

IEM Committee

From: cadowns <cadowns@haereticus-lab.org>
Sent: Wednesday, October 18, 2017 10:22 AM
To: IEM Committee
Subject: Ahihi & Maui Sunscreen Chemical Survey Results of 2015 and partial-2017
Attachments: 2015 & 2017 Maui & Ahihi Sunscreen Chemical Survey.pdf

Dear IEM Committee,

I've been asked to submit this scientific data to you.

The 2017 data was done under NELAC/NELAP certification and followed a US EPA Method. This means that the method is forensically rigorous and complies with State of Hawaii requirements. Unfortunately, this forensic method is about 100x less sensitive than methods that are currently used in science.. This is because US EPA is kind of 20 years behind current technologies/methods (not their fault, standardization takes time, and by the time a standard method is approved, the method has been improved). The limit of quantification for the 2017 data is 1,000 parts per trillion. The 2015 method had a limit of quantification of 10 parts per trillion. The 2015 data was not to NELAP certification, but under the Spanish Government forensic certification (it was analyzed by the Spanish Government). In 2017, a volunteer working with Jeff sampled the Ahihi Cove at low tide, and we didn't detect anything, but that isn't surprising because it was low tide, and the limit of quantification was so horrible.

I was shocked and cringed at the 2017 data. Was kind of hoping to see a big impact on reducing sunscreen pollution by Jeff's education efforts, but as I mentioned to Jeff and Fern, I think EVERYONE is going to the poles of Maui's west coast, since that is where the best reefs are that are of the most value to tourists.

If you have any questions, I am more than happy to answer.

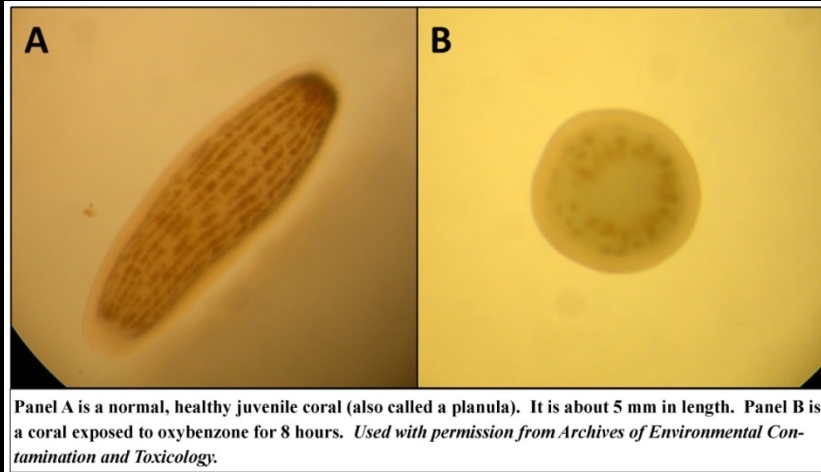
Sincerely,

Craig A. Downs, Ph.D.
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Coral Ecotoxicology of Oxybenzone



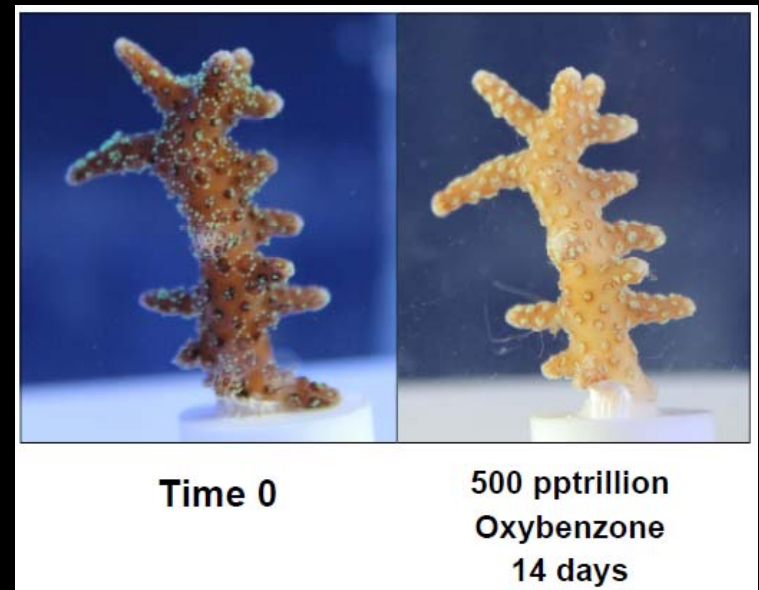
➤ DNA Damage 8h EC_{20} =
129 ppTrillion

