Comparing Clean Water Act (CWA) National Pollutant Discharge Elimination System (NPDES) Discharge Monitoring Report (DMR) Data and Toxics Release Inventory (TRI) Data

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Version 1.0

1.0 Overview

This document provides additional background on the two main sources of wastewater pollution data supporting EPA's DMR Pollutant Loading Tool or "Loading Tool" (http://cfpub.epa.gov/dmr/). In particular, this document offers insights on how to compare these two data sources, Discharge Monitoring Reports (DMR) and Toxics Release Inventory (TRI), as well as considerations for analysis and interpretation. The Loading Tool allows users to compare the DMR data search results against TRI data search results and vice versa. The tool clearly labels the source of data when displaying search results but does not mix TRI or DMR data when calculating pollutant discharges.

2.0 Background on TRI and DMR

The programs under which EPA collects TRI and DMR data are the Emergency Planning and Community Right-to-Know Act (EPCRA) and the Clean Water Act (CWA) National Pollutant Discharge Elimination System (NPDES), respectively.

EPCRA was created to help communities plan for emergencies involving hazardous substances. The Community Right-to-Know provisions help increase the public's knowledge and access to information on chemicals at facilities, their uses, and releases to the environment. TRI collects toxic chemical use and release data from facilities and provides this information to the public. Each year, facilities that meet certain thresholds must report their estimated releases and other waste management activities for listed toxic chemicals. Facilities must report the quantities of toxic chemicals recycled, collected, and combusted for energy recovery, treated for destruction, or disposed. The TRI list of chemicals includes more than 650 chemicals and chemical categories. In general, chemicals covered by the TRI Program are those that cause one or more of the following: (1) cancer or other chronic human health effects; (2) significant adverse acute human health effects; and (3) significant adverse environmental effects. Please see the TRI program web page[1] for a list of chemicals reported in the TRI program. Industrial facilities classified as direct dischargers release wastewaters directly into surface waters of the U.S. Indirect dischargers discharge wastewaters to publicly owned treatment works (POTWs) for further treatment prior to release into the environment. A single facility may have both direct and indirect discharges.

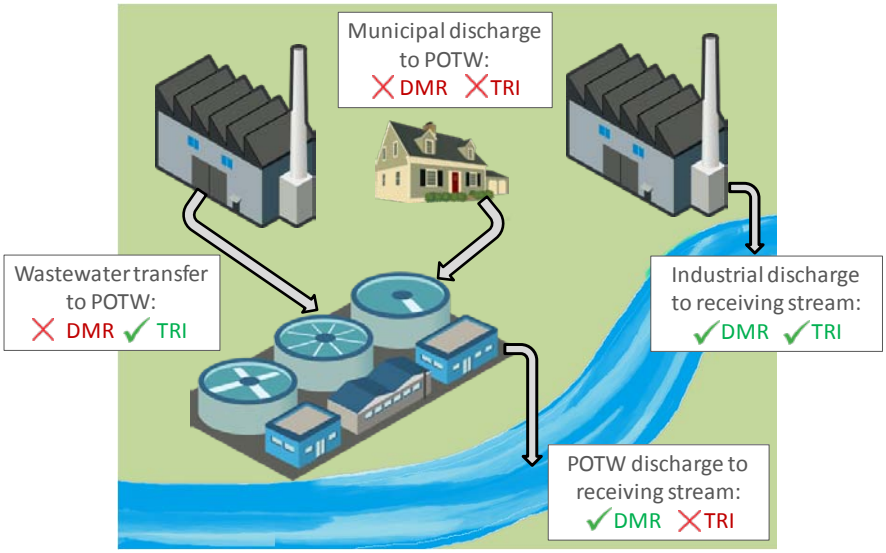
The **NPDES program** aims to protect and restore the quality of U.S. rivers, lakes, and coastal waters through permit requirements to monitor and control pollutant discharges from point sources. The Clean Water Act requires all point source dischargers to obtain a NPDES permit and report compliance with NPDES permit limits via monthly DMRs submitted to the permitting authority. The permitting authority then enters these data into EPA's Integrated Compliance Information System (ICIS-NPDES) or their own state NPDES program database and checks whether the discharger is in compliance with the NPDES permit requirements. Facilities report pollutant discharge monitoring data in their DMR as mass-based quantities (e.g., pounds per day) and/or concentrations (e.g., mg/L); however, discharges

[1] See: http://www2.epa.gov/toxics-release-inventory-tri-program/tri-listed-chemicals

are reported using a wide variety of units. Pollutants in ICIS-NPDES include water quality parameters (such as pH and temperature), specific chemicals, conventional parameters [such as biochemical oxygen demand (BOD_5) and total suspended solids (TSS)], and flow rates. Although other pollutants may be discharged, ICIS-NPDES contain data only for the parameters identified in the facility's NPDES permit. Facilities report discharges in concentration or quantity units as average, total, maximum, or minimum values.

EPA developed the DMR Pollutant Loading Tool to identify facilities that discharge, what pollutants they are discharging and how much, and where they are discharging. The tool calculates pollutant loadings from permit and DMR data from ICIS-NPDES, and presents pollutant loadings as pounds per year and as toxic-weighted pounds per year to account for variations in toxicity among pollutants. The search results rank dischargers, industries, and watersheds based on pollutant mass and toxicity, and present "top ten" lists to show which discharges are important, which facilities and industries are producing these discharges, and which watersheds are impacted. The tool also includes wastewater pollutant discharge data from TRI.

Figure 1 illustrates the types of wastewater streams that can be characterized using TRI and DMR discharge data. TRI data capture discharges to receiving streams and chemical transfers to POTWs from industrial facilities. DMR data capture discharges to receiving streams by industrial facilities and POTWs. Neither data set captures municipal discharges to POTWs.



Images : Tracey Saxby. Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/imagelibrary/)

Figure 1. Wastewater Streams in DMR and TRI Data

Figure 2 illustrates the data flow from facilities to ICIS-NPDES and TRI. The figure highlights key differences in:

- Reporting requirements;
- Discharge quantification and measurement methods;
- Reporting frequencies; and
- Data uploaded to EPA's systems.

