



COMMISSIONER

DEPARTMENT OF THE TREASURY
INTERNAL REVENUE SERVICE
WASHINGTON, D.C. 20224

April 8, 2005

The Honorable Charles E. Grassley
Chairman, Committee on Finance
United States Senate
Washington, DC 20510-6200

Dear Mr. Chairman:

I am providing the enclosed report, *Technical Analysis of Chemical Blendstocks and Waste Products Found in Taxable Fuels*, under Section 871 of the American Jobs Creation Act (Act).

The Pacific Northwest National Laboratory, which handles our product testing for excise tax compliance, prepared the report. Attachment 1 to the report lists the untaxed products discovered as blending components in actual fuel examinations/investigations conducted by federal and state authorities.

Data furnished to the Department of Energy show approximately 138 billion gallons of gasoline, 62 billion gallons of distillate, and 25 billion gallons of aviation kerosene are produced and shipped each year – a total of 225 billion gallons. The report contains information based on 7,703 samples over a 15-month period. Of the fuel sampled, 6.7 percent of the samples reported "abnormal" results. The "abnormal" findings occurred in samples across the country. However, these were not random samples, so we cannot use the results to make assumptions about overall compliance.

As called for in subsection 871(b) of the Act, the report identifies the chemical products we believe should be added to the list of blendstocks. This information represents our best analysis at this time. Our recommendations are based on the frequency with which we found non-blendstock chemical products in our samples, as well as information about whether the samples contained above-normal concentrations of these chemical products. We also have contacted representatives of the chemical industry to validate our findings. Depending on their responses, we may have recommendations for further additions to, or possible deletions from, the list provided with this report.

As directed in subsection 871(c) of the Act, the report includes a table of waste products found in taxable fuel through laboratory analysis. Because we are able to sample and test only a very small proportion of the total volume of fuel that moves through the distribution chain each year, we have supplemented that table with additional anecdotal information from state and federal examinations (see Attachment 2 to the report).

Although information on erroneous exempt certifications is contained in the specific examination case files, we do not maintain statistics on this issue. In connection with the requirements of subsection 871(d) of the Act, we worked with the Federation of Tax Administrators to survey the states to determine if they maintain a list of governmental entities entitled to an exemption from federal fuel taxes. The results of the survey showed that only four states maintain this information. As a result, we are taking a different approach to collecting this information. We have initiated examinations on 100 claims filed by entities identifying themselves as exempt. Because the results of these examinations are not yet available, we will send you a supplemental report on this item, including our recommendations for addressing erroneous claims, by June 30, 2005.

I am also sending a letter to Ranking Member Max Baucus, and to Chairman William Thomas and Ranking Member Charles Rangel of the House Committee on Ways and Means. If you have additional questions please contact me or Bill Conlon, Director, Specialty Programs, at (202) 283-6874.

Sincerely,



Mark W. Everson

Enclosure

Technical Analysis of Chemical Blendstocks and Waste Products Found in Taxable Fuels

Executive Summary

Taxable fuels are defined in IRC section 4083(c)(1) as gasoline, diesel fuel and kerosene. A list of gasoline blendstocks is found at Treasury Regulations section 48.4081-1(c)(3).

In general, most liquid petroleum-based chemicals can be blended with middle distillate fuels provided that the physical limit of solubility isn't exceeded. Middle distillate fuels are very complex mixtures containing thousands of chemical components and it is possible to "hide" various blending chemicals in the mixture. Because diesel engines are so tolerant of a wide range of fuels, a person who blends chemical and waste products into commercial diesel fuel does so with little risk of being discovered. For example, a person is positioned to evade federal excise tax by purchasing gasoline blendstocks in large volume in a tax-free manner. Under existing regulations, the purchaser is merely required to provide a certification to the seller that the gasoline blendstocks will not be used to produce finished gasoline. Other chemicals and waste products that are not classified as gasoline, diesel fuel, or kerosene can be removed from a terminal without tax, dyeing, or certification.

Table 1 of this report provides a summary of post-terminal middle distillate fuel compliance samples collected. Tables 2 and 3 provide a comparable list of blendstocks and waste products that have been added to the distillate taxable fuels (diesel fuel and kerosene), along with the frequency observed. However, these were not random samples, so the results cannot be used to make assumptions about overall compliance.

