A Distinctive Approach to Odour Impact Assessments

Based on a Hybrid Methodology of Field Measurements, Source Sampling, and Dispersion Modelling

Elisabeth Lord, ing. P.Eng. M.Sc.
Senior professional engineer, Odour Expert

Air & Odour
elord@air-odour.com

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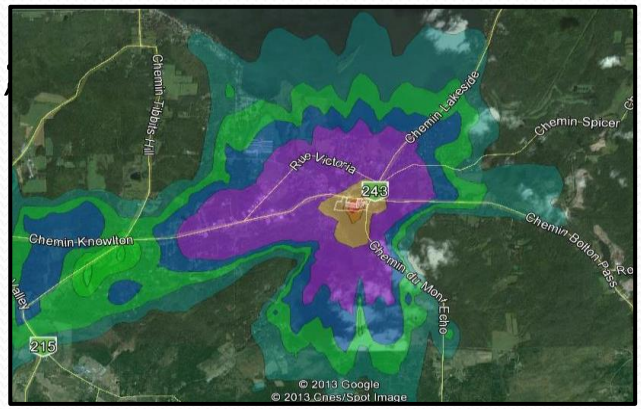
Conducting an Odour Impact Assessment

Conducting an Odour Impact Assessment

- **Typical Odour Impact Assessment:**
  - Source characterisation through sampling and olfactometric analyses
  - Dispersion modelling to generate max. impacts over a 3 to 5-yr period;
- **Downsides:**
  - Does not take into account the synergy of odours nor their intensities;
  - Sources sampling is limited and conducted once;
  - Does not study day-to-day impacts, only the maximum and highest percentiles (e.g. 98th)
  - Sampling and characterisation of known sources;
  - Atmospheric turbulence of the site is simulated and often minimized;



DISTINCTIVE APPROACH FOR ASSESSING ODOURS

The core elements of this distinctive approach are:

- adding an *odour patrol program* ; and
- use of dispersion modelling as a tool in view of developing an adapted mitigation plan.
  - for actual study of sources impacts, areas affected, frequencies of impacts, sources prioritisation, etc.

The main goal is to diagnose the odours, the site and the sources to develop a well adapted mitigation plan leading with gradual reduction of odour impacts rather than solely study the impacts using an air quality developed procedure.