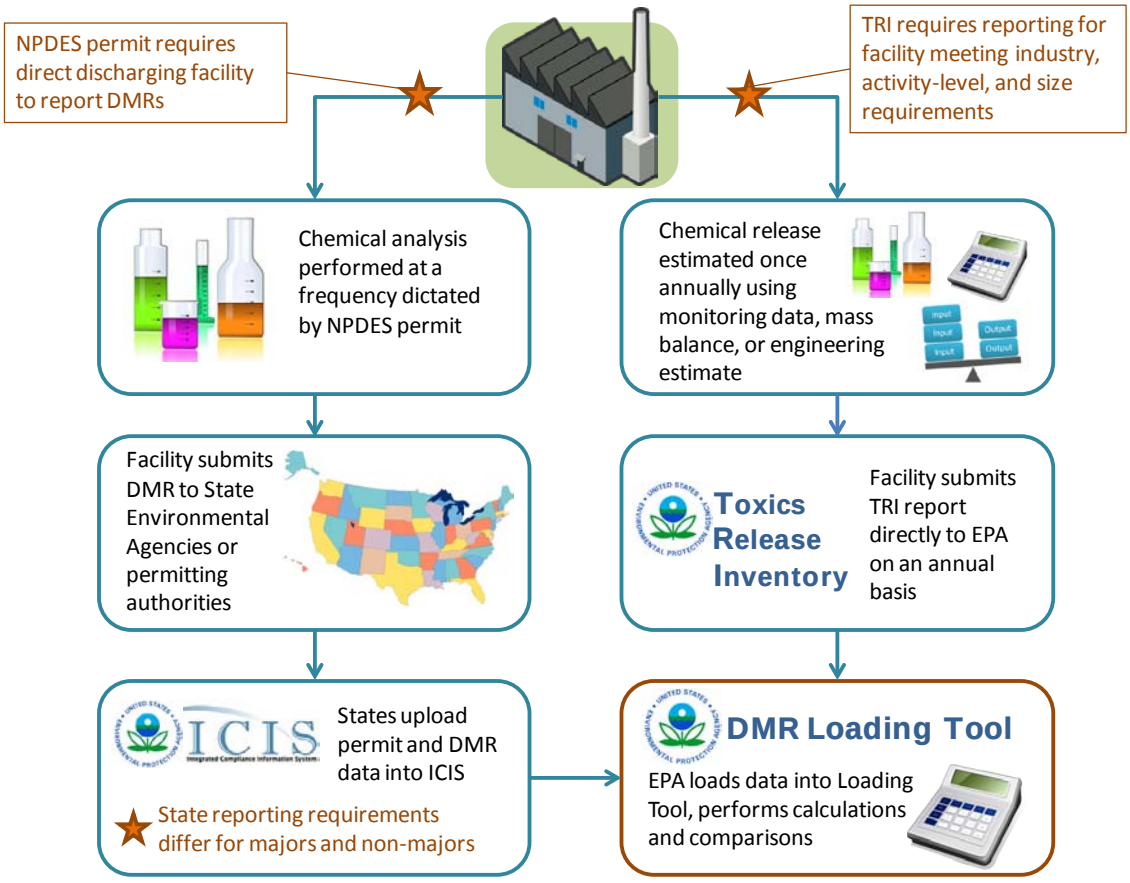


Figure 2. DMR and TRI Data Reporting

The ICIS-NPDES database is very useful for evaluating wastewater pollutant discharges for the following reasons:

- Is national in scope, including data from all 50 states, territories, and tribes;
- Contains discharge data that facilities determine through effluent chemical analyses and metered flow; and
- Includes information for all facilities that discharge directly to surface waters (e.g., rivers, lakes, and coastal waters).

The data collected in TRI is also very useful for evaluating wastewater pollutant discharges for the following reasons:

- TRI includes data from all 50 states, territories, and tribes;
- TRI includes transfers to POTWs (i.e., indirect dischargers), not just facilities that discharge directly to surface waters (i.e., direct discharges);
- TRI includes discharge data from manufacturing NAICS codes and some other industrial categories which may handle significant quantities of toxic chemicals; and
- TRI includes releases of many chemicals, not just those already identified as problems and limited in facility discharge permits.

2.1 Considerations When Using DMR Data in EPA's ICIS-NPDES

More than 180,000 industrial facilities and municipal wastewater treatment plants have obtained NPDES permits for discharges of regulated pollutants. Facilities may be covered under individual or general NPDES permits. General NPDES permits cover multiple facilities that have similar discharges and are located in a specific geographic area and apply the same or similar conditions to all dischargers covered under the permit. Individual NPDES permits are unique to each facility. The limitations and other conditions in an individual permit are based on the facility's operations, type and amount of discharge, and receiving stream, among other factors. ICIS-NPDES does not have DMR data for all facilities with NPDES permits. All authorized states are required to report facility and some permit data (PDF) for all facilities ("major" and "non-major")[2]. EPA has facility, permit, and DMR data on most major facilities and less facility and permit data on individually permitted non-major facilities and non-major general permit covered facilities (Figure 3).

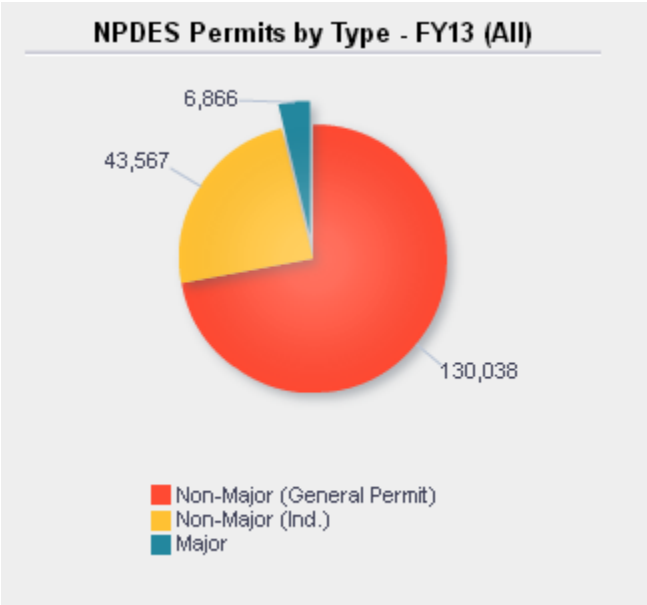


Figure 3: Number of NPDES Permits in ICIS-NPDES (FY13)

For "major" facilities, EPA expects authorized states to enter compliance and enforcement information into the national database for at least 95% of their permitted facilities. For "non-major" (or "minor") facilities, EPA does not require authorized states to enter compliance and enforcement information into ICIS-NPDES; however, many authorized states are providing the information voluntarily. The amount of DMR data on non-major permitted facilities in ICIS-NPDES is expected to rise as more states move towards electronic collection and management of these data. Currently, about half of the individually permitted non-major facilities have their DMR data in ICIS-NPDES.

[2] A "major" NPDES facility is classified as such by the regional administrator, or in the case of approved state programs, the regional administrator in conjunction with the state director. Major municipal dischargers include all facilities with design flows of greater than one million gallons per day and facilities with EPA/state approved industrial pretreatment programs. Major industrial facilities are determined based on specific ratings criteria developed by EPA/State.

The following are some additional limitations of the DMR data collected in EPA's ICIS-NPDES database:

- ICIS-NPDES contains data only for pollutants a facility is required by permit to monitor; the facility is not required to monitor or report all pollutants actually discharged.
- ICIS-NPDES includes very limited data characterizing indirect discharges from industrial facilities to POTWs.
- Many of the pollutant parameters included in ICIS-NPDES are not chemical compounds (e.g., "total Kjeldahl Nitrogen," "oil and grease") and cannot have toxic weighting factors (TWFs).
- Some facility reports in ICIS-NPDES lack applicable SIC codes and only a few facilities in ICIS-NPDES provide information on applicable NAICS codes. This can limit the user's ability to search on these fields.
- DMR data may be entered into the ICIS-NPDES database manually, which leads to data-entry errors.

Additionally, some NPDES permitted facilities have intermittent discharges and may have one or more outfalls that don't discharge for one or more months. ICIS-NPDES has ways of identifying when there is no discharge at a particular outfall for an entire monitoring period. In such cases, the Loading Tool does not calculate pollutant loads for these outfalls during these monitoring periods.