The IRS has a highly qualified scientific capability in the Excise Forensics Laboratory (EFL), provided under an interagency agreement between the IRS and the U.S. Department of Energy. The EFL has developed methodologies such as fuel fingerprinting and automated pattern matching programs which enable it to analyze the individual components in samples of taxable fuel collected nationwide, allow sample results to be compared, and differences noted.

In the period 10/1/2003 through 12/31/2004, EFL determined that 516 samples out of 7703 analyzed (or 6.7%) were "abnormal." Abnormal means they were blended with or adulterated with chemical products that are not normally found in taxable fuels or were found at concentrations in excess of what is expected. EFL provided a comprehensive list of chemical products found blended into distillate taxable fuels.

A number of civil and criminal state and federal fuel tax cases have been successful in addressing situations where the addition of waste products to bulk up taxable fuel volume was the central point. Generally, the presence of blending was developed by leads, interviews, record examination, etc., because the benefit of sophisticated chemical analysis was not available. The most prevalent waste products found were used motor oil, transmix from pipeline deliveries, new and used transformer oil, out-of-date military fuel, and heavy fuels (called "barge bottoms", among other things.) In all these cases, the advantage to the guilty person was not just not remitting tax on the increased volume, but also in having an easy and practical means of getting rid of the waste product, itself.

Component analysis at the EFL has confirmed that these waste products can still be found in taxable fuel samples.

Technical Analysis of Chemical Blendstocks and Waste Products Found In Taxable Fuels

Taxable fuels are defined as gasoline, diesel fuel, and kerosene. See Treasury Regulations sec. 48.4081-1(c)(3). The Internal Revenue Service extensively studies and reports on all three taxable fuels, but the focus of this report is the middle distillate taxable fuels, e.g., diesel fuel and kerosene. More intensive sampling and chemical analysis of gasoline is currently being initiated. In general, liquid petroleum-based and bio-based products (e.g., plant oils and animal fat renderings) can be blended with middle distillate fuels provided the physical limit of solubility is not exceeded. Because diesel engines are so tolerant of a wide range of fuels, a person who blends chemical and waste products into commercial diesel fuel does so with little risk of discovery. That person can then evade federal and state excise tax on the portion of total volume associated with the chemical- or waste product.

IRS Fuel Compliance Officers (FCOs) collect samples of taxable fuel nationwide and send them for analysis to the IRS Excise Forensics Laboratory (EFL). The EFL was created to provide scientific expertise, research and development, and laboratory capabilities for IRS excise tax functions. The EFL is located at the Pacific Northwest National Laboratory and is operated under an Interagency Agreement between the IRS and the U.S. Department of Energy. The EFL analyzes fuel samples for the presence and concentration of red dye to ensure that untaxed dyed fuel is not used on the highway and for indications of fuel blending and/or adulteration.

Middle distillate fuels are very complex mixtures containing thousands of chemical components and it is possible to "hide" various blending chemicals in the mixture. As more sophisticated methods are developed, various waste products, adulterants, and blending chemicals have been identified. Chemical analysis methods used by the EFL to detect and quantify blending and/or adulterants include: solid phase extraction; high resolution gas chromatography; high resolution gas chromatography/mass spectrometry; multidimensional gas chromatography/mass spectrometry; liquid chromatography/mass spectrometry; simulated distillation; inductively coupled plasma mass spectrometry; and x-ray fluorescence.

The EFL has developed fuel "fingerprinting" and statistical based pattern matching methods that allow fuel sample results to be compared and any differences detected. Fingerprinting involves gas chromatographic analysis which provides a graphic profile (fingerprint) of the chemical make-up of each sample. Each chemical or chemical product has a unique fingerprint. The fingerprints are used to create a statistical model for each of the reference terminal fuel sources. The statistical models are designed to account for product blending that occurs when one field location commingles fuel from several reference sources.

Following a strict methodology called an initiative, reference samples and field samples are collected, analyzed, and compared. Any differences in the profile of the field sample, called "abnormal" results, are further analyzed to determine type and quantity of the chemical or waste product. Since fuel fingerprints are dynamic, the sampling window is usually no more than three weeks.

A similar fuel fingerprinting and pattern matching technique, called a compliance sweep, is also used in which field samples and terminal reference samples are collected simultaneously. The fuel fingerprints from the same reported sources, including the terminal reference sample, are compared to one another. Groupings of field samples with the same source and/or multiple sources create a temporal fingerprint history for a several week period that allows rigorous comparisons to be made. Field samples that do not match their reported source(s), also called "abnormal" results, are subjected to further interpretations and chemical analysis to characterize the anomaly.