DISTINCTIVE APPROACH FOR ASSESSING ODOURS

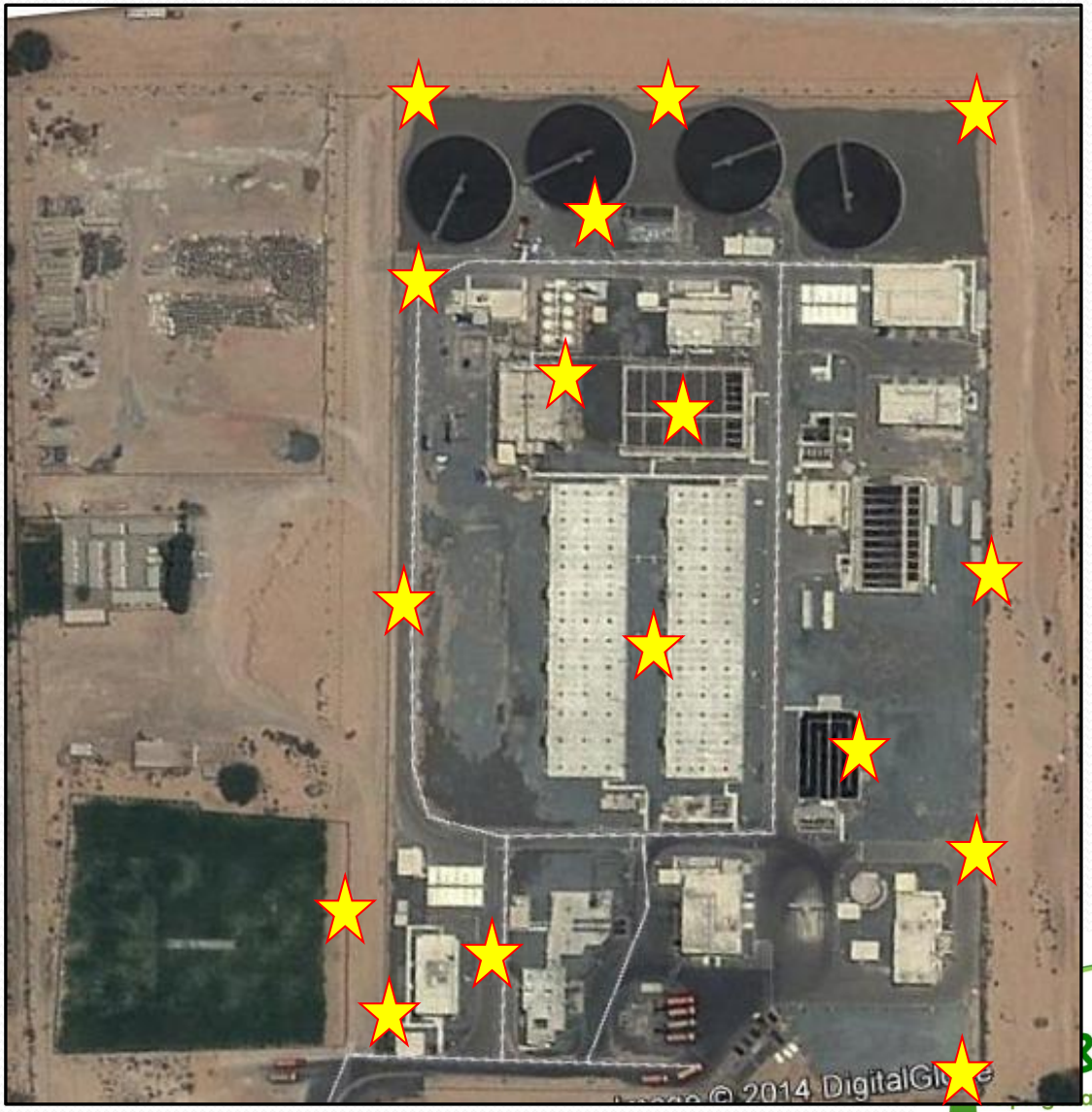
Adding an *odour patrol program* :

- Qualifies and quantifies odours at different locations on and off sites;
- Allows setting baseline levels and provides:
  - Full investigation of the site, the sources and emissions variabilities;
  - Better understanding of the level of annoyances in “normal” conditions;
  - Better understanding of impacted areas and variances on-site and beyond;
  - Odour monitoring in relation with on-site operations and upset conditions;
  - Analysis of types of odours perceived;
  - Others.

Approach – Step 1
Ambient Patrol

- Monitor established monitoring points;
- These points are established to monitor at
  - the peripheral of the site;
  - nearby sources;
  - in various key sectors within the site;
  - at distance, beyond property line;
- Recording of :
  - Odour concentrations (in my case I like to use a Scentroid SM100 field olfactometers);
  - Description of odours perceived, of operating conditions and of any incidents observed;
  - Local wind speed and direction;

