



## Odor Science & Engineering, Inc.

January 5, 1992

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Mr. Osmond Engleton  
Hyperion Wastewater Treatment Plant  
1200 Vista Del Mar  
Playa Del Rey, California 90291

RE: Evaluation of Odor Neutralizing Products on Sludge Odors  
OS&E Project No. 0285-M-00

Dear Mr. Engleton:

This letter constitutes Odor Science & Engineering, Inc.'s (OS&E) report of the evaluation of odor neutralizing products on reduction of sludge odors for the Hyperion Treatment Plant.

Manufacturers/suppliers of odor neutralizing products were contacted by Hyperion and invited to send their products to OS&E's laboratory for evaluation. The following products were selected to be tested:

<u>Manufacturer/Supplier</u>	<u>Product Name</u>
1. F-Matic of America	#1002-250 (Manufactured by Nature Plus)
2. A.T. Products Corp.	Anotec 0307
3. Odor Management, Inc.	Ecosorb 606
4. X-O Corporation	X-O
5. Epoleon Corp. Of America	N-7C
6. Empire	# 5423
7. Odor Control Co.	#10181 and #10410
8. Surco Products Inc.	# 121292
9. Odor Control International	Zerodor
10. Ecolo	#23 (GR)
11. C + L Supply Company	ADL Odor Eliminator A

### PROCEDURE:

Samples of the sludge air were collected by Hyperion staff into 25 L Tedlar gas sampling bags on December 16th and 17th, 1992. Each day, the bags were shipped via overnight air express to OS&E's Olfactory Laboratory in Bloomfield, CT. The effectiveness of each odor neutralizing product in control of the sludge odors generated at Hyperion was tested using a trained and screened odor panel in accordance with the following testing procedures:

To best simulate the intimate gas/liquid contact of the proposed atomized spray system, the odorous sludge air was bubbled through solutions of the odor neutralizing products for

laboratory comparison testing. At the request of Hyperion, a concentration of 1 part concentrate to 250 parts water was made for each product. A 10 ml aliquot of this solution was placed in a midget impinger. Following a 1 liter purge of the sludge air through the solution, a 2 liter volume was then bubbled through the solution and collected at the outlet of the impinger into a 2 liter Tedlar sampling bag for analysis by the odor panel. The inlet (untreated) and outlet (treated) samples were analyzed by dynamic dilution olfactometry in accordance with ASTM Method E-679. The odor properties of concentration, intensity, character and hedonic tone (degree of pleasantness or unpleasantness) were determined for each sample by the odor panel.

## RESULTS

The results of the odor analyses are presented in Table 1. The table lists the odor concentration in terms of dilutions-to threshold (D/T) as measured by the odor panel. The table also lists the average of the individual panelist's hedonic tone scores and intensity ratings. For the purposes of direct comparison, these scores were developed at a set dilution of 100 times for each sample. The hedonic tone is a measure of the degree of perceived unpleasantness or pleasantness of the odor. This was rated on a scale with the following parameters: -5 (Extremely Unpleasant), 0 (Neutral) and +5 (Extremely Pleasant). The intensity was based on the n-butanol standard reference scale in accordance with ASTM Method E-544. The scale consists of a series of 8 standardized concentrations of butanol vapor which represent different odor intensities. The scale ranges from 1 (near threshold level) and increases to 8 (extremely strong).

Odor complaints are based primarily on the intensity of the perceived odor sensation. To some extent, the intensity of the sensation is also affected by the hedonic tone of the odor. The relation between intensity and concentration of an odor is expressed in Steven's Law of Psychophysics, as follows:

$$I = kC^n$$

where I = odor intensity (butanol scale)

C = odor concentration (D/T or ppm)

k = proportionality constant (y-intercept)

n = exponent specific for each odor, but usually varying between 0.2 and 0.8

Thus, from this relation it is apparent that intensity increases (or decreases) more slowly than odor concentration.

Accordingly, in evaluating the effectiveness of each material tested with regard to improving the odor sensation of the treated sludge odor the following weighting factors were used:

intensity score x 1.5 plus hedonic tone score x 1.2 plus percent reduction in odor concentration.

The results of the untreated sludge air are compared to those treated with the various neutralizing agents. To be successful and considered to function as an odor neutralizer, the treatment with the neutralizing agents should result in some degree of odor removal, a



change in the odor character resulting in something considered to be hedonically more pleasant and a change to an odor which is perceived to be of less intensity than the unadulterated sludge odor. To make this comparison, the effectiveness of all three parameters was calculated and an overall ranking of product effectiveness was developed. The overall rank score was determined by the sum of the weighted net improvement in hedonic tone and the weighted net reduction in intensity (as compared to the untreated sludge air) and the percent odor removal efficiency. Since the tests were performed on two separate days with different samples of sludge air, the ranking was performed for each day's tests.