EPA also developed a methodology with the states to estimate intermittent discharges that occurring within a monitoring period (e.g., there is a discharge from the outfall but it only occurs two days out of the monthly monitoring period). Specifically, the Loading Tool uses three ICIS-NPDES "Duration of Discharge" codes for identifying these intermittent dischargers (50037, 82517, and 81381). The Loading Tool will automatically adjust the pollutant loading calculation such that the calculation only estimates pollutant discharges for the time when the outfall is discharging (e.g., two days in the month instead of the entire month).

However, not all NPDES permits require permittees to submit these Duration of Discharge codes when intermittent discharges occur within a monitoring period. Consequently, the tool may overestimate pollutant discharges for these intermittent dischargers that do not report these Duration of Discharge codes. NPDES permittees with intermittent discharges are encouraged to engage with their permit writers to add one of these Duration of Discharge codes to their DMR.

2.2 Considerations When Using EPA's TRI Data

TRI provides annual wastewater chemical releases (lb/year) for direct and indirect discharging facilities. The following are some considerations when using TRI data for evaluating wastewater pollutant discharges:

- Small establishments (less than 10 employees) are not required to report, nor are facilities that do not meet the reporting thresholds. Therefore, facilities reporting to TRI may not provide a complete picture of an industrial.
- Release reports are in part based on estimates as there is no requirement for monitoring. In addition to monitoring information if available, the estimated release reports could be based on emission factors, mass balance or engineering calculations or other methodology which may result in inaccurately reported releases. For example, TRI encourages facilities to report some

compounds as present at one-half the detection level if a facility suspects that the compound is known or reasonably anticipated to be present, even if measured data show the compound is below its detection level. As a result, many companies are conservative and adopt this approach. For facilities with large flows, this can result in large estimates of pounds or TWPE of pollutant released with no measurements to support that the compound was ever present above the detection level.

- Certain chemicals (e.g., Glycol Ethers are reported as a class, not as individual compounds. Because the individual compounds in the class have widely varying toxic effects, the potential toxicity of chemical releases can be inaccurately estimated.
- The list of chemicals covered by TRI is not all-inclusive.
- Only facilities in certain industrial sectors (identified by NAICS codes) are required to report; therefore, some sources of water pollutant discharges are not included.
- A facility is not required to report releases if the facility does not exceed the chemical activity threshold.

The following table on the number of TRI reporters that provide data on wastewater pollutant discharges is showing Figure 4.

TRI Search Results

Search criteria:
Reporting Year: 2012 and Nationwide and All pollutants and All industries

Search statistics:

	Search Results					Related to Search Results			Search Results With	
	All Facilities	Direct Discharges Only	Indirect Discharges Only	Both Direct and Indirect Discharges	No Reported Discharges	Nationwide	All pollutants	All industries	Link to NPDES Permit	Discharges Reported to TRI and ICIS-NPDES
Facility Counts:	19,069	2,301	3,719	853	12,196	19,069	19,069	19,069	6,744	1,540

Figure 4: Number of TRI Reports with Separate Counts of Direct and Indirect Dischargers

As noted above, TRI does not require facilities to sample and analyze wastewater streams to determine the quantities of toxic chemicals released. Facilities may estimate releases based on mass balance calculations, published emission factors, site-specific emission factors, or other approaches. Facilities must indicate the basis of their release estimate using reporting codes, which are provided below:

M1: continuous monitoring data or measurements;
M2: periodic or random monitoring data or measurements;
C: mass balance calculations, such as calculation of the amount of the toxic chemical in streams entering and leaving process equipment;
E: published emission factors;
E2: site-specific emission factors; and
O: other approaches, such as engineering calculations.

Additionally, TRI allows facilities to report releases as specific numbers or as ranges, if appropriate. Specific estimates are encouraged if data are available to ensure the accuracy; however, EPA allows facilities to report releases for non-persistent chemicals in the following ranges: 1 to 10 pounds, 11 to 499 pounds, and 500 to 999 pounds. If a release is reported as a range, the Loading Tool uses the mid-point of the reported range to represent that release.

2.3 DMR Pollutant Loading Tool Comparison Feature

EPA developed the TRI and DMR Comparison Feature in 2013. The Comparison Feature provides information on the differences in discharges reported in DMRs and to TRI for each reporting year since 2007, presented in:

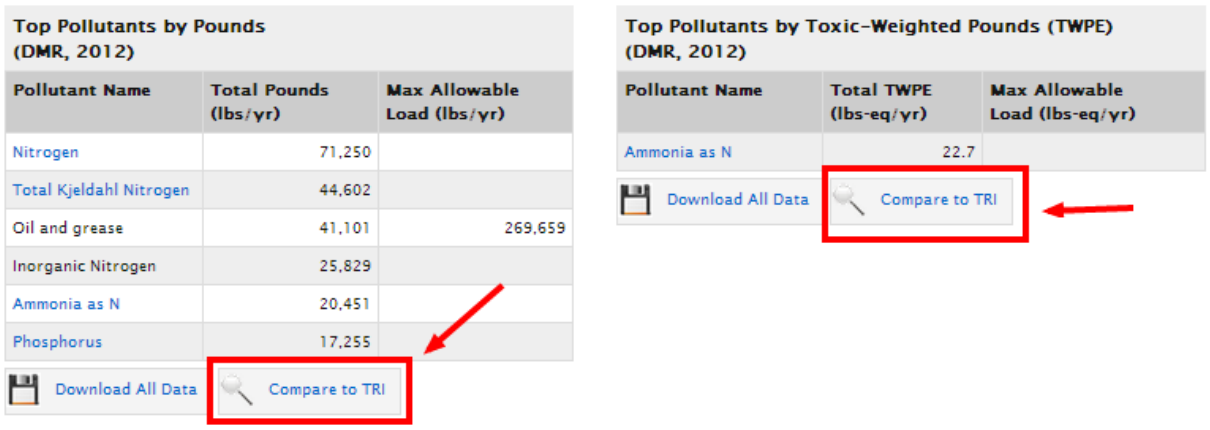
- Pounds per year;
- Toxic-weighted pounds per year; and
- Percent difference.

Discharges to Chemical Groups by Pounds and Toxic-Weighted Pounds (TWPE) (2012)

Chemical Group	DMR Pounds (lbs/yr)	Load Over Limit (lbs/yr)	TRI Pounds (lbs/yr)	Pounds Diff (%)	Pounds Diff (lbs/yr)	DMR TWPE (lbs-eq/yr)	Load Over Limit (lbs-eq/yr)	TRI TWPE (lbs-eq/yr)	TWPE Diff (%)	TWPE Diff (lbs-eq/yr)
AMMONIA	20,451	0	838	2,340%	19,613	22.7	0	0.93	2,340%	21.7
Phosphorus	34,511	0	NA			0		NA		
Nitrogen	187,102	0	NA			0		NA		
ABAMECTIN			1							
ETHYLENE GLYCOL			17					0.022		
Oil and grease	41,101	0	NA			0		NA		
METHANOL			110					0.0016		

Figure 5: Loading Tool 'Compare DMR and TRI' page

To view the comparison page for an individual facility, users can easily view both DMR and TRI pollutant discharge estimates in the Loading Tool by using the buttons shown below in Figures 6 and 7. The comparison feature only compares DMR loadings to TRI direct releases.