During 2000 and 2001, approximately 16,000 terminal reference and field compliance samples were collected and subjected to fingerprinting and pattern matching. See Figure 1 showing the locations of the initiatives. The results of these initiatives were used to validate and refine the methodology. The reported abnormal rates listed in Table 1 are based on a pattern matching parameter that correlates with potential blending/adulteration. Since the focus of this work was on pattern matching development, further

characterization to identify adulterants/blending chemicals was not performed. However, these data establish a trend for fuel abnormalities across the country.

From 2003 onward, initiatives using refined fingerprinting and pattern matching methods were conducted and in 2004 sweeps were first employed. All abnormal sample results were fully characterized. The number of samples, locations, and reported abnormal rates are listed in Table 1. The sample locations for the initiative and sweep samples collected during FYs 2003, 2004, and 2005 are shown on the map in Figure 2. For FYs 2004 and 2005, the summation of the total quantity of fuel reported to be in the tanks that were sampled is also listed. For FY 2004, this tank volume of 25.1 million gallons allows a measurement of how much fuel was evaluated relative to the total fuel supply. The Energy Information Administration, Petroleum Monthly Supply (DOE/EIA-0109, 2005/01), tables S-4, S-5, and S-7, adjusted for FY2004, report total fuel supply volume of 224.7 billion gallons of gasoline, diesel fuel, and aviation fuel. IRS directly sampled approximately 0.01%. The reported abnormal rates establish that a small, but significant amount of fuel anomalies exist. Due to practical constraints of implementing compliance initiatives and sweeps, the collected data is considered statistically representative, but cannot be used to make inferential predictions to broader populations for estimating noncompliance. Plans are being evaluated to address the issues associated with developing a statistically valid approach to allow reliable estimates of nationwide noncompliance to be predicted.

The adulterant/blendstock chemicals identified from laboratory analyses in the abnormal sample results (516 out of 7703 or 6.7%) from the initiative and sweep samples collected during FY2003 and through the end of December 2004 are listed in Table 2. The rates of occurrences and general levels of blending are also described. Since gasoline can be blended into middle distillate fuels, and has been detected (see Table 2), the blendstock list in the regulations (48.4081-1(c)(3)) for gasoline should also be considered for middle distillate fuels.

Historically, waste products other than the chemical blendstocks discussed above have been found in taxable fuels. A person adding waste products (and some of the chemical blendstocks) gains a double benefit by doing so: it is a relatively easy means to get rid of the waste product and yields a larger volume of taxable fuel for which the additional tax is not remitted. Materials such as used motor oil, new and used transformer oil, transmix from pipeline receipts, and out-of-date military fuel and heavy fuel products (sometimes called "barge bottoms") have been found in taxable fuel. Fuel tax evasion by adding waste products to taxable fuel has been the issue in several successful federal and state civil and criminal tax cases.

The EFL has detected these same types of waste products in samples received in the past two years. This confirms that used motor oil, transmix, new and used transformer oil and other waste products are disposed in and used to extend taxable fuel. Waste products that were identified from laboratory analyses of the same sample grouping used to describe the chemical blendstocks, above, are listed in Table 3.

TABLE 1. Summary of Post-Terminal Middle Distillate Fuel Compliance Samples Collected by IRS Fuel Compliance Officers

YEAR (FY)	Activity Type ^a	Number of Field Samples	Location	Reported Percent Abnormal Ranges ^b	Average Percent Reported Abnormal ^b	Fuel Volume ^c (10 ⁶ Gallons)
2000-2001	Initiative	16,000 ^d	Nationwide ^e	0 to 18.1 ^f	3.8 ^f	Not available
2003	Initiative	1061	Midwest ^g	1.5 to 21.1	8.0	Not available
2003	Investigative	211	Nationwide	n/a	n/a	n/a
2004	Initiative	2263	Midwest/West ^h	2.8 to 29.5	10.5	14.635
2004	Sweep	2435	Midwest/West ⁱ	0 to 8.1	4.5	10.515
2004	Investigative	447	Nationwide	n/a	n/a	n/a
2005	Sweep	1206	Northeast, Northwest ^j	6.3 to 14.3	10.3	6.242
2005	Investigative	80	Nationwide	n/a	n/a	n/a

^aInitiative samples are post terminal (retail, wholesaler, end-user) samples collected during an organized campaign in a 100-200 mile geographic area where reference samples from the fuel distribution terminals were sampled during the previous two weeks. Sweep samples are similar to Initiative samples except terminal samples are collected at the same time as post-terminal samples. Investigative samples are *ad hoc* samples collected due to any suspicious characteristics.

