

Used Oil LCA – Material Flow Results

November 27, 2012

The attached spreadsheet reports aggregated annual results of the used oil material flow analysis (MFA) performed to support the life cycle assessment project.

INTRODUCTION

In California, hazardous waste manifest information is available to the public under the County Waste Management Plans Act of 1986 (AB 2948), known as the "Tanner Report" after its legislative sponsor¹. The hazardous waste summaries published under AB 2948 are meant to provide an authoritative record of public knowledge of waste flows to enable counties to manage their wastes. The Tanner report data are reported on an annual basis. Each annual report includes a listing of manifest records describing all shipments of regulated wastes to or from facilities in California; a listing of facilities both in and outside of California which are referenced in the manifest lists; and reference information describing the waste reporting system. The Tanner reports do not include information about wastes managed by the US EPA under RCRA unless the wastes are also listed as California hazardous wastes.

Because used oil is regulated as hazardous waste in California, shipments of used oil are tracked and reported to the state under the manifest system. The Tanner reports thus include information about the collection, transport, and eventual fate of used oil.

METHODS

Used oil material flows were determined through the analysis of manifest data collected by the California DTSC and hauling and processing data collected by CalRecycle. Manifest data describe the shipment of waste from a generator (or transfer facility) to a processor (or transfer facility). Computing the total amount of used oil transported requires adjusting for double counting of oil that travels through one or more transfer stations.

A manifest record includes:

- description of the waste (California Waste Code),
- facility ID of the origin facility,
- facility ID of the destination facility,
- management method code used at the destination facility,
- quantity of waste transported.

We use the manifest records to estimate generation and disposition of oil based on a mass balance analysis over all destination facilities.

1. For each unique facility ID that appears in the corpus, compute flows into and out of the facility:

IN_i = sum of quantities over all manifests with the facility as TSDF

term_i = subset of IN_i; manifests showing "terminal" method codes.

¹Tanner report data can be found online: http://www.dtsc.ca.gov/HazardousWaste/HW_Summary/index.cfm

OUT = sum of quantities over all manifests with the facility as generator

Facilities with only outflows (IN=0) are considered strict generators. Facilities with only inflows (OUT=0) are considered strict processors. Facilities where both IN>0 and OUT>0 are transfer facilities; net generation or disposition of oil is determined by mass balance.

2. Terminal method codes imply that the waste meets its final disposition at the facility (does not leave the facility as “used oil.”) We consider the following method codes to be terminal:

- H010 metals recovery,
- H020 solvent recovery,
- H040 destructive incineration,
- H050 on-site energy recovery,
- H061 fuel blending for off-site energy recovery,
- H081 biological treatment,
- H111 stabilization or fixation prior to disposal
- H129 other treatment,
- H132 landfill or surface impoundment,
- H135 discharge to POTW / NPDES

Manifests containing other method codes, including H039, H077, H101, H103, H141, and unspecified, are considered to have an ambiguous fate: maybe the oil is recycled; maybe it is transferred to another facility. The fate of these oils is determined by mass balance.

3. The mass balance value b is given by:

$$(IN - term) + b = OUT \quad (1)$$

If $b \gg 0$, that implies a net outflow from the facility, which is attributed to consolidated collection.

If $b \ll 0$, that implies a net inflow to the facility, which is attributed to oil meeting final disposition.

If b is close to 0 relative to the magnitudes of IN and OUT, the facility is acting like a transfer station. The mass balance discrepancy b may indicate transfer losses or incidental dewatering.

4. Once each facility’s mass balance is computed, the results are added together over all facilities to estimate the size of the total used oil material flow.
5. Facility totals are then passed through the LCA model to determine the quantities of coproducts generated.

RESULTS

Sales + Generation Upstream figures reporting the quantity of oil entering use in California in the given year. These values are used to estimate the quantity of recoverable used oil, and thus the quantity of oil that is improperly disposed, lost, and/or burned on site.

LubSalesCA CalRecycle Sales of “lubricants” reported to CalRecycle to support the oil recycling incentive program; based on fee payments.