Top Pollutants by Pounds (DMR, 2012)

Pollutant Name	Total Pounds (lbs/yr)	Max Allowable Load (lbs/yr)
Nitrogen	71,250	
Total Kjeldahl Nitrogen	44,602	
Oil and grease	41,101	269,659
Inorganic Nitrogen	25,829	
Ammonia as N	20,451	
Phosphorus	17,255	

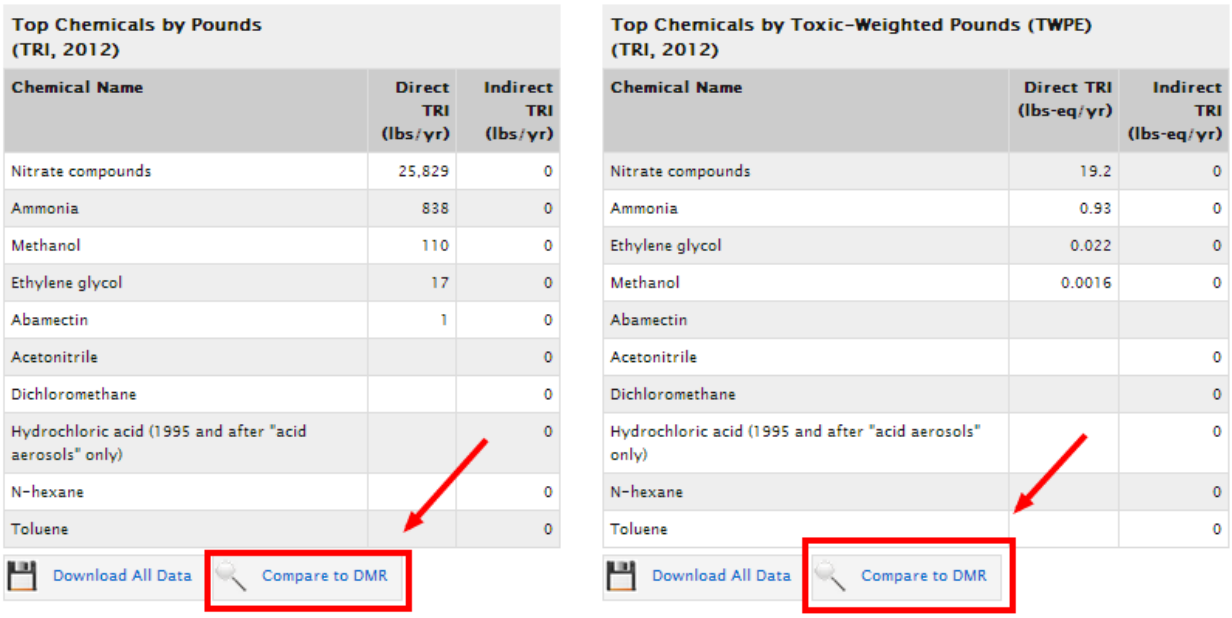
Download All Data | Compare to TRI

Top Pollutants by Toxic-Weighted Pounds (TWPE) (DMR, 2012)

Pollutant Name	Total TWPE (lbs-eq/yr)	Max Allowable Load (lbs-eq/yr)
Ammonia as N	22.7	

Download All Data | Compare to TRI

Figure 6: Links available on the Facility Information (DMR) page that navigate to the 'Compare DMR and TRI' page



Top Chemicals by Pounds (TRI, 2012)

Chemical Name	Direct TRI (lbs/yr)	Indirect TRI (lbs/yr)
Nitrate compounds	25,829	0
Ammonia	838	0
Methanol	110	0
Ethylene glycol	17	0
Abamectin	1	0
Acetonitrile		0
Dichloromethane		0
Hydrochloric acid (1995 and after "acid aerosols" only)		0
N-hexane		0
Toluene		0

Download All Data | Compare to DMR

Top Chemicals by Toxic-Weighted Pounds (TWPE) (TRI, 2012)

Chemical Name	Direct TRI (lbs-eq/yr)	Indirect TRI (lbs-eq/yr)
Nitrate compounds	19.2	0
Ammonia	0.93	0
Ethylene glycol	0.022	0
Methanol	0.0016	0
Abamectin		
Acetonitrile		0
Dichloromethane		0
Hydrochloric acid (1995 and after "acid aerosols" only)		0
N-hexane		0
Toluene		0

Download All Data | Compare to DMR

Figure 7: Links available on the Facility Information (TRI) page that navigate to the 'Compare DMR and TRI' page

DMRs use parameter codes to identify pollutants. These parameter codes are specific to the CAS number and analysis type. As a result, multiple parameter codes may exist for a single CAS number (e.g., total residual chlorine, free available chlorine).

TRI chemicals are identified, for the most part, using CAS numbers. TRI also includes chemical categories, such as glycol ethers and chlorophenols, which comprise multiple CAS numbers. When linking DMR parameters to TRI chemicals, there is potential for double counting loads when individual TRI chemicals are also included in TRI chemical categories. For example, 2,4,5-Trichlorophenol is a TRI chemical but also falls under the chlorophenols chemical category. To avoid double counting, the

Loading Tool groups TRI chemicals within their broader chemical categories, and produced a list of unique chemical groups that link to multiple CAS numbers.

To create the chemical crosswalk between the two programs, EPA uses the CAS numbers to identify the DMR parameters and TRI chemicals that should be included in each chemical group. To match DMR data to TRI-reported discharges, and to avoid double-counting within DMR and TRI, EPA groups and sums the pollutant discharges in DMR and TRI data to the chemical group level and matches on a unique chemical group ID. The DMR/TRI/Chemical Group crosswalk is available on the User Guide tab.

The Loading Tool uses Facility Registry System (FRS) identification numbers to link NPDES permit numbers to TRI facility IDs. FRS uniquely identifies a facility by assigning an identification number (FRS ID), and uses this FRS ID to link together all regulatory program database records (such as permit IDs and facility IDs that facilities use in reporting to EPA).

2.4 Summary of General Data Considerations and Potential Uses

As previously noted, not all facilities report the same pollutants on their DMRs or on their TRI reports to EPA. These differences in pollutant reporting mean that there will likely not be a one-to-one match between pollutant discharges displayed by the Loading Tool (e.g., EZ Search (DMR) and TRI Search). In particular, the TRI program focuses on toxic pollutant discharges and the NPDES program focuses on all aspects of water pollution. Consequently, the results of EZ Search (DMR) may show Total Suspended Solids (TSS) as the top pollutant discharge while the corresponding TRI search will not display any results for TSS (as TSS is not a toxic pollutant and is not reported under the TRI program).

Additionally, the universes of facilities that report under the NPDES and TRI programs do not overlap perfectly. For example, POTWs do not report under the TRI program. Consequently, the Loading Tool will have pollutant discharge data for a facility that submits DMRs that are imported into ICIS-NPDES even when the facility does not report under the TRI program. Conversely, the Loading Tool will have estimates of pollutant discharges to surface waters and POTWs for a TRI reporting facility even when the facility's DMR data is not in ICIS-NPDES. Table 1 summarizes some of the key considerations for comparing DMR and TRI data.