➤ Bleaching 8h EC_{20} =
695 ppTrillion

➤ Skeletal Endocrine Disruption

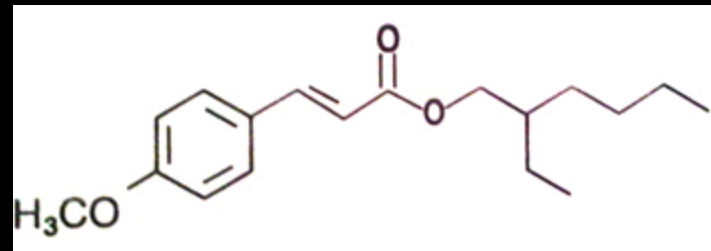
See an effect as low as 62 parts per trillion in coral planula

Will induce coral bleaching at 80°F
In less than 14 days at 1/3 full sunlight



Octyl methoxycinnamate (octinoxate)

- **Endocrine Disruptor**
 - Reduced sperm count
 - Reduced gonad tissue
 - Reduced thyroid function
 - Reduced neurological function
- **Developmental Disruptor**
- **Sea urchin Embryo EC_{20} = 900-49,000 ppTrillion**
- **Clown Fish Embryo EC_{20} = 223 ppTrillion**



**Sunscreen chemical
in sunscreen lotions**

Estimated Contamination?



Ahihi Kina'u Bay (Natural Areas Reserve)

(2017 averaged 1,200 swimmers/day)

= 76.8 kilograms of sunscreen lotion a day. 64 grams per person (American Acad. Dermatol.)

= 2.3 kilograms of oxybenzone a day (3% oxybenzone).

= 69.1 kilograms of oxybenzone per month (~152 pounds per month)

= 829 kilograms of oxybenzone per year (1,828 pounds /year)

= 27,648 kilograms of sunscreen product per year (60,953 lbs/year)

Oxybenzone Pollution

425 pptrillion
(2015)

- 868 pptrillion (2015)
- 1,850 pptrillion (2017)

