below.

Water Quality

The State of Texas 1996 303(d) List, based in part on the suspect pre-1993 data, identified two segments, Segments 1005 and 1006, as impaired for nickel, but cautioned the data might be misleading, so these segments were not carried forward to subsequent 303(d) lists. After discarding the invalid pre-1993 data, there was insufficient valid data to reassess the segments. TCEQ uses a seven to ten-year data period for assessment; therefore, the segments could not be reassessed until 2002. In 2002, using data solely obtained with the revised sampling procedure, the segments were assessed as fully supporting. In all nine assessments subsequent to 2002, the segments have been assessed as fully supporting or no concern for nickel, as shown in Table 1.

Data Collection/Analysis

Figure 2 shows all nickel observations from 1973 thru 2018 for all monitoring stations in the HSC. Note the 10 × scale reduction from the upper panel to the lower panel. The large number of "×"s shown in the upper panel represent the invalid data that led to the concern about dissolved nickel concentrations in the HSC System. The dots ("●") shown in the lower panel are subsequent observations after the sample collection problem was resolved. The large number of "o"s shown in the lower panel are observations where the nickel concentration was too small to quantify. Overall, this figure suggests that most pre-1993 observations were invalid, and that all post-1993 observations are below the standard.

As shown in Figure 3, nickel concentrations were frequently too small to quantify and nickel has only been detected several times in samples during the most recent assessment period, December 1, 2011 through November 30, 2018. Since every sample was below the chronic criterion for nickel in saltwater, 13.1 micrograms per liter (µg/L) (TCEQ 2014), this data shows these water bodies are not currently impaired. The flat trend also suggests the water bodies were not previously impaired.

Control Measure

The control measure already taken is wasteload reduction regulated by the TPDES permitting process. All new permit applications, amendments, and permit renewals are closely examined to ensure discharge of the maximum permitted load will not cause an impairment. Because the TPDES renewal cycle is typically five years, all permits have been reviewed at least once since the I-Plan was approved in 2001. In addition, TPDES permit amendments or new permits that allow increased pollutant loading are subject to review under the antidegradation policy in the Texas Surface Water Quality Standards (30 Texas Administrative Code (TAC) Chapter 307). A description of the TPDES screening procedures for nickel is described below.

Table 1. Houston Ship Channel Nickel Assessments, 1996 – 2020

Source: TCEQ 1996-2020. Texas Integrated Report.

Water Body		Assessment											
		Invalid Data	Insufficient Data		Valid Data										
Segment [1]	Description	1996	1998	2000	2002 [2]	2004 [2]	2006 [3]	2008 [3]	2010 [3]	2012 [3]	2014 [3]	2016 [3]	2018 [3]	2020 [3]
1001	San Jacinto River Tidal				FS	FS	FS	FS	FS	FS	FS	FS		
1005	Houston Ship Channel/ San Jacinto River Tidal	NS [4]					NC			NC	NC			
1006	Houston Ship Channel Tidal	NS [4]			FS	FS	FS	FS	FS	FS	FS	FS	NC	FS
1007	Houston Ship Channel/ Buffalo Bayou Tidal				FS	FS	FS	FS	FS	FS	FS	FS	FS	NC
1016	Greens Bayou Above Tidal				NC	NC	NC	NC						
1017	Whiteoak Bayou Above Tidal				FS	FS								

NS = Non-Supporting FS = Fully Supporting NC = No Concern [5] (Blank) = Not Assessed [6]

[1] Segments 1013, 1014, 2426, 2427, 2428, 2429, 2430, and 2436 were not assessed, but are part of the HSC System.
[2] Chronic Metals in Water
[3] Chronic Toxic Substances in water - Nickel
[4] Assessed as Non-Supporting, but data qualified as misleading
[5] Limited Data
[6] Insufficient Data

Routine TPDES screening procedures for nickel start with the calculation of WLAs using effluent percentages (acute and chronic) for the discharge and numeric criteria (acute and chronic) for nickel. Effluent percentages can either be default percentages specified based on water body type and characteristics or developed from highly site-specific mixing analyses using modeling. Numeric nickel criteria are contained in the Texas Surface Water Quality Standards (30 TAC Chapter 307). The WLA is the end-of-pipe effluent concentration that can be discharged when, after mixing in the receiving stream, the instream numerical criteria will not be exceeded.