Table 1. DMR and TRI Data Considerations for a Comparative Analysis

Data Scope/Limitations	DMR Considerations	TRI Considerations
Facility universe	Permitting authorities are not required to report DMR measurements for non-majors to EPA's ICIS-NPDES.	Facilities may be exempt from reporting due to industry classification or number of employees.
Chemical universe	Facilities only report discharges of pollutants for which their NPDES permit requires them to monitor. Other pollutants may be discharged but are not reported on DMRs.	Facilities only report chemicals on the TRI list and may be exempt from reporting certain chemicals due to activity thresholds.
Industry classification	Some facilities in ICIS-NPDES do not have SIC or NAICS code data. As a result, it may not	The primary NAICS code in TRI is associated with the facility's

	be straightforward to determine industrial classification. The primary industrial activity reported in DMR data may differ from the primary industrial activity reported in TRI.	revenues, and may not relate to its pollutant discharges.[3]
Data quality	Data entry errors and incorrectly identified units of measure can significantly impact loading calculations.	Facilities can use engineering estimates, emissions factors, and mass balances to report pollutant releases. Not all releases are based on measurements.

Users of the Loading Tool can use DMR and TRI data to investigate the following questions for facilities or industrial sectors of interest:

- What pollutants are discharged? What is the mass (pounds) or hazard (toxic-weighted pound equivalents) associated with these pollutants?
- What facilities or industrial sectors contribute the most wastewater pollution (in terms of pounds or toxic-weighted pound equivalents) for a geographic area of interest to the user?
- What is the geographic distribution of the facilities or industrial sectors of interest to the user?
- Are there any discharge trends for the facility or industrial sector?
- Is there a match between what is being discharged and an impairment in the receiving waterbody?
- What percentage of the raw pollutant loadings pass through on-site treatment and/or POTW treatment into surface waters?

5.0 Additional Considerations When Using DMR and TRI Data

There are also some additional considerations when comparing DMR and TRI data. The following discussions provide more information on how to use, compare, and interpret DMR and TRI data.

5.1 Ammonia Reporting

There is a difference in how aqueous ammonia (CAS # 7664-41-7) is reporting to EPA on TRI reports and on DMRs. This section describes this difference and how to compare DMR and TRI data for this chemical.

5.1.1 TRI Ammonia Reporting

Ammonia is included on the TRI toxic chemical list with the qualifier "includes anhydrous ammonia and aqueous ammonia from water dissociable ammonium salts and other sources; 10 percent of total aqueous ammonia is reportable under this listing."[4] As this qualifier indicates, the quantities applied to TRI threshold determinations depend on the specific form of ammonia manufactured, processed, or otherwise used, and released and the discharge of ammonia to POTWs and surface waters

[3] See http://tri.supportportal.com/link/portal/23002/23021/Article/21087/What-is-the-definition-of-primary-NAICS-code-How-can-there-be-more-than-one-NAICS-code-for-a-facility

[4] See: http://www2.epa.gov/sites/production/files/2014-01/documents/rfi_table_ii_ry2013_112513_abt.pdf

also depend on the form of ammonia. The term "anhydrous" means "lacking water," whereas "aqueous" means "dissolved in water."

If anhydrous ammonia is manufactured, processed, or otherwise used, then 100 percent of the anhydrous ammonia must be counted when determining whether an activity threshold has been exceeded. If the facility exceeds an activity threshold for ammonia (anhydrous and/or aqueous), then all of the anhydrous ammonia released and otherwise managed as waste must be included in the facility's release and other waste management calculations.

Total aqueous ammonia includes both the ionized (NH_4^+) and un-ionized (NH_3) forms of ammonia present in aqueous solutions (e.g., wastewater). When a facility manufactures, processes, or otherwise uses aqueous ammonia, it is conducting a threshold activity on 100 percent of the aqueous ammonia. However, the facility owner or operator counts only 10 percent of the total aqueous ammonia involved in a covered activity when making threshold determinations. Similarly, when estimating annual releases and other waste management estimates of ammonia from a facility, only 10 percent of the total aqueous ammonia must be included in the calculations. This means that when a facility discharges aqueous ammonia to a POTW or surface water it will only report 10 percent of the total quantity of aqueous ammonia released or transferred on its TRI report. If the source of aqueous ammonia is the dissociation of ammonium salts in water, total aqueous ammonia (calculated in terms of NH_3 equivalents) is calculated from the weight percent of the NH_3 equivalents of the ammonium salt. EPA applies this 10 percent factor to estimate the portion of the aqueous ammonia that is toxic.[5] The following is an example.[6]

[5] See EPA's rulemaking on this issue for more information (30 June 1995; 60 FR 34179).

[6] U.S. EPA, 2000. "Emergency Planning And Community Right-To-Know Section 313: Guidance for Reporting Aqueous Ammonia," EPA 745-R-00-005, December 2000. The example shown here is Example #6 in this TRI guidance document, which is available at:
http://www2.epa.gov/sites/production/files/documents/2000ammonia.pdf.

In a calendar year, a facility uses 1,250,000 pounds of ammonium nitrate, NH_4NO_3, in aqueous solution which is released to waste water streams, then transferred to a POTW. The NH_3 equivalent wt% of ammonium nitrate is 21.28%.

The total quantity of aqueous ammonia present in solution is 21.28% of the 1,250,000 pounds of ammonia chloride used, or 266,000 pounds.

The quantity applied towards threshold determinations for the ammonia listing is 10 percent of the total quantity of aqueous ammonia present in solution, or 26,600 pounds. The quantity of ammonia reported as released or transferred is 10 percent of the total quantity of aqueous ammonia released or transferred, or 26,600 pounds.

5.1.2 DMR Ammonia Reporting

NPDES permitted facilities that are required to monitor their wastewater for ammonia discharges typically report all of their discharges of aqueous ammonia (i.e., no 90% reduction factor). The wastewater analytical methods approved for measurement of for ammonia at Part 136, including EPA Method 350.1, are designed to measure 100% of the total unionized (NH_3) and ionized (NH_4^+) forms of ammonia. Consequently, the permit limits and corresponding DMRs capture 100 percent of the aqueous ammonia discharged by the NPDES regulated entity.

5.1.3 Comparing DMR and TRI Ammonia Reporting

One suggested method to make a direct comparison between TRI and DMR ammonia loads is to estimate TRI ammonia releases by multiplying the reported TRI ammonia release by 10 and then compare this value to the DMR ammonia load.

5.2 Dioxin Reporting

Dioxin discharges may be reported differently on DMRs and TRI reports and the difference is mainly due to differing EPA guidance on how to report dioxin discharges when the measured wastewater dioxin concentration is below the laboratory analytical method detection limit. This section describes this difference and how to compare DMR and TRI data for this chemical group. Dioxin is very toxic as compared to other wastewater pollutants so even small amount of dioxin (in terms of mass) translate to large amount of toxic pollution (in terms of toxic-weighted pound equivalents or TWPE).