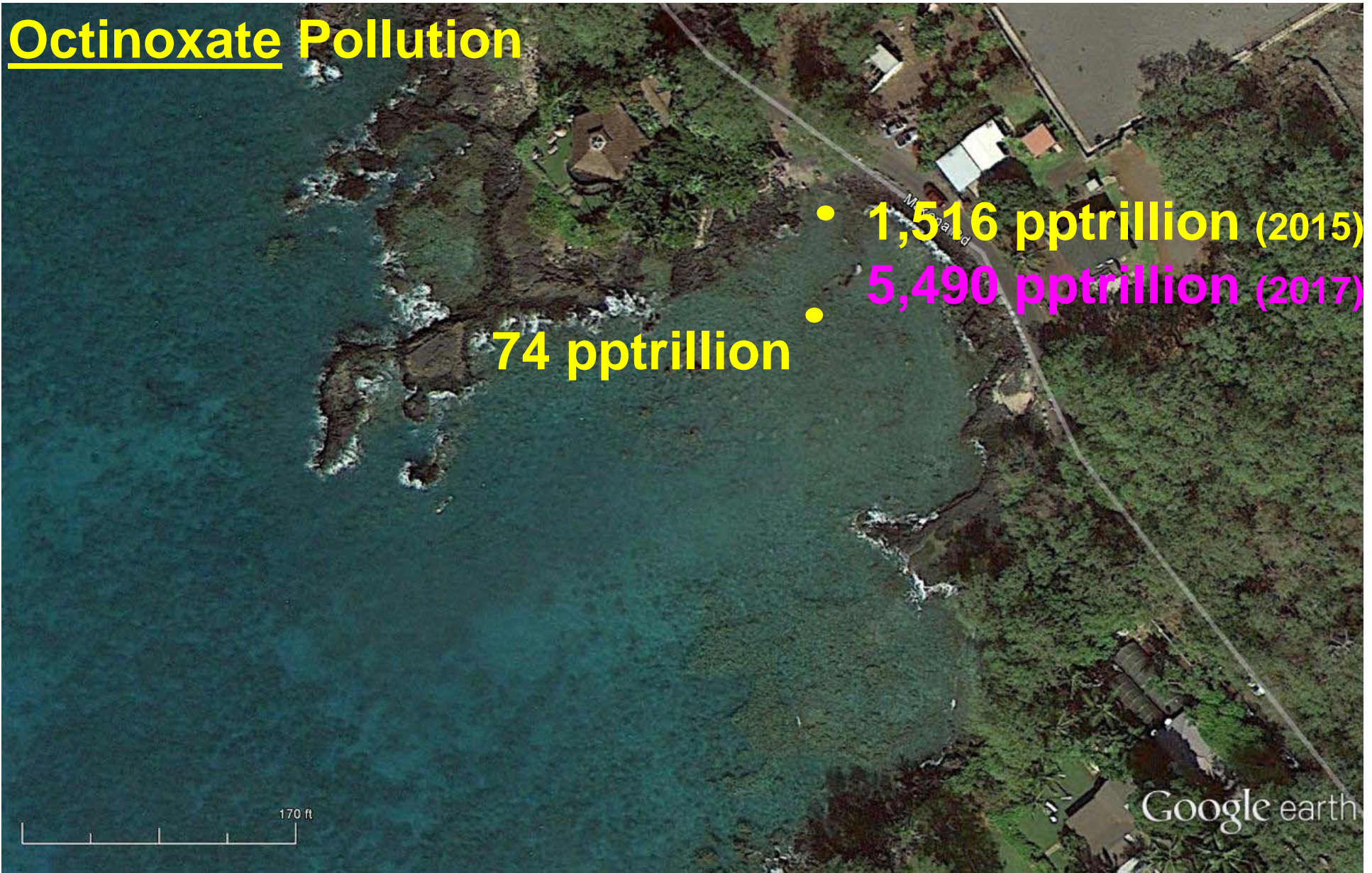


Google earth

Sampled on July 27, 2015, 15:00 HST

Sampled on June 23, 2017, 17:05 HST

Octinoxate Pollution



Sampled on July 27, 2015, 15:00 HST

Sampled on June 23, 2017, 17:05 HST

An aerial satellite image from Google Earth showing a coastline. The ocean is on the left, and the land is on the right. A yellow dot is placed on the shoreline, indicating a sampling location. The land features a mix of green vegetation and brown, possibly volcanic, terrain. A parking lot with several cars is visible in the upper right corner.

10,400 pptrillion (Oxybenzone)

13,100 pptrillion (Octinoxate)