Conducting an Odour Impact Assessment



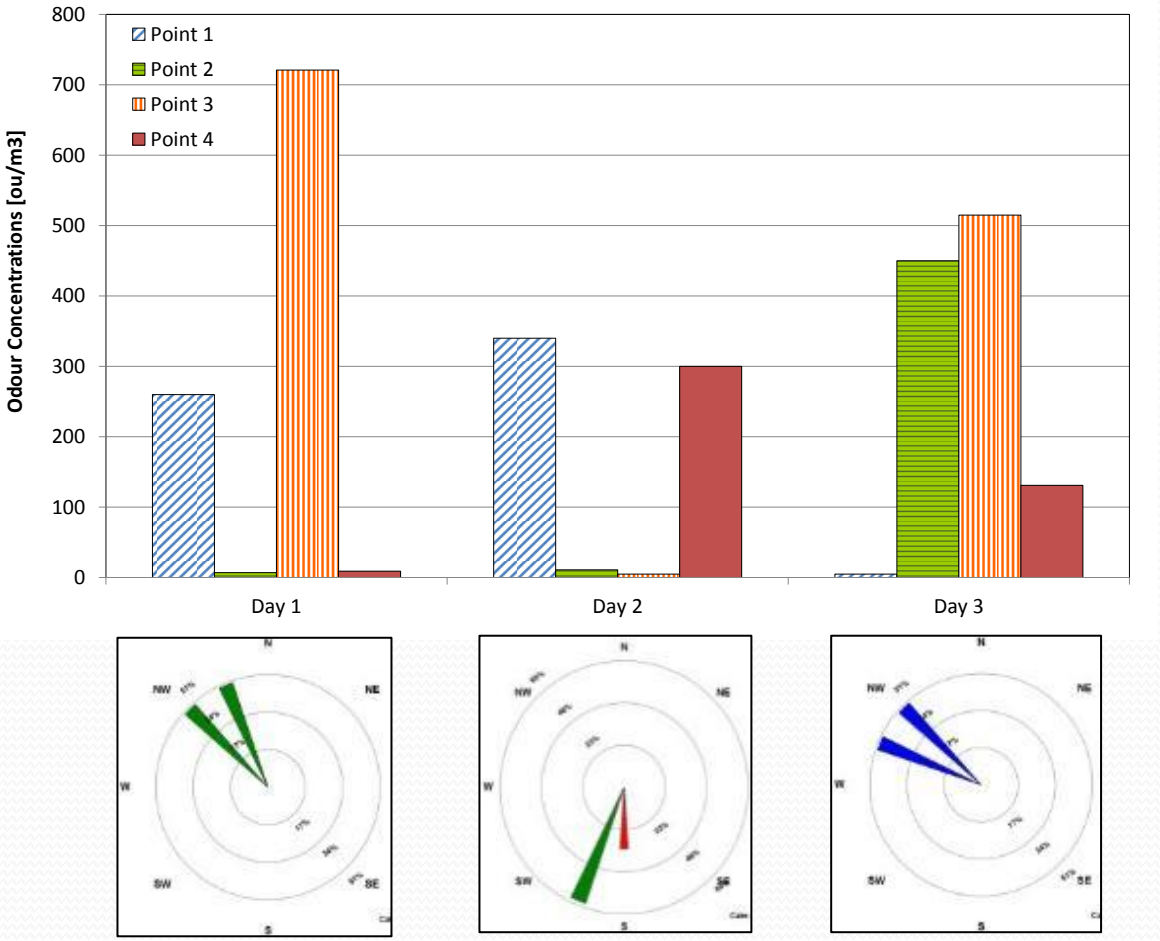
Worth of Chemical Monitoring conducted in Parallel

- Chemical compound concentrations also interesting to measure:
  - for seeking chemical tracers;
  - for obtaining information on the origin of odours; and
  - for cumulating valuable information for future odour abatement devices and future mitigation systems.

- Depending on the plant and process, chemicals of interest vary and may include:
  - Total Reduced Sulfurs (monitored individually);
  - Hydrogen sulfide (H_2S);
  - Volatile organic compounds (VOCs):
    - Total or specifics;
  - Methane (CH_4);
  - Ammonia (NH_3).