The term ‘dioxins’ refers to polychlorinated dibenzo-p-dioxins (CDDs) and polychlorinated dibenzofurans (CDFs), which constitute a group of persistent bioaccumulative and toxic chemicals. There are 17 CDDs and CDFs congeners with chlorine substitution of hydrogen atoms at the 2, 3, 7, and 8 positions on the benzene rings, the most toxic of which is 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). The 17 compounds (called congeners) are referred to as ‘dioxin-like,’ because they have similar chemical structure, similar physical-chemical properties, and invoke a common battery of toxic responses, though

the toxicity of the congeners varies greatly. In this document, EPA uses the term "dioxin and dioxin-like compounds" to refer to all 17 of the 2,3,7,8-substituted CDDs and CDFs.

EPA developed toxic weighting factors (TWFs) for each of the 17 dioxin congeners, ranging from 703,584,000 for 2,3,7,8-TCDD to 2,021 for octachlorodibenzofuran. These TWFs convert the mass of the dioxin discharges to toxic pollution (in terms of TWPE). Due to their toxicity and ability to bioaccumulate, the various dioxin congeners have high TWFs relative to most chemicals. As previously noted, even small mass amounts of dioxin and dioxin-like compound discharges translate into large amounts of toxic pollution (in terms of TWPE). Table 2 presents the dioxin congener-specific TWFs used by the Loading Tool.

Table 2. Dioxins Congeners and Their Toxic Weighting Factors

CAS Number	Chemical Name	Abbreviated Name	Toxic Weighting Factor
CDDs			
1746-01-6	2,3,7,8-tetrachlorodibenzo-p-dioxin	2,3,7,8-TCDD	703,584,000
40321-76-4	1,2,3,7,8-pentachlorodibenzo-p-dioxin	1,2,3,7,8-PeCDD	692,928,000
39227-28-6	1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	1,2,3,4,7,8-HxCDD	23,498,240
57653-85-7	1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	1,2,3,6,7,8-HxCDD	9,556,480
19408-74-3	1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	1,2,3,7,8,9-HxCDD	10,595,840
35822-46-9	1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	1,2,3,4,6,7,8-HpCDD	411,136
3268-87-9	1,2,3,4,6,7,8,9-octachlorodibenzo-p-dioxin	1,2,3,4,6,7,8,9-OCDD	6,586
CDFs			
51207-31-9	2,3,7,8-tetrachlorodibenzofuran	2,3,7,8-TCDF	43,819,554
57117-41-6	1,2,3,7,8-pentachlorodibenzofuran	1,2,3,7,8-PeCDF	7,632,640
57117-31-4	2,3,4,7,8-pentachlorodibenzofuran	2,3,4,7,8-PeCDF	557,312,000
70648-26-9	1,2,3,4,7,8-hexachlorodibenzofuran	1,2,3,4,7,8-HxCDF	5,760,000
57117-44-9	1,2,3,6,7,8-hexachlorodibenzofuran	1,2,3,6,7,8-HxCDF	14,109,440
72918-21-9	1,2,3,7,8,9-hexachlorodibenzofuran	1,2,3,7,8,9-HxCDF	47,308,800
60851-34-5	2,3,4,6,7,8-hexachlorodibenzofuran	2,3,4,6,7,8-HxCDF	51,204,160
67562-39-4	1,2,3,4,6,7,8-heptachlorodibenzofuran	1,2,3,4,6,7,8-HpCDF	85,760
55673-89-7	1,2,3,4,7,8,9-heptachlorodibenzofuran	1,2,3,4,7,8,9-HpCDF	3,033,984
39001-02-0	1,2,3,4,6,7,8,9-octachlorodibenzofuran	1,2,3,4,6,7,8,9-OCDF	2,021

Source: *Toxic Weighting Factor Development in Support of the 304(m) Planning Process* [7]

5.2.1 TRI Dioxin Reporting

[7] http://water.epa.gov/scitech/wastetech/guide/304m/upload/2005_09_19_guide_304m_2006_toxic_weighting.pdf

When detected in facility discharges, dioxin and dioxin-like compounds are found in minute quantities, e.g., one part-per trillion (1 ppt) or less, and as mixtures of dioxin and the dioxin-like compounds. Wastewater concentrations are measured with high resolution gas chromatography combined with high resolution mass spectrometry. For example, EPA Method 1613 (used to quantify CDDs and CDFs in wastewater, solids, air, and tissue samples) can reliably detect these compounds at or below one part per trillion [i.e., 10 parts per quadrillion (ppq) in water; 1 ppt in solid waste]. This presents a challenge in terms of interpretation of results in which a CDD/CDF compound is reported by the analytical laboratory as "Not Detected" (shown as the abbreviation 'ND' on lab sheets).

Even with these extremely low levels of detectability with current laboratory methods, it is not possible to know with certainty if 'not detected' (ND) is actually zero (i.e., that dioxin and dioxin-like compounds are not present in the sample) or if dioxin and dioxin-like compounds really are present in the sample at some concentration below the laboratory analytical method detection limit. EPA recommends that facility's use monitoring data and emission factors that are consistent with EPA industry specific guidance.

For example, EPA Method 1613 indicates that laboratory results below the analytical method detection limit should be reported as not detected (ND) or as required by the regulatory authority. For purposes of threshold determinations and the reporting of releases and other waste management quantities for dioxin and dioxin-like compounds under EPCRA section 313, either with monitoring data, or by using the emission factor approach, non-detects are treated as 'zero' if that is how the method being used treats non-detects (e.g., Method 1613). However, facilities should use their best readily available information to report, so if a facility has better information than provided by these methods then that information should be used. For example, if a facility is not detecting dioxin or a particular dioxin-like compound using a particular method but has information that shows that they should be detecting them the facility should use this other information and it may be appropriate to estimate quantities using one half the detection limit.

If the method being used by a facility to detect dioxin and dioxin-like compounds is not an EPA approved method and the detection level being used is not as sensitive as those approved for use under EPA methods then EPA's EPCRA section 313 guidance with regard to non-detects should be followed. This guidance states that facilities must use reasonable judgment as to the presence and amount of a listed toxic chemical based on the best readily available information. An indication that a reportable chemical is below detection is not equivalent to stating that the chemical is not present. If the reportable toxic chemical is known to be present, EPA recommends that a concentration equivalent to half the detection limit be used to calculate annual environmental releases. Facilities should not estimate releases solely on monitoring devices (i.e., measured concentrations), they should also rely on their knowledge of specific conditions at the plant.

This means that EPA requires TRI reporters to make reasonable estimates of their releases to surface waters and POTWs (in addition to other air, land, and groundwater releases). TRI reporters may elect to use the product of one-half the laboratory analytical method quantitation limit and the related wastewater flow, monitoring time period, and appropriate conversion factors to estimate their annual releases when all of their wastewater monitoring data is below the laboratory analytical method quantitation limit.