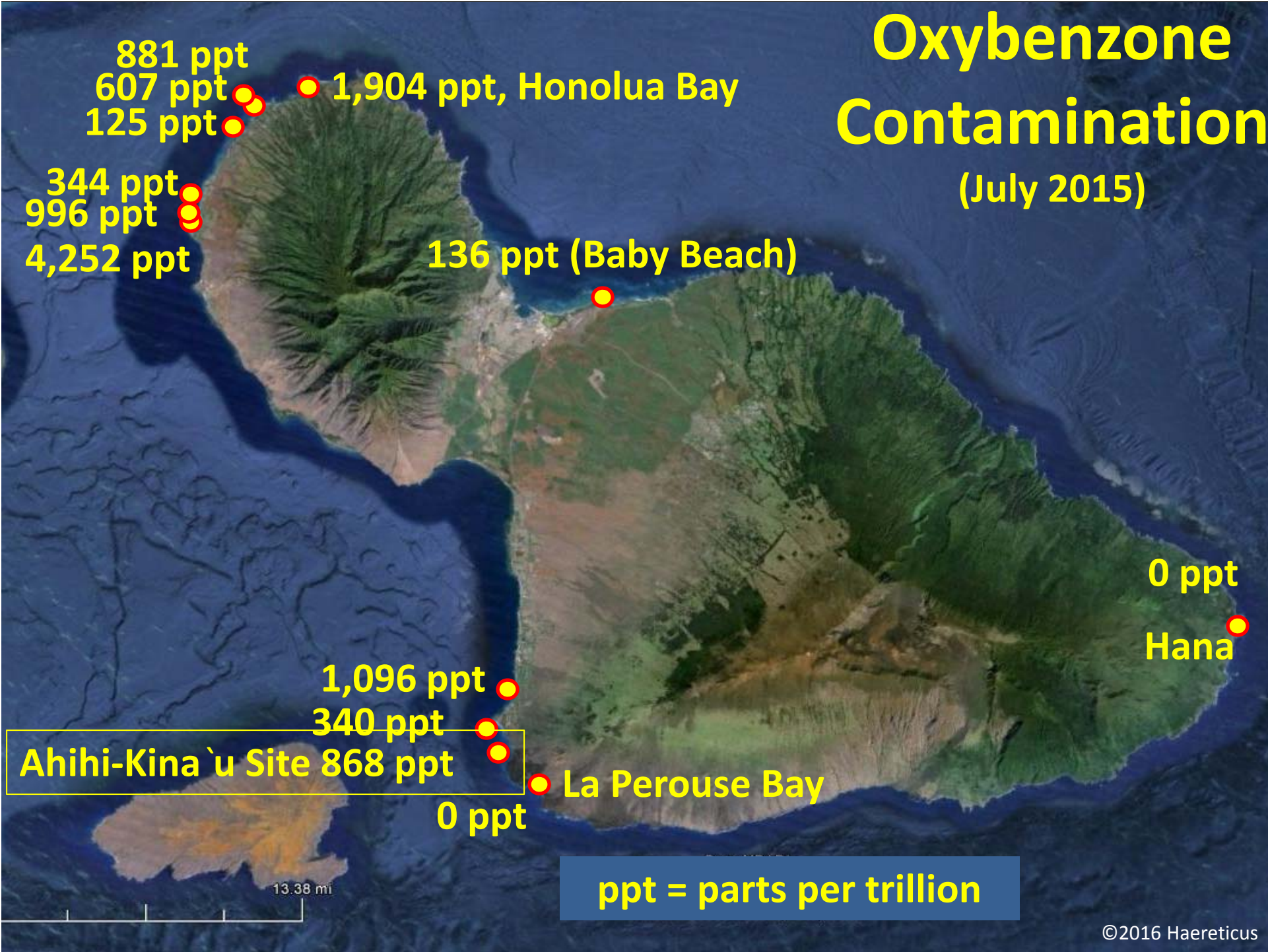
Google Earth

**Oxybenzone & Octinoxate Contamination
Sampled on June 23, 2017, 16:19 HST**