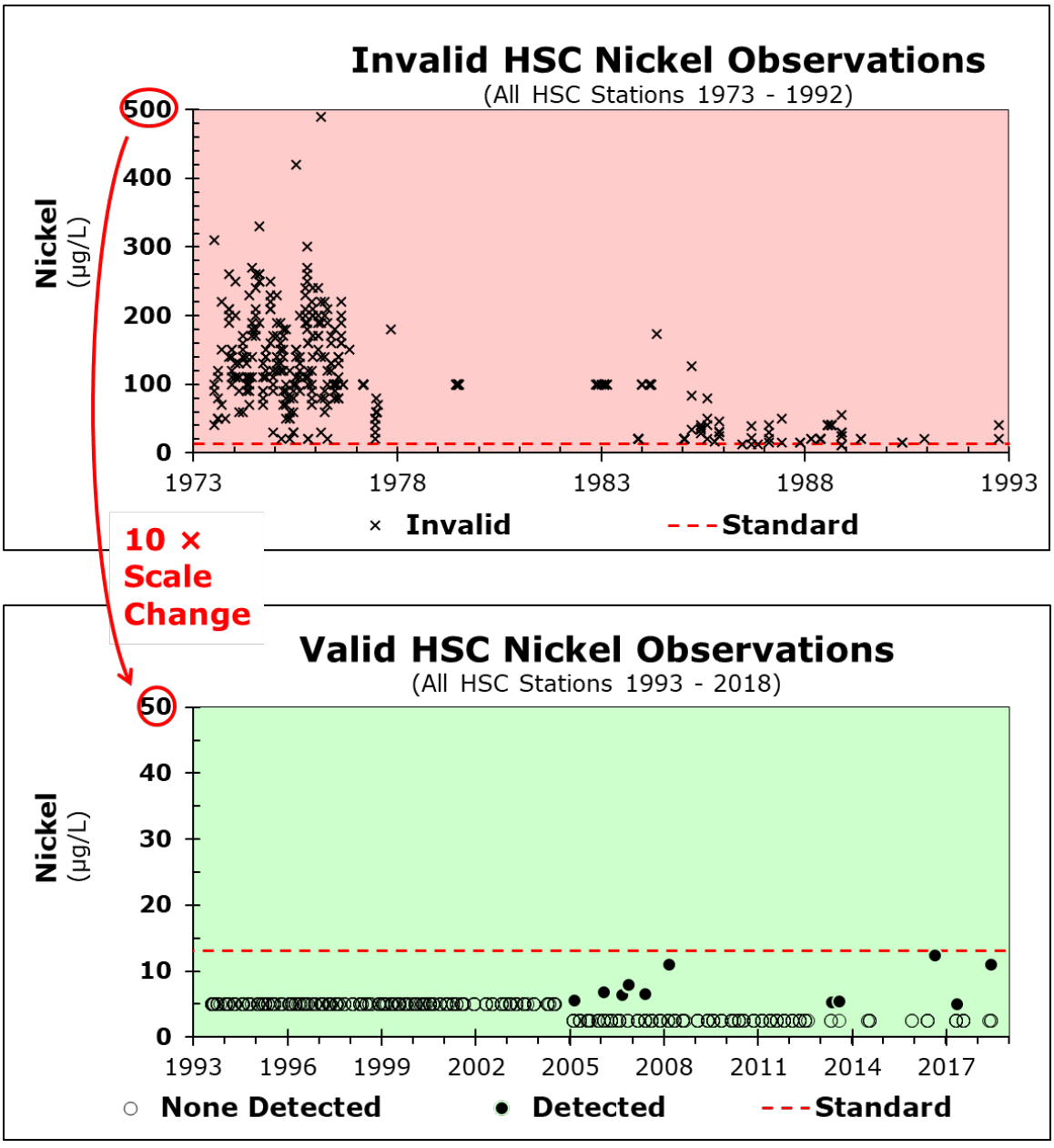

Figure 2. Observed Nickel Concentrations: 1973-1992 Invalid. 1993-2018 Valid.