^bSamples are designated abnormal when the chemical fingerprint indicates adulteration or blending with chemicals that are not present, or are present at approximately twice the concentration, compared to fuels having the same source, or when the chemical fingerprint does not match the declared source.

^cRepresents the summation of the reported fuel on-hand in the individual storage tanks from which samples were taken and analyzed.

^dIncludes both terminal reference and field compliance samples.

^eSee map shown in Figure 1.

^fSamples collected in 2000 and 2001 were used for research purposes to develop and validate pattern matching methods. The numbers listed in the table relate to a pattern matching parameter that coordinates with blending/adulteration.

^gActivities centered around Corning, IA, Kansas City, MO, Duluth, MN, Sioux Falls, SD, Dallas, TX, Dickinson, ND, Aberdeen, SD, and North Platte, NE. See map shown in Figure 2.

^hActivities centered around Wichita, KS, Amarillo, TX, Phoenix, AZ, El Paso, TX-Las Cruces, NM, Portland, OR, St. Louis, MO, San Bernardino, CA, Scottsbluff, NE-Cheyenne, WY, Del Rio-Laredo, TX, Tulsa, OK, Lupton, AZ, Reno, NV, and Highway 2, MN-ND. See map shown in Figure 2.

ⁱActivities centered around Davenport-Des Moines, IA, San Antonio, TX, Houston, TX, Austin, TX, Waco, TX, Salina, KS, Omaha-Lincoln, NE, San Francisco, CA, Stockton-Chico I-5 corridor, CA, Seattle, WA, Rapid City, SD, Texarkana, TX, Gilroy, CA, Bozeman, MT, Sikeston, MO, Minneapolis, MN, Corpus Christi, TX, Oklahoma City, OK, and Fresno, CA. See map shown in Figure 2.

^jActivities focused in NY, PA, CT, NH, MA, NJ, MD, and northern border of WA. See map shown in Figure 2.

TABLE 2. List of Chemical Blendstocks Identified from Laboratory Analysis of Middle Distillate Fuel Samples Collected During 2003 and 2004.

Type of Blendstock*	Frequency Observed**	Percent Observed**
Fuel Products		
Gasoline/Transmix	84	1.09
Jet Fuel/Kerosene	128	1.7
Heavy Distillate	54	0.70
Chemicals/Solvents		
Butane	2	0.026
Methyl tertiary-butyl ether (MTBE)	3	0.039
Toluene	10	0.13
Methanol	2	0.026
Ethanol	10	0.13
Phenol	1	0.013
Butylated hydroxy toluene (BHT)	2	0.026
C ₂ -Styrene	8	0.10
1-Dodecene	1	0.013
Phthalates	4	0.052
Aldehydes/Ketones	4	0.052
Ethylene Glycol/Diethylene Glycol	1	0.013
Methyl esters of C ₁₆ - and C ₁₈ - acids (biodiesel)	54	0.70
C ₄ - to C ₆ -Containing solvent	1	0.013
C ₁₀ - to C ₁₂ -Containing solvent	3	0.039
Branched Alkanes	8	0.10
Light Aromatics		
C ₂ -Alkylated benzenes	18	0.23
Xylenes		
Ethylbenzene		
C ₃ -Alkylated benzenes	17	0.22
Cumene		
Mesitylene		
Ethyltoluenes		
Propylbenzenes		
Unspecified	6	0.078
Fractionator Products	28	0.36
Light Non-Paraffins		
C ₁ - to C ₃ -Alkylated cyclohexanes	7	0.091
Indane	1	0.013
C ₁ - to C ₃ -Alkylated indanes	2	0.026
Unspecified	3	0.039
Mid-Range Aromatics	16	0.21
C ₄ -, C ₅ -, and C ₆ -Alkylated benzenes		
Naphthalene		
C ₁ -, C ₂ -, and C ₃ -Naphthalenes		
Phenanthrene		
C ₁ -Phenanthrene		
Mid-Range Non-Paraffins		

Tetralin	3	0.039
C ₁ -Alkylated tetralins	9	0.12
C ₂ -Alkylated tetralins	7	0.091
C ₃ -Alkylated tetralins	1	0.013
Decalin	4	0.052
C ₁ - to C ₅ -Alkylated decalins	6	0.078
Unspecified	8	0.10
Total	516	6.7

*Individual compounds found at concentration ranges from approximately <1% to 20%. Mixtures within the middle distillate profile found at concentration ranges from approximately <15% to 50%. The concentrations for compounds normally present in #2 diesel were at least a factor of two higher than expected. Expected compositions and concentrations ranges were determined from gas chromatographic fingerprinting, pattern matching between same-source samples, and gas chromatography/mass spectrometry.