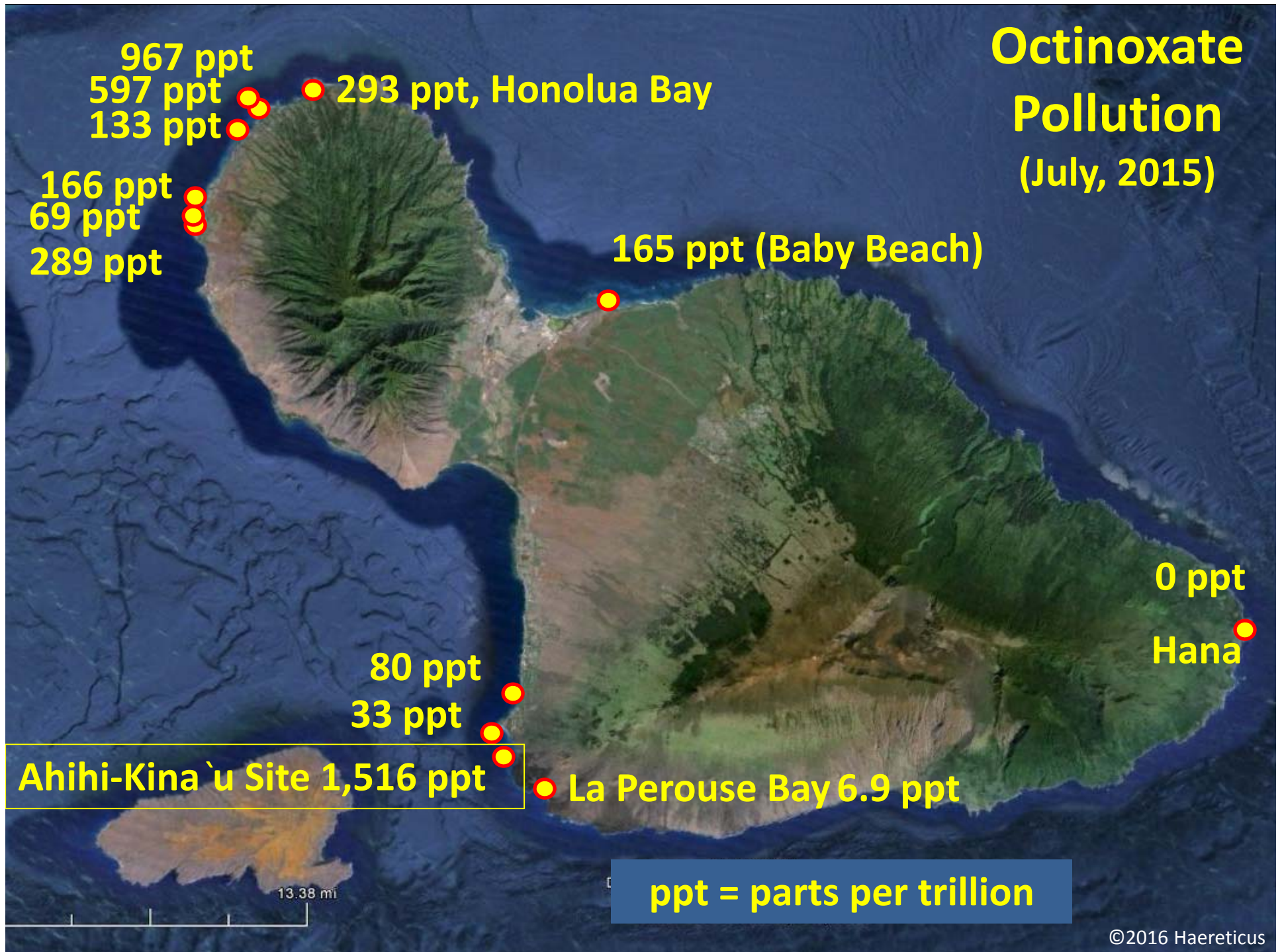
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Oxybenzone Contamination

(July 2015)



Octinoxate Pollution (July, 2015)