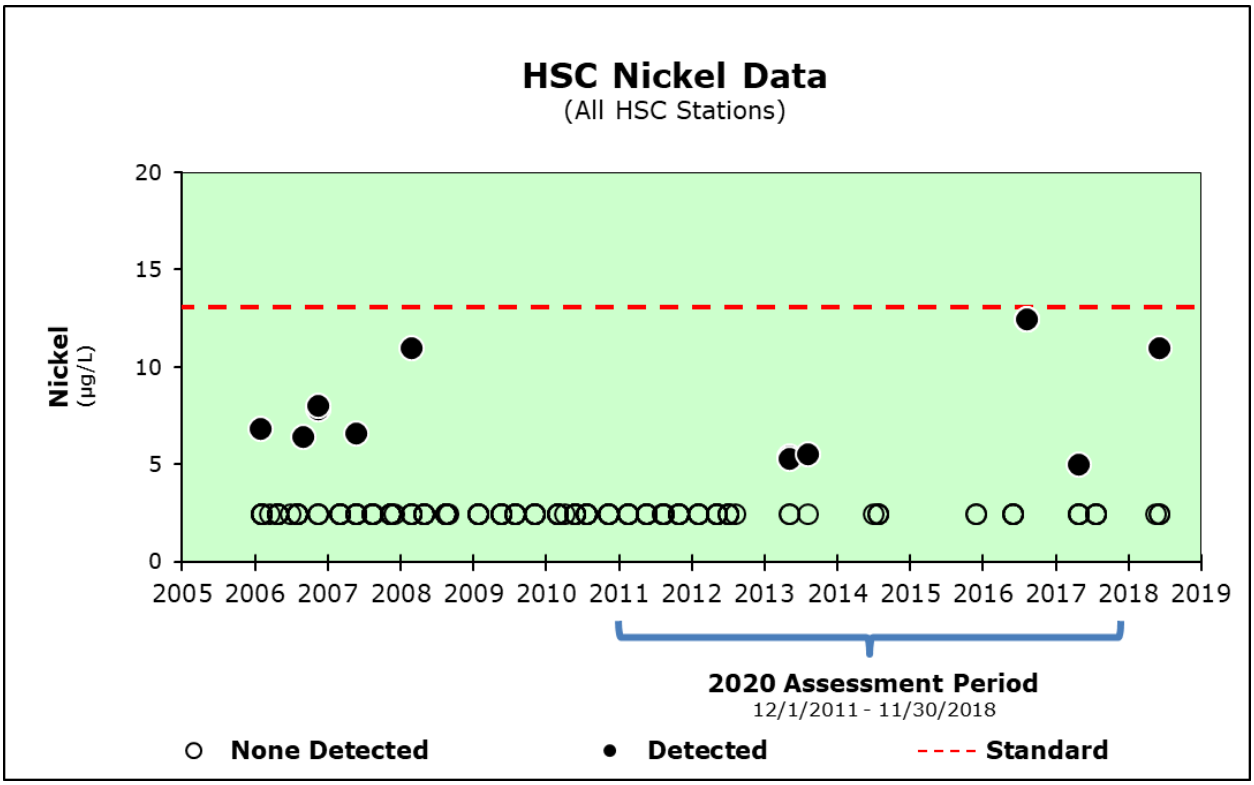

Figure 3. HSC Observed Nickel Concentrations

2020 Assessment period, December 1, 2011 – November 30, 2018.

A long-term average (LTA) is calculated from each WLA, using a lognormal probability distribution, a given coefficient of variation (0.6), and either a 90th percentile confidence level (for freshwater streams, rivers, and narrow tidal rivers with upstream flow data) or a 99th percentile confidence level (for lakes, reservoirs, bays, estuaries, wide tidal rivers, and narrow tidal rivers without upstream flow data). The LTA is the long-term average effluent concentration for which the WLA will never be exceeded using a selected percentile confidence level.

The lower of the two LTAs (acute or chronic) is used to calculate a daily average and daily maximum effluent limitation for the protection of aquatic life using the same statistical considerations with the 99th percentile confidence level and a standard number of monthly effluent samples collected (12). For nickel limits based on saltwater criteria, an added level of safety is incorporated by assuming that the total nickel concentration is equivalent to the dissolved concentration. That is, the permit limits based on saltwater criteria are written for total nickel, while the instream criteria are for dissolved nickel. Permit limits are included when the reported average concentration for nickel equals or exceeds 85% of the calculated daily average limit or when technology-based limits are mandated by federal regulation. Monitoring is typically required if the

reported average concentration is between 70% and 85% of the calculated daily average limit.

Ongoing Monitoring

As part of the Surface Water Quality Monitoring Program and the Clean Rivers Program, TCEQ and the Houston-Galveston Area Council have conducted coordinated monitoring in the Houston Ship Channel. TCEQ plans to continue collecting metals data in Segments 1006 and 1007. Surface water quality monitoring data are entered into the Surface Water Quality Monitoring Information System database and used for assessment purposes.

Conclusion

The initial concern regarding nickel was based on samples that may have been contaminated during the sample collection process prior to 1993. Since the true status of these segments was unknown, these TMDLs were developed as a precaution. The TMDLs included a caveat that these segments may never have been impaired, and the TMDL I-Plan specified that the TMDLs should be revised as appropriate when the total permitted point source nickel load reached the reopener limit. This TMDL Withdrawal is the result of that reevaluation.

Table 1 shows that Segments 1005 and 1006 have been assessed as fully supporting or no concern for all nine assessments after 2002. As demonstrated in Figure 2, analysis of all subsequent data (1993 – 2018) has shown that the segments were always below the established criteria for nickel. Figure 3 shows that for the most recent assessment period (December 1, 2011 – November 30, 2018), nickel concentrations were below the criteria, and frequently too small to quantify (at or below detection limits).

Overall, this analysis shows that Segments 1005 and 1006 are currently meeting the water quality standards for nickel. The TPDES program will continue to evaluate TPDES permit applications and require permit discharge limitations in accordance with applicable rules and procedures. In addition, TCEQ plans to continue collecting metals data in Segments 1006 and 1007.

Therefore, TCEQ proposes to withdraw the TMDLs, because they were developed for water bodies that were incorrectly placed on the Texas 303(d) List.

References

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Abbreviations

AFG	allowance for future growth
EPA	Environmental Protection Agency (U.S.)
FS	fully supporting
HSC	Houston Ship Channel
I-Plan	Implementation Plan
LTA	long-term average
NC	no concern
NS	non-supporting
SJR	San Jacinto River
TAC	Texas Administrative Code
TCEQ	Texas Commission of Environmental Quality
TMDL	total maximum daily load
TNRCC	Texas Natural Resource Conservation Commission (Predecessor agency of TCEQ)
TPDES	Texas Pollution Discharge Elimination System
WLA	wasteload allocation
µg/L	micrograms per liter