

DNT – The Importance of Testing for All Six Isomers

Dinitrotoluene, commonly known as DNT, exists as a mixture of two or more of its six isomers (forms). The 2,4- and 2,6- DNT isomers are the most predominant and have been used in military munitions and dye manufacture.

Technical grade DNT is a mixture composed of approximately 76% 2,4-DNT, 19% 2,6-DNT, and 5% other DNT isomers (3,4-DNT, 2,3-DNT, 2,5-DNT, and 3,5 DNT). In groundwater and drinking water, however, these isomers can be found independently and in much different ratios.

If you live near a facility that has DNT contamination, it is important that your groundwater and drinking water well be tested for all six (6) isomers of DNT.

In groundwater monitoring wells at Wisconsin's Badger Army Ammunition Plant, for example, levels of 2,4 and 2,6-DNT are much lower than 3,4-DNT concentrations in the same well. In one sample, 2,4- and 2,6-DNT levels were both below 0.08 parts per billion while 3,4-DNT was detected at levels 80 times higher or 6.45 parts per billion (June 2004).

It is also possible to see one isomer of DNT in a well and not see any others. This can come about in several different ways:

One way is if degradation is nearly complete for other isomers and a more resistant isomer could remain. Unlike 2,4- and 2,6-DNT, for example, 2,3-DNT has not been demonstrated to be biodegradable.

A second way, although less likely, is if there are differences in the affinity of different DNT isomers to the aquifer material and one could show up faster or slower than the other.

Another way one isomer could show up by itself may be that the source area for the well is primarily contaminated with one isomer.

And finally, it is possible that one or more conditions could occur at the same time, resulting in the presence of a single isomer in a specific well.

Wisconsin's safe drinking water standard for both 2,4- and 2,6-DNT is 0.05 parts per billion. Wisconsin recently set an Interim Health Advisory Level of 0.05 parts per billion for total DNTs (the sum concentration of all 6 isomers).

DNT can affect the blood, nervous system, liver, kidneys, and male reproductive system in both humans and animals, and is a suspected human carcinogen. It is anticipated that the health risks of other DNT isomers are similar due to their structural similarity. Several recent studies, however, indicate that certain isomers such as 3,4-DNT may be more toxic than the other more common isomers.

Relative Concentrations of DNT Isomers over Time *Specific Wells at Badger Army Ammunition Plant*

Groundwater Monitoring Well ELM-8907 License 2813 (Existing Landfill)

	2,4-DNT	2,6-DNT	2,3-DNT	3,4-DNT	3,5-DNT	2,5-DNT
March 2006	0.02	ND	0.056	0.181	0.015	ND
June 2006	ND	ND	0.077	0.194	0.015	ND
Sept/Oct 2006	0.006	0.009	0.054	0.201	0.014	ND
Dec 2006	ND	0.012	0.063	0.234	0.018	ND
March 2007	ND	0.009	0.053	0.217	0.011	ND
June 2007	ND	ND	0.054	0.188	0.012	ND

Groundwater Monitoring Well DBM 8201 License 3037 (Deterrent Burning Ground)

	2,4-DNT	2,6-DNT	2,3-DNT	3,4-DNT	3,5-DNT	2,5-DNT
April 2004	0.13	0.16	2.36	8.65	no data	no data
data sporadic						
April 2006	ND	0.085	2.01	6.65	1.61	0.007
June 2006	ND	no data	no data	no data	no data	no data
Sept 2006	0.049	0.097	1.92	7.6	1.25	ND
March 2007	0.107	0.119	2.2	9.0	1.27	ND
June 2007	no data					

Groundwater Monitoring Well ELM-9501

License 2813 (Existing Landfill)

	2,4-DNT	2,6-DNT	2,3-DNT	3,4-DNT	3,5-DNT	2,5-DNT
March 2006	0.02	0.016	0.01	0.033	ND	ND
June 2006	0.006	0.019	0.009	0.058	ND	ND
Sept/Oct 2006	ND	0.016	ND	0.077	ND	ND
Dec 2006	ND	0.021	0.021	0.098	ND	ND
March 2007	ND	0.025	0.018	0.139	ND	ND
June 2007	ND	0.021	0.025	0.136	ND	ND

Groundwater Monitoring Well PBN-8202A

License 2814 (Propellant Burning Grounds)

	2,4-DNT	2,6-DNT	2,3-DNT	3,4-DNT	3,5-DNT	2,5-DNT
April 2004	0.29	6.8	149	no data	no data	no data
Dec 2004	11,000	5,500	no data			
June 2005	ND	290				
October 2005	2.3	6.1	242	419		
March 2006	3.2	1.8	19.4	21.1		
Sept 2006	3.9	ND	35	33.6	5.2	1.2
March 2007	4	ND	12.5	13.3	3.8	ND

NOTATIONS:

All results are in micrograms per liter (ug/l) ND= below detection limit (non-detection)

The Level of Detection (LOD) and test method vary over time and in individual wells. Some results are between the LOD and Level of Quantification (LOQ).

BACKGROUND INFORMATION:

The Deterrent Burning Grounds and Existing Landfill are adjacent capped hazardous waste disposal sites that have a passive biotreatment system and there is no groundwater treatment or capture system.

The Propellant Burning Ground Waste Pits are the source of a groundwater plume containing solvents and DNT that has moved south past the installation's boundary. There is a full scale biotreatment system at the uncapped site; a groundwater extraction system is designed to capture contamination before it migrates offsite.

The first three (3) monitoring wells were selected by the Army as representative of groundwater trends at the site (Badger Restoration Advisory Board, June 2007). The fourth well (at the Propellant Burning Grounds) is provided as an example of a well with higher DNT concentrations. As in the other wells, concentrations of the less common isomers often appear at concentrations much higher than 2,4- and 2,6-DNT.

SOURCES: USEPA Office of Water, 2,4 and 2,6 Dinitrotoluene Health Advisory, April 1992. Dr. Jerry Eykholt, environmental engineer and technical consultant for the Badger Restoration Advisory Board, November 6, 2004 correspondence. J. Spain and S. Nishino, Bioremediation of DNT, Air Force Research Laboratory, Tyndall AFB, Florida,, February 2001. The Wisconsin Groundwater & Environmental Monitoring System database is available online at <http://www.dnr.state.wi.us/org/aw/wm/monitor/gemsweb/>

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Citizens for Safe Water Around Badger (CSWAB) is working to mobilize and empower rural communities near Wisconsin's Badger Army Ammunition Plant in support of a sustainable future that will protect and restore the integrity of soil, water, air, and biological diversity. **For more information contact:** CSWAB, E12629 Weigand's Bay South, Merrimac, WI 53561 (608) 643-3124 or <http://www.cswab.org>