Additionally, beginning with Reporting Year 2000 through 2007, facilities meeting certain reporting criteria were required to report to TRI the total mass, in grams, of the 17 dioxin and dioxin-like

compounds released to the environment every year. Facilities were given the option to report a facility-specific congener distribution, which means that if dioxins are released to more than one medium, the facility can report only one distribution. Consequently, for 2007 the Loading Tool cannot determine if the single dioxin congener distribution reported by a facility accurately reflects the dioxin distribution in wastewater. Nevertheless, this dioxin data is the best available information and the Loading Tool uses it to calculate the reporting facility's dioxin TWPE. To account for the relative toxicities of the different dioxin congeners, the Loading Tool first converts the reported dioxin releases from grams to pounds to be consistent with the units used for other chemicals. The Loading Tool then calculates dioxin TWPE estimates using the facility-specific congener distributions for all facilities that reported a distribution.

For Reporting Year 2008 and subsequent years, EPA amended the TRI reporting regulations to require TRI reporters to provide the mass quantities for each individual member of the dioxin and dioxin-like compounds category, if available, for each reportable release or waste management activity.[8] This means that for Reporting Year 2008 and after the Loading Tool can more accurately estimate the toxicity for any reported dioxin discharges using the mass of each congener and applying the congener specific TWF.

5.2.2 DMR Dioxin Reporting

The following approach is used for all pollutants reported on DMRs and it particularly relevant when reviewing dioxin discharges. As previously noted, even small mass amounts of dioxin and dioxin-like compound discharges translate into large amounts of toxic pollution (in terms of TWPE).

If pollutant concentrations for all monitoring periods in a given year are reported below the laboratory analytical method quantitation limit then the annual load calculated by EZ Search (DMR) for that parameter is equal to zero. This means that all pollutant concentrations in a given year are either "0" or qualified with "<". In practical terms this means that pollutants may have been detected as present through wastewater sampling but never reliably quantified during the year.

EZ Search (DMR) uses a hybrid approach for calculating pollutant loads when at least one monitoring period has a pollutant concentration that is above the laboratory analytical method quantitation limit. This means that pollutants were reliably quantified at least once during the year, which confirms the presence of the pollutant in the wastewater discharge. In this case the EZ Search (DMR) annual pollutant load is the sum of:

- The product of the pollutant concentrations that are above the laboratory analytical method quantitation limit and the related wastewater flow, monitoring time period, and the appropriate conversion factors; and
- The product of one-half the laboratory analytical method quantitation limit and the related wastewater flow, monitoring time period, and the appropriate conversion factors.

It is important to note this method uses the reported laboratory analytical method quantization limit. In cases where there is no reported laboratory analytical method quantitation limit in ICIS-NPDES, the EZ Search (DMR) does not make an estimate of the laboratory analytical method quantitation limit and uses "0" (zero) for the pollutant load for that monitoring period. Additionally, ICIS-NPDES data entry

[8] U.S. EPA, 2007. "Dioxin and Dioxin-like Compounds; Toxic Equivalency Information; Community Right-To-Know Toxic Chemical Release Reporting," (10 May 2007; 72 FR 26544).

errors where the "<" sign or other qualifier is inadvertently omitted means that the Loading Tool will treat such values without the "<" qualifiers as being above the laboratory analytical method quantitation limit (even though they may be reported on the paper DMRs with the appropriate "<" qualifiers). Finally, it is also important to note that the hybrid approach is the method EPA uses to calculate annual pollutant loadings for its review of industrial sources of wastewater and develop is Biennial Effluent Guidelines Program Plan (see Section 304(m) of the CWA).

5.2.3 Comparing DMR and TRI Dioxin Reporting

To understand differences between DMR and TRI pollutant discharge estimates it is important to review the underlying DMR monitoring data. These monitoring data will indicate whether the facility reported any measurements above the laboratory analytical method quantitation limit. It is also important to review the TRI data to determine if these reported values are based on monitoring data, emission factors, of engineering estimates. Additionally, facilities may not be required to monitor and report dioxin on their DMRs. In this case, you can use the TRI data to supplement the DMR data.

5.3 Metal Compounds Reporting

There may be differences in how metals and metal compounds are reported to EPA on TRI reports and on DMRs. This section describes this differences and how to compare DMR and TRI data for these chemical compounds.

5.3.1 TRI Metal Compounds Reporting

For TRI reporting, facilities report annual releases of metal compounds on a single reporting form for each parent metal and do not specify the individual compound(s) released. In addition, if the facility is required to report releases of a metal (e.g., zinc) and its compounds (e.g., zinc compounds), the facility may report both the metal and metal compound on a single form (reported as the metal compound). For metal compound reporting, the release quantities are based on the mass of the parent metal, only. To calculate TWPEs for metal compounds, EPA used the TWF for the parent metal. EPA then combined the TWPEs for the metal and metal compounds (i.e., TWPE reported for "zinc and zinc compounds," rather than one TWPE for "zinc" and one TWPE for "zinc compounds"). This analysis does not double count metal discharges because all discharges are separated until the releases are combined. For example, if a facility reported 5 pounds of zinc and 10 pounds of zinc compounds, the discharges would be kept separate in the database but displayed as "Zinc and zinc compounds" in the Comparison tool.

5.3.2 DMR Metal Compounds Reporting

NPDES permits may require permittees to report discharges of different forms of the same pollutant [e.g., 01042 - Copper, total (as Cu) and 01040 - Copper, dissolved (as Cu)]. As a general rule, the Loading Tool uses pollutant parameters that represent the total mass of the pollutant discharged [e.g., 01042 - Copper, total (as Cu)] as opposed to parameters that only represent a portion of the total mass of the pollutant discharges [e.g., 01040 - Copper, dissolved (as Cu)]. However, if the NPDES permit does not require the total mass of the pollutant to be monitored and reported on the DMR [e.g., 01042 - Copper, total (as Cu)], then the Loading Tool will use the available parameter [01040 - Copper, dissolved (as Cu)]. Consequently, this might mean that only a portion of the total mass of a pollutant is monitored and reported on the DMR and total facility discharges of the pollutant will be underestimated.

5.3.3 Comparing DMR and TRI Metal Compounds Reporting

To understand differences between DMR and TRI pollutant discharge estimates it is important to review the underlying DMR monitoring data. There may be errors in the DMR data reported to ICIS-NPDES and used in the Loading Tool calculations and the DMR data may only represent a portion of the total mass of the pollutant discharged. Additionally, facilities may not be required to monitor and report some toxic metals on their DMRs even though they are required to report these toxic metals on their TRI reports. In this case, you can use the TRI data to supplement the DMR data.

5.4 Chlorine Reporting

There is a difference in how chlorine is reported to EPA on TRI reports and on DMRs. This section describes these differences.

5.4.1 TRI Chlorine Reporting

Chlorine (CAS 7782-50-5) and chlorine dioxide (10049-04-4) are TRI chemicals and TRI reporters must report any releases of these chemicals on their TRI forms. It is important to note that these are the gaseous form of chlorine. For example, at standard temperature and pressure, two chlorine atoms form the diatomic molecule Cl_2. Most releases of these gases would be fugitive air releases. More importantly, use of chlorine and chlorine dioxide gas in manufacturing process water or water treatment should not be reported on TRI reporting forms as no releases are typically expected of either of these chemicals to water. Chlorine (Cl_2) reacts very quickly with water to form HOCl, Cl^-, and H^+. Although this is an equilibrium reaction, at a pH above 4 the equilibrium shifts almost completely toward formation of these products. Therefore, essentially zero releases of chlorine (Cl_2) to water occur under normal circumstances. Releases of chlorine dioxide to water should be considered but are unlikely based on its strong oxidizing potential and the constant supply of organics in the waste stream.[9] The following describes a common TRI reporting error.