Ambient Patrol

Combining fence-line monitoring with wind direction



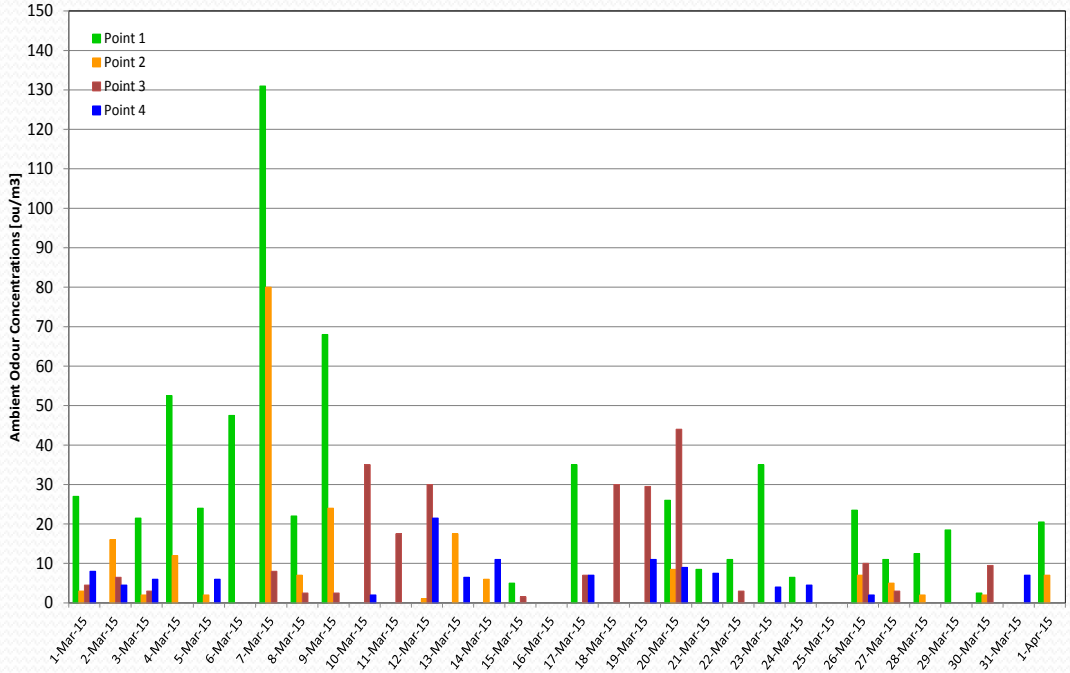
Reveals the influences of:

- On-site sources;
- External neighbouring sources;
- On-site turbulence;