**Based on 7703 total samples

TABLE 3. List of Waste Products Identified from Laboratory Analysis of Middle Distillate Fuel Samples Collected During 2003 and 2004.

Waste Product*	Frequency Observed**	Percent Observed**
Motor Oil	34	0.44
Mineral Oil	2	0.026
Transformer Oil	2	0.026
Foreign-Sourced Fuel	77	1.00
Total	115	1.5

*Waste products determined from solid phase extraction, gas chromatographic fingerprinting, pattern matching between same-source samples, gas chromatography/mass spectrometry, liquid chromatography/mass spectrometry, and inductively coupled plasma/mass spectrometry.

**Based on 7703 total sample



- ★ June/July/August 2000 Initiative
- ✚ September/October/November 2000 Initiative
- ◆ December/January/February 2000-2001 Initiative
- ▲ March/April/May 2001 Initiative
- June/July/August 2001 Initiative
- September/October/November 2001 Initiative

FIGURE 1. Map Showing Locations Where Initiatives Were Performed During 2000 and 2001.

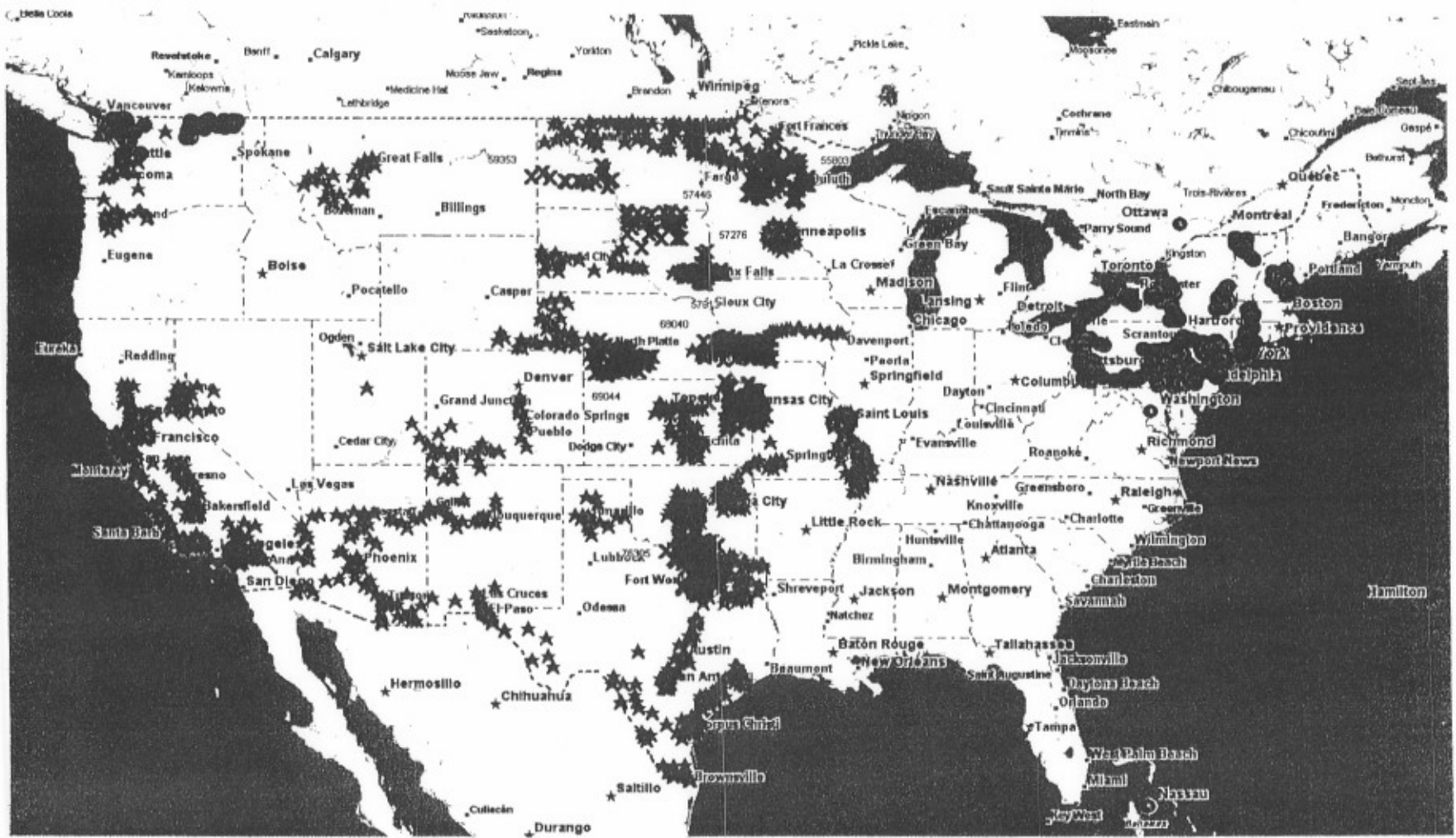


FIGURE 2. Map Showing Locations Where Initiative and Sweep Samples Were Collected that Were Used to Create the Lists in Tables 2 and 3. Key: Blue FY2005, Green FY2004, Red FY2003.

Listing of Products Found in Taxable Fuel

The following is a list of products found in fuel by IRS and/or State agents during audits conducted since 1991. This is in addition to the information reported as found through the IRS fuel sampling process. In each instance, the agent was able to determine that tax had not been paid on the listed product. These products were waste material or product removed from a terminal or refinery without tax being paid. In some situations, existing law/regulations that allow for the tax free removal of product by the purchaser providing the seller with a certification that the product will not be used in a taxable manner was misused. In these cases, the purchaser simply took the tax free product and used it to bulk up taxable fuel or simply sold the product to unsuspecting retailers as taxable fuel.

1. 70/30 Hexane-Toluene Blend
2. Atmospheric Gas Oil
3. Barge Strippings
4. Benzene
5. C13/16 Paraffins