> "The most common reporting error for chlorine or chlorine dioxide treated water is reporting discharges or transfers when the chemicals have been treated on site. As indicated above, if the discharge is maintained at a pH above 4, none of these chemicals are expected to be released to water streams. Although some facilities may monitor the residual chlorine concentration in their water, this parameter does not represent the Cl_2 concentration. Residual chlorine is the sum of the Cl_2, HOCl, and OCl^-concentrations. Because the Cl_2 concentration will be negligible under neutral pH conditions, direct discharges to water or transfers to a POTW may be reported as zero."

Source: EPCRA Section 313 Reporting Guidance for Food Processors (U.S. EPA, 1998)

[9] U.S. 1998. "EPCRA Section 313 Reporting Guidance for Food Processors," EPA-745-R-98-011, September 1998. Available at; http://www.epa.gov/tri/reporting_materials/guidance_docs/pdf/1998/1998food.pdf

5.4.2 DMR Chlorine Reporting

Many NPDES permits require facilities to monitoring their wastewater for Total Residual Chlorine or Free Available Chlorine. Free Available Chlorine is defined as the concentration of residual chlorine in water present as dissolved gas (Cl_2), hypochlorous acid (HOCl), and/or hypochlorite ion (OCl^-). Total Residual Chlorine (TRC) is the sum of total of Free Available Chlorine and combined (bound) residual chlorine. Total Residual Chlorine or Free Available Chlorine are toxic to aquatic communities and have TWFs for estimating toxic pollution.

5.4.3 Comparing DMR and TRI Chlorine Reporting

Users of TRI data should consider any reporting of chlorine and chlorine dioxide to surface waters or POTWs as errors. These data should be excluded from consideration. In order to make a more direct comparison between TRI and DMR data, you may wish to separately count Total Residual Chlorine or Free Available Chlorine DMR pollutant discharges as the TRI program does include these chemicals in their reporting requirements.

5.5 Polycyclic Aromatic Compounds

The TRI program defines polycyclic aromatic compounds (PACs) as the following chemicals. See Table 3.

Table 3. List of Chemicals in the TRI Polycyclic Aromatic Compound (PAC) Group (N590)

CAS Number	Chemical Name	CAS Number	Chemical Name
56-55-3	Benz(a)anthracene	192-65-4	Dibenzo(a,e)pyrene
205-99-2	Benzo(b)fluoranthene	189-64-0	Dibenzo(a,h)pyrene
205-82-3	Benzo(j)fluoranthene	191-30-0	Dibenzo(a,l)pyrene
207-08-9	Benzo(k)fluoranthene	57-97-6	7,12-Dimethylbenz(a)-anthracene
206-44-0	Benzo(j,k)fluorene	42397-64-8	1,6-Dinitropyrene
189-55-9	Benzo(r,s,t)pentaphene	42397-65-9	1,8-Dinitropyrene
218-01-9	Benzo(a)phenanthrene	193-39-5	Indeno(1,2,3-cd)pyrene
50-32-8	Benzo(a)pyrene	56-49-5	3-Methylcholanthrene
226-36-8	Dibenz(a,h)acridine	3697-24-3	5-Methylchrysene
224-42-0	Dibenz(a,j)acridine	7496-02-8	6-Nitrochrysene
53-70-3	Dibenzo(a,h)anthracene	5522-43-0	1-Nitropyrene
194-59-2	7H-Dibenzo(c,g)carbazole	57835-92-4	4-Nitropyrene
5385-75-1	Dibenzo(a,e)fluoranthene		

5.5.1 TRI and DMR Reporting for Polycyclic Aromatic Compounds

For reporting to TRI, facilities may not monitor for the individual chemicals in the PACs and may rely instead on industry emissions estimates or engineering calculations for reporting. NPDES permits may require permitees to sample and analyze wastewater discharges for some or all of these pollutants and to report the results on DMRs. The DMR forms do not group these chemicals into one group like the TRI reporting process.

5.5.2 Comparing DMR and TRI Data for Polycyclic Aromatic Compounds

When understanding differences between DMR and TRI pollutant discharge estimates of toxic organics it is important to review the underlying DMR monitoring data. There may be errors in the DMR data reported to ICIS-NPDES and used in the Loading Tool calculations and the DMR data may only represent a portion of the chemicals listed in the TRI PAC chemical group. Facilities may not be required to monitor and report some toxic metals on their DMRs even though they are required to report these toxic organics on their TRI reports. In this case, you can use the TRI data to supplement the DMR data.

5.6 Phosphorus (Yellow or White)

Phosphorus (yellow or white) is the elemental form of phosphorus and is very unstable. It is insoluble in water but is pyrophoric (i.e., auto-ignites upon contact with air). More important, this form of phosphorus is not the same form of phosphorus commonly measured in wastewater. Users of TRI data should consider any reporting of phosphorus (yellow or white) to surface waters or POTWs as errors. These data should be excluded from consideration.

6.0 DMR and TRI Data Quality Improvements

The TRI Program conducts a number of activities every year to ensure the quality of TRI data reported to EPA. These activities range from providing facilities with extensive reporting guidance, intelligent reporting software, and training prior to the reporting deadline as well as data validation and analysis after the annual reports are received. TRI compliance and enforcement initiatives also aim to ensure that facilities submit on-time and accurate reports of their toxic chemical releases. EPA enforcement staff target facilities that are non-filers or under-reporters, as these actions prevent the full public disclosure of toxic chemical releases.

Similarly, EPA has implemented mechanisms to review DMR data quality. For example, EPA designed the Loading Tool to bring the largest discharges to the top of the results, which helps to expose outliers and potential data entry errors. The tool provides the following functions to facilitate quality review:

- Flags results to indicate if loads are calculated using DMR data that the tool identifies as potential errors;
- Provides underlying data and equations that the tool uses to calculate loads from DMR data;
- Links to error reporting forms, where users can report data errors to EPA.

Both TRI and DMR data validation procedures include reviewing the data for internal consistency as well as comparing to other data sources. Linking TRI reported annual releases to annual discharge loads calculated using DMR data is not always straightforward due to the differences in the reporting requirements. Therefore, EPA developed the Comparison Feature to make it easier for users to directly compare TRI releases and DMR loads, and to enhance data validation efforts by highlighting discharges that have the largest differences between TRI and DMR. EPA, states, and facilities can use the Comparison Feature to identify discrepancies in discharges reported to DMR and TRI and investigate these discharges to identify potential data quality issues.

You can use the Loading Tool to review DMR loading calculation details, raw DMR data, and TRI data in order to answer the following questions and identify potential data errors:

- Are the measurements used for loading calculation close to or below detection limits?
- Are the loads based on daily maximum measurements?
- Does the Loading Tool estimate loads for months where DMR data are missing?
- Is TRI release based on the same measurement data that the facility uses for DMR reporting?
- Is the TRI release calculated assuming a continuous or intermittent discharge?