AMBIENT PATROL

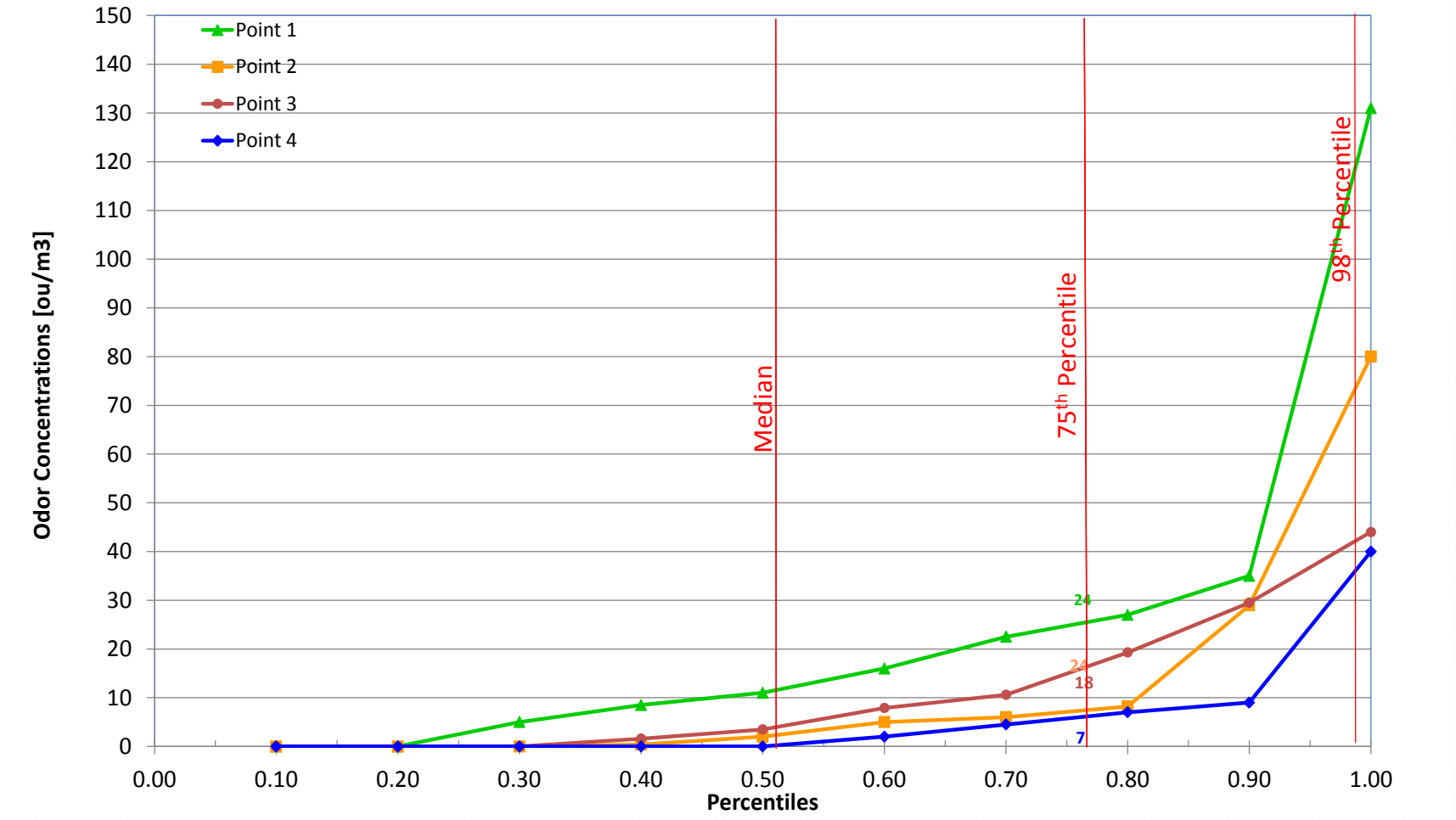
ANALYZING LONG-TERM VARIANCES

- Linkage of results to the location of measuring points is essential:
  - Close vs. distant sources;
  - Ground vs. elevated sources;
- Importance to go on-site with new acquired vision of the site to investigate with new eyes the tangible existing apparatuses and processes.
- A palpable hands-on of the odour levels and sources can be achieved.



Ambient Patrol

Setting Baseline Levels



AMBIENT ODOUR PATROL

CORRELATION WITH AIR CONTAMINANTS

- H_2S is often pointed out as being responsible for odours, though rarely can good correlations be found between these two contaminants.

Example:

Sources	WWTP-1 (Industrial)		WWTP-2 (Sanitary)	
	Odours [ou/m^3]	H_2S [ppm]	Odours [ou/m^3]	H_2S [ppm]
Sludge Dewatering building	290,000	0	208,000	135
Sludge Thickening tanks	70,000	0	184,575	135
Primary Sedimentation Tanks	16,425	5	94,850	52
Screen House	9,500	0	35,000	117
Clarifier	7,800	0	5,000	105