**Is beach contamination and tidal
flux a source of sunscreen
pollution?**

Northwest coast of Maui, Hawaii, USA

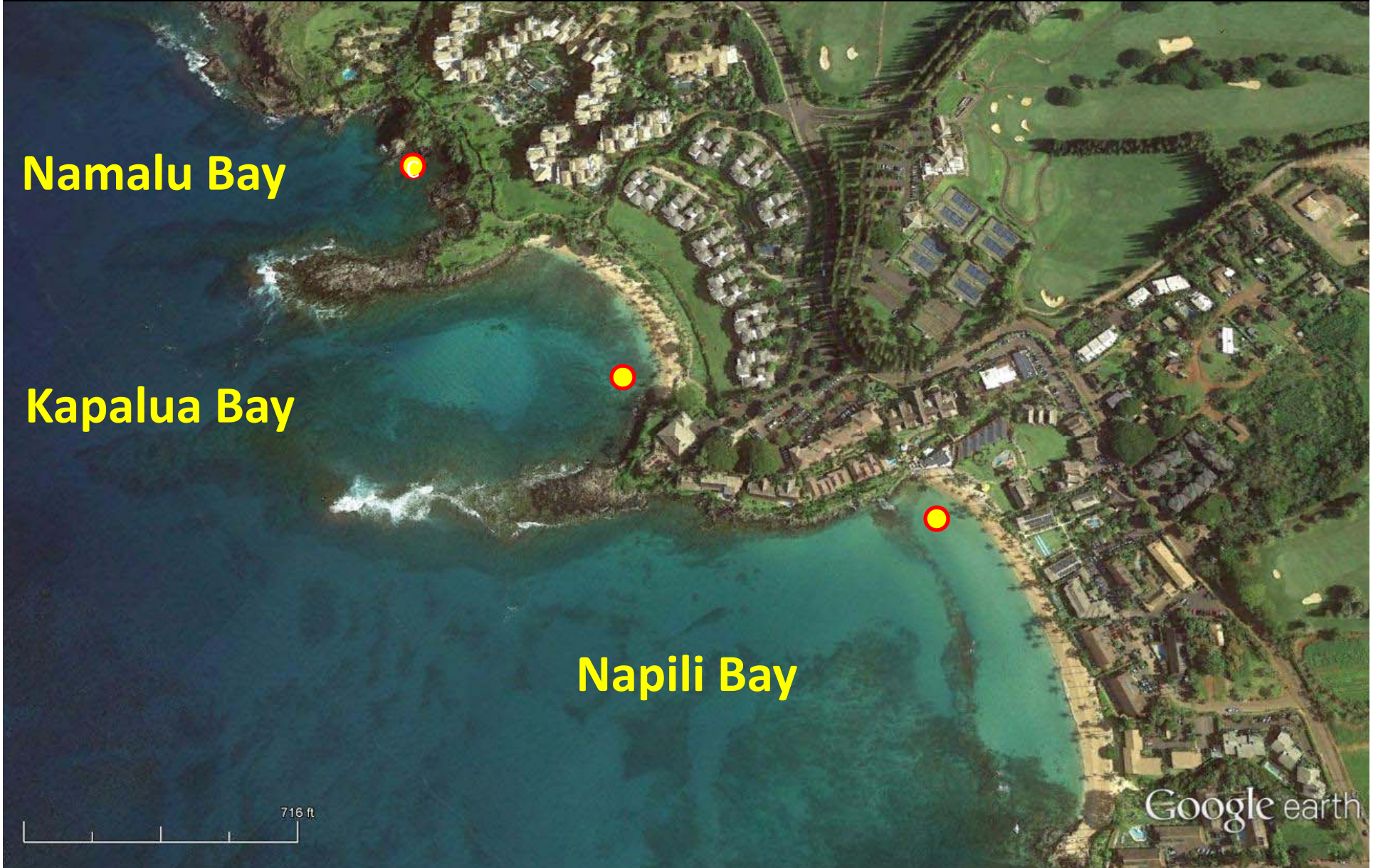
Namalu Bay

Kapalua Bay

Napili Bay

716 ft

Google earth



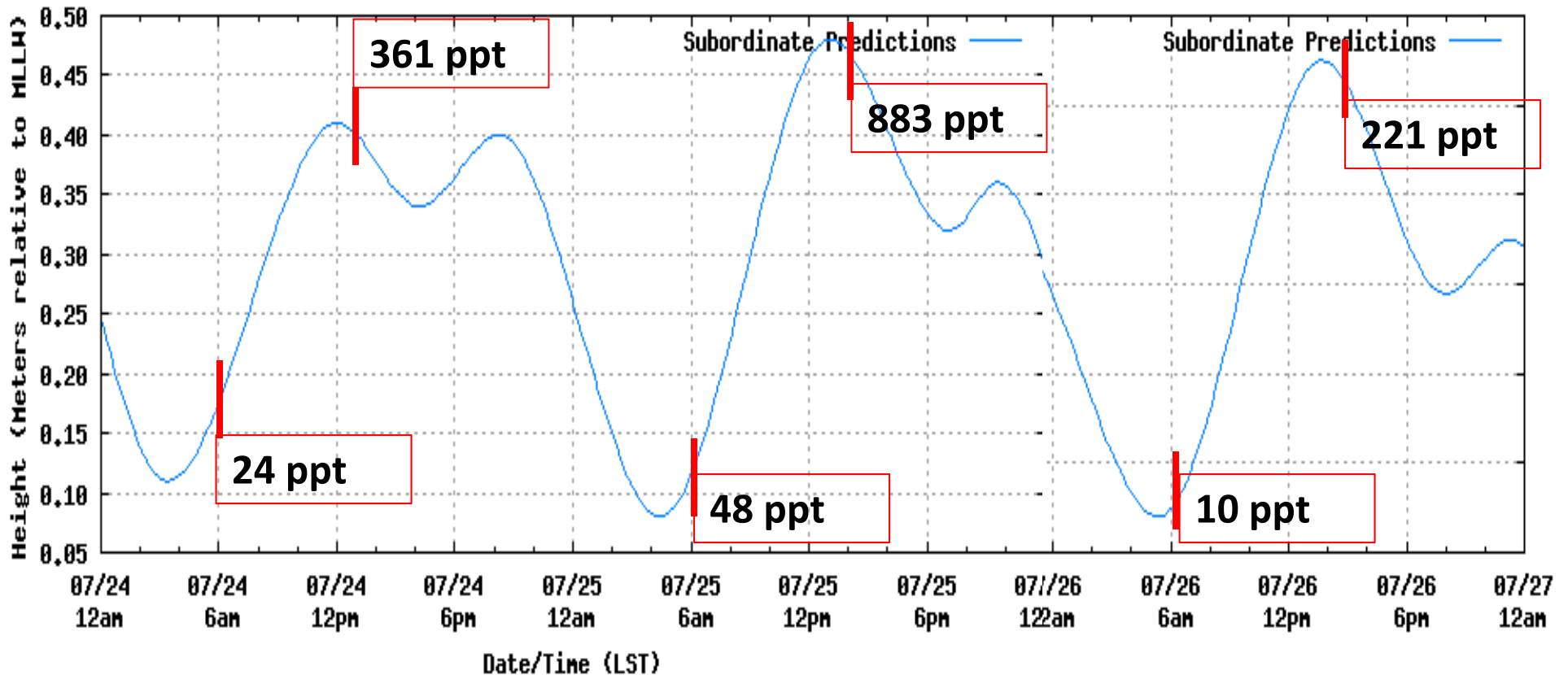
Kapalua Bay

We sampled water at the same spot during low and high tide for 3 days.



Kapalua Bay

(Maui, Hawaii)



Tidal fluctuations of Oxybenzone Concentration

Correlation = 0.7698, $p = 0.0034$

High tide “frees” up sunscreen residue that accumulates in the sand. Most likely from aerosol spray can applications.

Is Oxybenzone Found in Beach Sand?

- Collected 2.5 kg beach sand per site
- Liquid extraction, then SPE capture
- LC-MS/MS analysis

Yes!

Napili Bay = 478 ng/kg Oxybenzone

Kapalua Bay = 1,004 ng/kg Oxybenzone

How far does aerosol sunscreen mist carry?

