

Sustainable Remedial Methods; The Evolution of TO-15 and It's Green Chemistry Principles and Processes



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Volatile presence in the air matrix has increasingly become a concern for policy makers, regulatory agencies, government and private enterprise. There are a number of ways to analyze for VOC concentrations in air. Many methods use harmful solvents during the extraction process and bulky non reusable media. Why would you use an environmentally unfriendly method to sample and analyze for projects looking to improve the environment? Improvements through innovative technologies and updates along with green principles and processes have made TO-15 unique in it's ability to analyze a wide range of compounds while infusing a sampling program that is simple, cost effective, and sustainable for remedial purposes.

6 Liter Can 7 day Recovery Test - 10% RH Filled to 10 psia

Compound	10 ppb Std	Can 3662 Silonite	Can 3661 Silonite	54106 Summa	15275 Summa	22094 Summa	54102 Summa	00405 TO Can	00460 TO Can	00546 TO Can	00408 TO Can
Fill/Run Order	1	8	2	5	3	7	10	9	4	6	11
Propene	10.00	9.58	9.73	8.87	7.45	8.89	8.88	8.80	9.04	9.01	9.05
Dichlorodifluoroethane	10.00	8.67	8.28	8.05	7.46	7.66	4.55	7.64	7.49	5.46	8.14
Chloromethane	10.00	8.50	8.53	7.91	5.94	7.79	5.98	7.82	7.92	7.40	7.89
Dichlorotetrafluoroethane	10.00	7.94	7.99	7.46	5.52	7.28	5.24	7.27	7.38	6.30	7.43
Vinyl Chloride	10.00	8.38	8.39	7.69	5.82	7.70	5.84	7.65	7.79	7.54	7.83
1,3-Butadiene	10.00	8.53	8.46	7.84	6.05	7.93	6.03	7.80	8.00	7.82	8.08
Bromomethane	10.00	8.04	8.04	7.60	5.68	7.34	5.71	7.34	7.42	7.42	7.59
Chloroethane	10.00	8.43	8.53	7.94	6.02	7.79	6.06	7.66	7.83	7.88	7.99
Bromoethane	10.00	8.35	8.46	7.81	5.85	7.69	5.93	7.59	7.66	7.77	7.95
Trichlorofluoromethane	10.00	8.15	8.31	7.69	5.81	7.50	5.90	7.44	7.56	7.56	7.71
Acetone	10.00	9.28	11.59	10.02	13.07	8.84	9.68	10.40	11.70	10.08	10.79
Isopropyl Alcohol	10.00	8.75	8.86	8.13	10.92	8.26	8.63	8.58	8.33	9.25	8.78
1,1-Dichloroethene	10.00	9.03	8.96	8.35	8.13	8.32	8.17	8.26	8.41	8.00	8.47
Trichlorotrifluoroethane	10.00	9.04	9.08	8.40	6.33	8.31	6.42	8.28	8.39	8.42	8.48
Allyl Chloride	10.00	9.31	9.40	8.65	6.53	8.41	3.07	8.13	8.48	8.76	8.08
Methylene Chloride	10.00	9.30	9.31	8.55	6.59	8.48	6.57	8.52	8.63	8.71	8.68
Carbon Disulfide	10.00	9.03	9.16	8.37	6.34	8.32	6.36	8.52	8.58	8.49	8.55
trans-1,2-Dichloroethene	10.00	9.29	9.38	8.60	6.49	8.55	6.58	8.51	8.63	8.78	8.71
Methyl tert-Butyl Ether	10.00	9.29	9.35	8.35	6.51	8.63	8.46	8.46	8.56	8.81	8.51
Vinyl Acetate	10.00	9.33	9.34	0.09	3.74	8.10	0.03	1.5	0.2	8.87	0.03
1,1-Dichloroethane	10.00	8.48	8.38	8.28	7.45	8.27	8.27	8.22	8.42	8.27	8.45

The Evolution Canister Size Range

Why TO-15? The EPA developed method TO-15 as an indoor air method in the mid-1980's. Initially the method was used to analyze VOC's at high concentrations. As years past. Innovative scientists made adjustments to their modified TO-15 methods as new technology and understanding occurred. At Centek Labs, specialization in TO-15 and the air matrix allows our scientists and environmental professionals to fully dedicate resources to staying at the forefront of technology. Technology has increased usability and technical advancement of TO-15. The remedial applications of TO-15 include but are not limited to;

- Brownfield Redevelopment
- Biogas
- Hazardous Waste
- Federal Sites
- State Sites
- Emergency Response
- Regulatory Guidance
- Perimeter Monitoring
- Personnel Monitoring

In the early years, TO-15 indoor air sampling required bulky 6L canisters. The cost for analysis and transport of the media was significant. Even today, laboratories heavily invested in old technology will claim the use of 6L canisters is still necessary. NOT SO FAST!! Over the past few years, we have participated in studies that show 6L canisters are not required and studies show they provide less value, relative to accuracy and sustainability of sampling utilizing method TO-15. You will see the study that indicates these findings in the chart to the left and in the graph below.

Not only has the size of the canister decreased, field sampling is easier, more sustainable and less sample volume is needed to analyze for a more extensive list of compounds. Research grade instrumentation updates has allowed the invested laboratory to actually expand the range of volatile compounds analyzed while decreasing sample volume needed. 1-liter silica lined canisters sample volume can be used to analyze for a full list of VOC's. In addition Centek Labs has a powerful NIST 129K library database to identify unknown compounds.

Why is TO-15 Sustainable?

We've made mention of how TO-15 does not use hazardous solvents in the extraction process. How does this make the method more sustainable for remedial purposes? In other methods, common hazardous solvents used in the extraction process include:

- Hexane
- Methylene Chloride
- Carbon Disulfide



Where do these compounds go after being used in the extraction process? These compounds are stored in Hazardous containment drums. After a certain amount of time, the solvents must then be shipped to an incinerator. Alternative methods also contribute greatly to landfill waste by use of non reusable media, gloves, tubing, and glass.