IndSalesCA □ CalRecycle □ Sales of “industrial oils” reported to CalRecycle to support the oil recycling incentive program. No fees are paid on industrial oils so exports from California are likely under-reported, leading to overstated results.

IndSalesCA □ Kline (DIM) □ California demand for industrial oils, as estimated by Kline under contract to CalRecycle (and as reported by the Direct Impacts Model produced by ICF)

CollectableUO □ Kline (DIM) □ Collectable used oil, as estimated by Kline and reported by the Direct Impacts Model.

Manifest Data Manifest data are reported for Waste Code 221 (“waste oil and mixed oil”) and Waste Codes 222+223 combined (“oil-water separation sludge” and “other oil-containing waste,” respectively). Both WC 222+223 are expected to be high in water content and to contain oily waste that is not derived from used oil. WC 222 numbers will be revised downward as the model is refined. WC 223 numbers exclude non-liquid waste. NOTE: manifest data for year 2006 are poor quality and have been omitted.

TotalCollected □ Total amount of the given waste code collected, after adjusting for double-counting. Imports of used oil from out of state are excluded.

Consolidated □ A subset of TotalCollected, this reports the quantity of waste that was collected under a consolidated manifest (manifest lists the transporter as “generator”). This term corresponds to the sum of mass balance values that indicate net outflows from a transfer facility ($b \gg 0$).

TotalTransferred □ Total amount of transfers between facilities reported on manifests. This number can be larger than the total amount of oil collected.

TxLosses □ Amount of waste apparently lost at transfer facilities due to leaks, spills, or incidental dewatering. When the mass balance value is small relative to the total inflows or outflows (<10%), the discrepancy is considered a transfer loss.

ExportedFromCA □ Total amount of oil reported on a manifest for which the generating facility was in California and the receiving facility was outside of California.

Freight □ Total freight transport of used oil reported on manifests. Freight requirements associated with each manifest are computed by multiplying the straight-line (great circle) distance between generator and TSDf facilities, by the quantity of oil transported, and summing over all manifests. The number is increased by a fixed factor to account for the difference between great-circle distance and roadway distance.

CalRecycle Recovery Data Data collected by CalRecycle through its used oil reporting system. There are two forms, one for haulers and one for processing facilities. The distinction between “lubricants” and “industrial oils” is subject to the discretion of the people returning the forms and may not be reliable. NOTE: year 2011 in-state processing data is understated by approximately 8 Mgal due to late reporting by processors. Reported industrial oil quantities may include high water fractions.

LubeCollected □ CalRecycle □ Total “lubricants” reported to CalRecycle on a Used Oil Hauler form.

IndCollected □ CalRecycle □ Total “industrial oils” reported to CalRecycle on a Used Oil Hauler form.

LubeProcessed □ CalRecycle □ Adjusted total “lubricants” reported to CalRecycle on a Used Oil Processor form. The number has been adjusted to remove oils reported “processed” by transfer facilities that do not in fact process the oil.

IndProcessed - CalRecycle □ Adjusted total “industrial oils” reported to CalRecycle on a Used Oil Processor form. The number has been adjusted to remove oils reported “processed” by transfer facilities that do not in fact process the oil.

LubeProcessedExCA □ CalRecycle □ A subset of LubeProcessed. Total “lubricants” reported to CalRecycle on a Used Oil Processor form by facilities operating outside of California. Excludes oil not generated in California.

IndProcessedExCA - CalRecycle □ A subset of IndProcessed. Total “industrial oils” reported to CalRecycle on a Used Oil Processor form by facilities operating outside of California. Excludes oil not generated in California.

LCA Coproduct Data Coproduct totals are computed by the LCA tool and include products generated both within and outside of California. Totals are reported in metric tons.

Light □ Fuel □ Light ends, distillate fuels, and other light petroleum products derived from used oil and sold for primary use as a fuel.

Asphalt Product □ Distillation bottoms and processing residues derived from used oil and sold for use as asphalt additives.

Re-refined □ Base Oil □ Base oil derived from re-refining used oil.

RFO □ to □ Combustion □

Dielectric □ Fluid □ Rejuvenation □ Used oil that was delivered to a facility whose primary business involves transformer maintenance or dielectric fluid reconditioning.