6. Hexane
7. Isobutenol (alcohol)
8. L210 Petroleum Alkylate
9. Light Aromatics
10. Light Cycle Oil
11. Light Fuel Oil
12. Light Hydrocarbons
13. MDO (Middle Distillate Oil)
14. MDO 62 Blendstock
15. MDO 69 Blendstock
16. Mineral Spirits
17. MR Solvent
18. MTBE
19. NA 1268 Fuel Oil
20. Parapol 9980
21. Petroleum Distillate (Benzene, Toluene, Xylene Mixture)
22. Petroleum Links 5600
23. Pyrolysis Oil
24. Specialty Alkylates
25. Toluene
26. Transmix
27. Transmix Naphtha
28. Used Transformer Oil
29. V9350L-O Specialty Alkylate
30. Waste Used Oil

Case Examples in Which Waste Products Were Used to Bulk Up Taxable Fuel Volume

- A state case confirmed that 13 million gallons of a 20 million gallon volume was Jet A/Kerosene purchased tax free from a refinery allegedly as an export product. The tax free Jet A/Kerosene was blended with other nontaxable products (solvents, middle distillate oils, other non-taxed chemicals such as alkaloids, C13, and C16 Parrafin) and delivered as diesel to retail stations within the United States.
- In a state prosecuted case, barge bottoms of predominantly gasoline/MTBE and occasionally diesel fuel were collected from 5 barge stripping companies. Surveillance noted deliveries of three 9,600-gallon truckloads of untaxed gasoline/MTBE nightly, 7 days a week, to approximately 50 retail stations over a 4 year period.
- A taxpayer operated a blending operation with 3 locations. At the first blending facility, the fuel blend included a non-taxed chemical, Parapol 9980, the base product; non-taxed waste toluene; non taxed waste hexane; and taxed gasoline or diesel. At the second and third blending facilities, the fuel blend included non-taxed waste toluene, non-taxed waste hexane, non-taxed MTBE, Parapol 9980, and a mixed hydrocarbon stream (for example, Paral Lite, MDO 62 blendstock, light fuel oil, L210 Petroleum Alkylate, H230L, and H230H). All products were primarily from chemical and waste oil companies.
- A taxpayer purchased barge strippings labeled as petroleum distillate and over a 12 month period, approximately 227,000 gallons were delivered directly to a retail station.