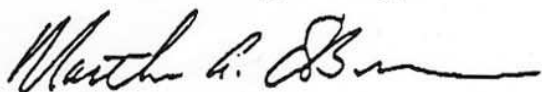
The results of the first day's testing showed that four of the five products tested did in fact perform as odor neutralizers. All four did reduce the odor concentration, as compared to the unadulterated sludge odor, reduced the intensity and improved the hedonic tone of the treated odor. The fifth product, N-7C, supplied by Epoleon Corp. of America, resulted in a slight increase in the intensity of the treated odor.

The most effective of these odor neutralizers was the F-Matic of America #1002-250\* product with an overall score of 5.27. The next most effective product was the Anotec 0307 supplied by A.T. Products Corp. with a total score of 4.77. This was followed by the Ecosorb 606 product supplied by Odor Management, Inc. with a total score of 3.72.

The results of the second day's testing show that only one of the seven (7) products tested, the #23 (Green) supplied by Ecolo, clearly functioned as an odor neutralizer in that the treated odor was lower in odor concentration and intensity and improved the hedonic tone of the treated odor. The Zerodor product supplied by Odor Control International, also performed as an odor neutralizer but the treated odor had a slightly higher odor intensity. The remaining five products tested on December 18, 1992 all are clearly masking agents - not odor neutralizers. The treated odors were all more concentrated (higher D/T values) than the untreated sludge and more intense although considered more hedonically pleasant.

We appreciate the opportunity to be of continued service to Hyperion. Please feel free to contact me or Richard Duffee if you have any comments or questions regarding these results or if you desire any further testing to be performed.

Sincerely,  
Odor Science & Engineering, Inc.



Martha A. O'Brien  
Principal

\* This is the EcoCare1002-250 formula manufactured for F-Matic by Nature Plus, Inc., New Canaan, CT 06840 (203-972-1100)



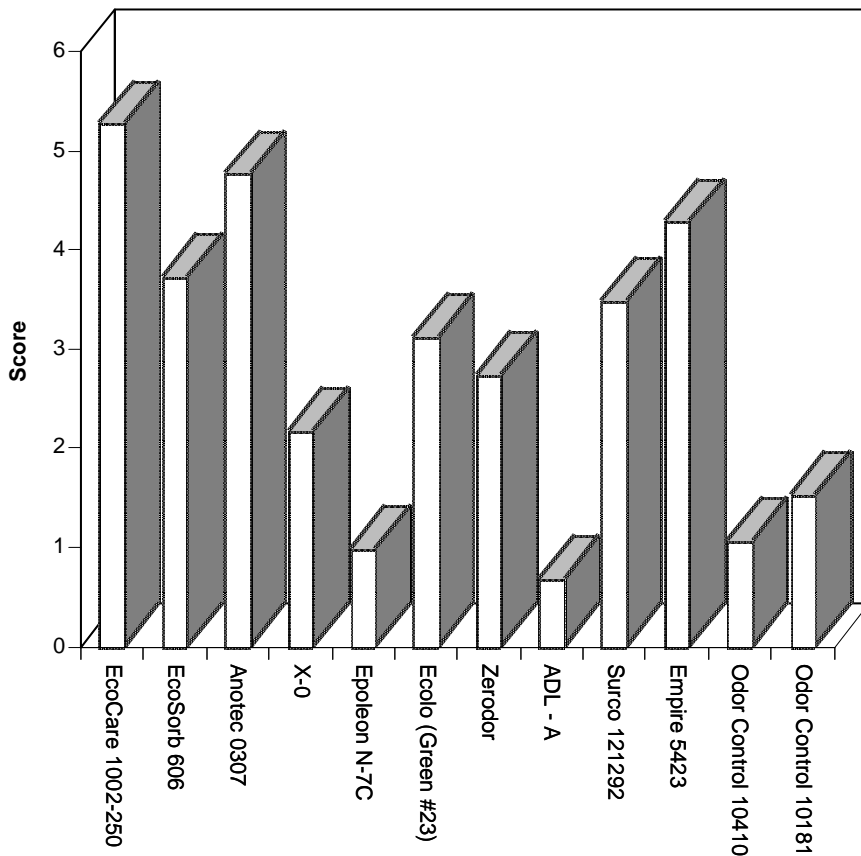
# NATURE<sub>plus</sub>

ENZYMEPRODUCTS

## EcoCare Exceeds Competitors

A comparison study conducted by an independent odor science laboratory compared the effectiveness of EcoCare® 1002-250 to eleven competitive odor neutralizing products. Treated and untreated sludge odor air samples were analyzed by dynamic dilution olfactometry. Odor properties of concentration, intensity, character, and hedonic tone (degree of pleasantness or unpleasantness) were determined for each sample by a trained and screened odor panel. Scores were given for each category and a total relative score was determined. The resulting scores are shown below. The most effective of the odor neutralizers tested was EcoCare 1002-250.

### OVERALL SCORING



(Details available upon request)