

EPA'S NON-TARGETED ANALYSIS COLLABORATIVE TRIAL (ENTACT)

How do you test for something when you don't even know it's there? EPA researchers are developing new ways to do just that in order to protect human health and the environment.

Chemicals registered for use in the U.S. number in the tens of thousands, and there is evidence of potential environmental and human exposure to some of these chemicals. However traditional analytical chemistry methods that look for the presence of unknown chemicals are not sufficient to monitor for all of these potential contaminants. Therefore, EPA has developed non-targeted analysis methods to rapidly assess for chemical exposures.

The objective of non-targeted analysis methods is to identify unknown chemicals in water, soil and other types of samples, without having a preconceived idea of what chemicals are present.

EPA scientists are leading a multi-phase project to evaluate the ability of non-targeted analysis methods to consistently and correctly identify unknown chemicals in samples. EPA's Non-Targeted Analysis Collaborative Trial (ENTACT) was formed in late 2015 and includes nearly 30 academic, government and industry laboratories.

ENTACT samples

Scientists used about 1,200 chemical substances from EPA's [ToxCast](#) library to make 10 liquid mixtures containing 100 to 400 compounds each.

Three types of samples were also used in the study: house dust, human serum and silicone wristbands. These samples were each spiked with one of the 10 liquid mixtures.



Ten mixtures made from 1,200 ToxCast chemicals. Each mixture contains about 100-400 chemicals.

The dust and serum samples were purchased from the [National Institute of Standards and Technology \(NIST\)](#) and are certified standard reference materials. Oregon State University prepared the



A certified sample of human serum.

wristbands by uniformly exposing them to outdoor air to allow them to absorb airborne environmental pollutants.

Phase 1: Blinded analysis

In Phase 1 of ENTACT, the sixteen total samples were sent to approximately 25 analytical labs. Those labs were instructed to use their own non-targeted methods to analyze the samples, and to report back to EPA what chemicals they detected in the samples. This phase of ENTACT began in September 2016 and is expected to be completed by August 2018.

Each lab received:

- 10 liquid mixtures (each containing 100 to 400 ToxCast chemical substances);
- Dust, serum, and wristband extract, each spiked with one of the 10 ToxCast mixtures prior to extraction; and
- Dust, serum, and wristband extract not spiked.

The labs send their results to EPA using a standardized format that allows comparison between the labs.



Silicone wristbands prepared by Oregon State University.

Phase 2: Unblinded analysis

For Phase 2 of ENTACT, as the labs report their analytical results from Phase 1, EPA scientists will reveal what chemicals were added to the samples they analyzed. This will allow the participating labs to evaluate what they correctly or incorrectly identified, and what they failed to detect.

Phase 2 of ENTACT started in June 2017 and has been completed by several labs.

Phase 3: Analysis of individual chemical substances

In the ongoing Phase 3 of ENTACT, the team shared the entire EPA ToxCast library of chemical substances (about 4,700) with five participating lab instrument vendors. Those vendors are analyzing each substance separately and creating a database of how these 4,700 substances look on their equipment.

Once the database is complete, it will be made publicly available. Then, when labs around the

world use non-targeted analysis methods to screen for substances that are included in the ToxCast library of chemical substances, they can compare their own results with those in the database.



A certified sample of house dust.

Next steps

EPA will host a [non-targeted analysis workshop](#) in August 2018 at its Research Triangle Park, N.C., facility. There, researchers will have the opportunity to discuss the interpretation of data from ENTACT, and next steps for the non-targeted analysis research community. ENTACT scientists aim to have completed Phase 1 by the time of the workshop and to have made good progress on Phase 2.

More information:

Sobus, J.R., Wambaugh, J.F., Isaacs, K.K., Williams, A.J., McEachran, A.D., Richard, A.M., Grulke, C.N., Ulrich, E.M., Rager, J.E., Strynar, M.J., Newton, S.R., 2017. Integrating tools for non-targeted analysis research and chemical safety evaluations at the US EPA. *Journal of Exposure Science & Environmental Epidemiology*.

EPA's 2018 ENTACT Workshop:

<http://bit.ly/Entact2018>

EPA's ToxCast Library:

<https://www.epa.gov/chemical-research/toxicity-forecasting>

National Institute of Standards and Technology:

www.nist.gov

Technical Contacts:

Elin Ulrich

Research Chemist
EPA National Exposure
Research Laboratory
ulrich.elin@epa.gov

Jon Sobus

Physical Scientist
EPA National Exposure
Research Laboratory
sobus.jon@epa.gov

Communications Contact:

Emily Smith

EPA National Exposure
Research Laboratory
smith.emily@epa.gov

April 2018