APPROACH – STEP 2

Odour Sampling and Olfactometric Analyses

2 types of sampling

SOURCE
Sampling

SURFACE
Sampling

Sampled in Teflon,
Nalophan or Tedlar bags

Sample characterisation
in o.u/m^3

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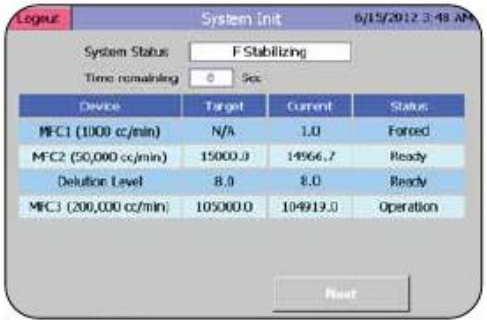
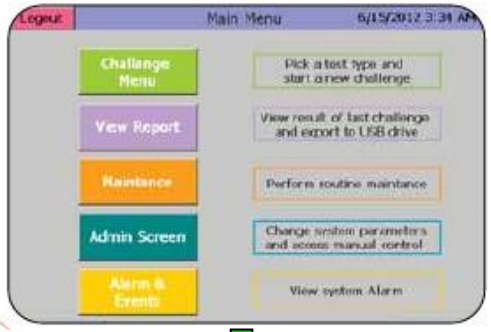
APPROACH – STEP 2

Odour Sampling and Olfactometric Analyses





Sample characterisation in o.u/m³

Use of the main reference standards :

- **ASTM for North-America**
- **CEN 13725 for Europe**
- **Etc.**

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APPROACH – STEP 3
Odour Dispersion Modelling

- **Odour Dispersion Modelling**
  - most often conducted using the AERMOD software;
  - a minimum of 3-year meteorological data from the closest airport meteorological station;
  - all sources sampled and identified as odorous are modelled;
  - odour concentrations predicted on a 4-min averaging time period (shortest time period that can be calculated and obtained);
  - the evaluation of percentiles (i.e. the 98th percentile) and the frequency of odour perception thresholds;
- **Source Prioritisation**
  - sources that have the greatest impacts off-site;
  - sources that disperse the farthest;
  - sources that impact nearby the most frequently;
  - completed while taking into account the odour patrol results and observations, the historical event analyses, discussions with the site personnel, etc.

DATA ANALYSIS

Odour Dispersion Modelling Results vs. Odour Patrol Results

Dispersion modelling results provide

- The contribution and impacts of each source or group of sources;
- Impacts of elevated sources;
- Indication of the distance of impacted areas;
- Source prioritization used into the development of a mitigation plan.

Comparison with ambient patrol data:

- Specific meteorological conditions (or days) must be looked at, and for selected sources.

Don’t forget, modelling cumulates the contaminants however odours blend together!

DATA ANALYSIS

Odour Dispersion Modelling Results vs. Odour Patrol Results

Combination of both dispersion modelling results with ambient measurements improves the understanding of

- Odours originating from the site;
- Baseline levels;
- Odour emissions;
- Impacted areas;
- Impacts from ground-level sources;
- Impacts from elevated sources;
- Level and types of odours;
- Frequencies of odours;

Both provide great information for the elaboration of a specific and adapted mitigation plan.

Approach – Step 4
Development of an Odour Mitigation and Management Plan

An odor management plan should have:

1- Detailed measures on:

- Communication with regulatory agencies and exposed receptors;
- Prevention of odour formation;
- Control odour releases; and
- Avoidance of odour nuisances.

2- Sources prioritisation;

3- Chronological Measures:

- Short-term and easy management/abatement procedures:
- Medium-term actions:
- Long-term actions:

Summary

The combination of

- ambient odour measurements: on-site and off-site;

with

- odour emission sampling, olfactometric measurements;
- dispersion modelling and impact assessment

Leads to

- A complete and real study of sources behaviours and odour levels;
- Source prioritisation;
- The elaboration of a specific and adapted mitigation plan.

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Summary

An odor patrol allows

- Achieving a better understanding of the odours originating from a site;
- Recognising the *common* conditions and variabilities;
- Investigating the site and sources prior to conducting source sampling;
- Developing an adapted mitigation plan that is specific to the sources, to the site and to the client objectives.

This approach also answers all requests from authorities and enhances communication routes.

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Thank you!

A warm thank you to A&WMA and Ides Canada

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