Parameter Brief

The CDS® Unit for Removal of Oil and Grease

The CDS system is a hydrodynamic separator which uses patented continuous deflective separation (CDS) technology to separate and trap debris, sediment and oil and grease from stormwater runoff. Indirect screening allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls separate captured solids and minimize resuspension of previously captured pollutants.

Oil and grease (O&G) are commonly found in stormwater runoff from automobiles and associated anthropogenic activities. O&G appear in many different forms in stormwater runoff: free, dissolved, emulsified, and attached to sediments. Total Petroleum Hydrocarbons (TPH) is the usual analytical measure of fuels, oil and grease (O&G) for stormwater. Typically the concentrations of TPH associated with runoff from streets and parking lots range from 2.7 to 27 mg/l (FHWA, 1996). The Oregon Association of Clean Water Agencies (ACWA) reports O&G levels for runoff from different land uses for the period of 1991 – 1996, as shown in Table 1.

Table 1. O&G levels from different land uses.

Land Use	Median (mg/L)	Range (mg/L)
Residential	1.2	ND - 12.6
Commercial	2.4	ND – 18
Industrial	2.0	ND – 107.6 (12 mg/l next highest)
Mixed	1.0	ND –28

CDS units can be equipped with a conventional oil baffle to capture and retain oil, grease, and other TPH pollutant as they are transported through the storm drain system during wet weather (stormwater) and dry weather (spills) flows. In addition, CDS units with the addition of oil sorbents can ensure the permanent removal of the free oil and grease from stormwater runoff. Laboratory investigations into the CDS unit's removal of oils and greases are summarized below.

Laboratory Studies – CDS Unit at Portland State University, 2003

In 2003, Slominski and Wells at Portland State University conducted tests on a CDS Model 20_20 unit equipped with a 2400 micron screen and oil baffle. Tests were conducted at 25, 50 and 75 percent of the unit's hydraulic capacity (500 gpm) for the removal of used motor oil with influent concentrations of 10, 25 and 50 mg/L. A summary of the test is shown in Table 2 (Slominski and Wells, 2003).

Table 2. Summary of oil and grease tests (Slominski and Wells, 2003).

Flow Rate (gpm)	Influent Conc. (mg/L)	Average Effluent Conc. (mg/L)	Removal Efficiency (%)
125	7.2	3.5	51
125	18.3	1.5	92
125	46.2	3.5	92
250	9.9	2	80
250	22.8	5	78
250	45.6	7.5	84
375	10.5	7.5	29
375	21.9	16	27
375	46.9	27	42

Laboratory Studies – CDS Unit Oil Spill Test at Portland State University, 2003

In addition to the regular capture test performed to measure the removal of free oil and grease from stormwater, Slominski and Wells (2003) also performed an oil spill test. The unit performed extremely well in the oil spill test, with the peak oil concentration in the effluent occurring right as the addition of oil to the unit stopped. This showed a capture rate of more than 99.75% of the oil dumped into the unit (82,000 mg/L). This demonstrates that a CDS unit would be a very effective means of containing an oil spill. An oil storage capacity chart for the CDS unit is available on request.

Laboratory Study – CDS Unit with Sorbents at University of California, Los Angeles (UCLA)

Studies by Stenstrom and Lau (1998) at UCLA demonstrated that the CDS unit with sorbents can achieve 80 to 90 percent removal of oil and grease at influent concentrations ranging from 13.6 mg/L to 41.1 mg/L. Test results showed that the effluent oil and grease concentrations were less than 10 mg/L.

A series of nine laboratory experiments were performed on a CDS unit (Model PMSU20_15) to determine its ability to remove free oil and grease using sorbents (Stenstrom and Lau, 1998). One control experiment was performed without sorbents. The focus of this study was to evaluate the effectiveness of various sorbent materials to control the typically low concentrations of free oil and grease found in urban stormwater runoff when applied within the separation chamber of a CDS unit. The conventional oil baffle was not installed within the CDS unit during this evaluation. The sorbents were allowed to float on the surface of the separation chamber of the CDS device. Different amounts of each sorbent were used because of the varying properties of the sorbents (density and surface area).

Tests were performed using a 2400-micron screen over 30 minutes at 125 gpm (approximately 40% of the CDS unit's nominal flow capacity). Used motor oil (Specific Gravity = 0.86) was introduced into the feed of the CDS at approximately 25 mg/L, which is generally the upper limit of oil and grease concentrations found in stormwater runoff. Oil and grease were measured at various times (influent/effluent) to determine the removal efficiency. Background oil and grease was measured as well as oil and grease released from the sorbents after the influent oil and grease was reduced to zero.

Five commercially available sorbents were evaluated. Two sorbents were found particularly effective and they are:

- OARS™ (AbTech Industries, 4110N. Scottsdale Rd., Suite 235, Scottsdale, AZ 85251)
- Rubberizer™ (Haz-Mat Response Technologies, Inc., 4626 Santa Fe Street, San Diego, CA 92109)

Results from the sorbent laboratory study (Stenstrom and Lau, 1998) are shown in Table 3.

Table 3. Performance of Oil and Grease Removal of CDS Units.

Test No.	Sorbent Type	Sorbent Mass (g)	Influent (mg/L)	Effluent (mg/L)	Percent Removal	Flow (gpm)
2	OARS	2600	19.6	2.7	86	125
3	OARS	2600	24.0	4.3	82	190
4	OARS	2600	30.7	1.7	94	75
5	OARS	2600	21.0	3.5	83	125
6	Rubberizer	1030	27.2	3.9	86	125

Effluent concentration of oil using the OARS™ sorbent was less than 1.0 mg/L. Effluent concentration of oil using the Rubberizer™ sorbent was 1.96 mg/L.

References:

Federal Highway Association. (1996). Evaluation and Management of Highway Runoff Water Quality. Publication No. FHWA-PD-96-032.

Slominski and Wells. (2003). Oil and Grease Removal using Continuous Deflection Separation with and Oil Baffle. Portland, Oregon: Author.

Stenstrom, M. K. and Sim-Lin Lau. (1998). Oil and Grease Removal by Floating Sorbent in a CDS Device. Los Angeles.