OHIO DEPARTMENT OF HEALTH

246 North High Street
Columbus, Ohio 43215

614/466-3543
www.odh.ohio.gov

Ted Strickland/Governor

Alvin D. Jackson, M.D./Director of Health

December 29, 2009

Irene Cook, Project Officer
Water Division, USEPA
77 West Jackson Blvd., WS-15J
Chicago, IL 60604

RE: Final Beach Grant Report – CU-00E52601-0

Dear Ms. Cook,

Enclosed please find a copy of the final report for Ohio's Beach Monitoring Grant program. We wish to thank you for the opportunity to provide Lake Erie beach monitoring services for the residents of Ohio.

If you have any questions or would like to discuss the information in this report, please feel free to call 614-466-1390 and ask to speak with Mary Clifton, Program Administrator or myself.

Sincerely,

Gene Phillips, RS

W. Gene Phillips, MPH, RS
Chief, Bureau of Environmental Health
Ohio Department of Health
246 N. High Street
Columbus, OH 43215

Cc: Holly Wirick, US EPA

YEAR 2009 BATHING BEACH MONITORING PROGRAM RESULTS

Ohio operates a monitoring and notification program of selected public and semi-public beaches located along the Ohio/Lake Erie border. The goal of the program is to monitor the bacteria content of the state's bathing beach waters and to notify the public whenever bacteria levels present a potential health risk to bathers. The program involves the efforts and cooperation of multiple state and local health agencies and organizations. The Ohio Department of Health (ODH) coordinates the state effort and is responsible for monitoring several beach locations along the border.

The normal beach season in Ohio runs approximately 13 weeks, from Memorial Day to Labor Day. For the 2009 swimming season, ODH staff collected water samples from most beaches at a frequency of 4 days per week. The waters at two island beaches on Lake Erie were sampled once per week during the period because results have shown that their bacteria levels have never presented a potential health hazard. Due to State budget turmoil, no samples were taken at beaches sampled by ODH from July 1st to July 15th. During this timeframe, the State froze all pending contracts until the legislature passed a biannual budget. The State of Ohio fiscal calendar runs from July 1st to June 30th.

During 2009, water quality analysis in Ohio was based upon the single sample maximum established by the US EPA of 235 E. coli colony forming units (cfu) per 100mL. of water sampled. All water samples collected by ODH staff were analyzed at private microbiological laboratories for E. coli bacteria content. ODH, Erie County and Lake County used the Collilert-18 method for sample analysis which has a maximum detection limit, without dilution, of 2419.6 cfu. Cuyahoga County and the Northeast Ohio Regional Sewer District used the Modified M-tech to analyze their samples. When sample results exceeded the standard, advisory signs were posted to alert the bathing public of the condition of the water. Under normal circumstances, beaches are not closed solely due to high bacteria levels. But the signage helps to educate the public and give them valuable data for making informed decisions about their aquatic recreational activity.

Additionally, the results of tests for each monitored beach were made available to the public at the Ohio Department of Health's website (www.odh.ohio.gov), on the Earth 911 website (www.earth911.com) and on the department's toll-free telephone information line: 1-866-OHIO-BCH (644-6224). In cooperation with the Cuyahoga County Health District, sample results were also published weekly in the "Cleveland Plain Dealer". Reports of beach conditions in Lake County were also published by the "News Herald" throughout the summer.

The following table depicts the results of this year's program for Lake Erie beaches, which operated from late May 2009 into the first week of September 2009.

Monitoring Data generated by the Ohio Department of Health

Sample frequency: 4 days per week (island beaches - weekly)

Beach Name	County	# of Sample Days	# of Times Sample Exceeded Standard	# of Days Advisory Signs Posted	Average E.coli Level Over Sample Period
Conneaut Twp. Park	Ashtabula	50	5	22	62.44
Geneva State Park	Ashtabula	50	3	9	96.27
Lakeshore Park	Ashtabula	50	17	36	260.31
Walnut Beach	Ashtabula	50	2	5	38.07
Century Beach	Lorain	49	13	26	227.82
Lakeview Beach	Lorain	49	6	12	106.02
Kelleys Island St. Pk.	Erie	10	0	0	22.35
Camp Perry	Ottawa	51	12	24	171.57
Catawba Island St. Pk.	Ottawa	51	3	3	81.85
East Harbor State Park	Ottawa	51	1	1	45.03
Lakeside	Ottawa	51	1	1	65.77
Port Clinton (Lakeview)	Ottawa	52	6	12	182.64
South Bass Island St. Pk.	Ottawa	13	0	0	24.58
Maumee Bay St. Pk. (Erie)	Lucas	51	10	16	118.97
Maumee Bay St. Pk. (Inland)	Lucas	51	5	8	156.08
Total		679	84	175	

Additional Monitoring/Notification Programs for 2009

Under a Personal Service Contract with ODH, the Lake County General Health District, a local health district in northeastern Ohio, conducted a monitoring and notification program of the 3 beaches on Lake Erie within its jurisdiction. It also utilized the single sample maximum to evaluate sample results. Results were reported to ODH for evaluation against the standard, determination of whether an advisory was warranted, notification to the public if necessary and eventual transmission to the US EPA for its e-beaches database.

Contracts were also awarded to the Erie County General Health District, Cuyahoga County Board of Health, and the Northeast Ohio Regional Sewer District. The Erie County General Health District monitored 25 public beaches within its jurisdiction. The Northeast Ohio Regional Sewer District monitored 3 beaches in its area, the same as in 2008. The Cuyahoga County Board of

Health monitored 16 beaches within its jurisdiction, up from 13 in 2008. Cuyahoga County has many semi-public and private beaches. Shorehaven beach is a private beach located in Cuyahoga County and is a new beach for the 2009 monitoring season. As it was a new beach, the Cuyahoga County Board of Health allotted for seven samples to be taken during the season. The last sample taken on the 14th of July showed elevated e-coli which caused an advisory posting. No further samples were taken at this beach. The advisory sign was left in place for the remainder of the season.

Monitoring Data generated by the Lake County General Health District

Sample frequency: daily

Beach Name	County	# of Sample Days	# of Times Sample Exceeded Standard	# of Days Advisory Signs Posted	Average E.coli Level Over Sample Period
Fairport Harbor	Lake	111	15	15	116.22
Headlands State Pk. (East)	Lake	111	9	9	85.85
Headlands State Pk. (West)	Lake	111	7	7	75.63
Total		333	31	31	

Monitoring Data generated by the Erie County General Health District

Sample frequency: Three times per week

Beach Name	County	# of Sample Days	# of Times Sample Exceeded Standard	# of Days Advisory Signs Posted	Average E.coli Level Over Sample Period
Battery Park	Erie	44	0	0	6.03
Bay View East	Erie	44	3	13	100.46
Bay View West	Erie	44	15	33	660.85
Cedar Point	Erie	44	5	8	98.58
Chappel Creek	Erie	44	5	9	103.98
Cranberry Creek	Erie	44	0	0	43.19
Crystal Rock	Erie	44	15	41	300.91
Darby Creek	Erie	44	11	21	283.52
Edson Creek	Erie	44	18	40	498.70
Fichtel Creek	Erie	44	3	10	56.43
Hoffman Ditch	Erie	44	3	7	69.82
Huron River East	Erie	44	6	15	164.05
Huron River West	Erie	44	6	16	129.61

Kiwanis Park	Erie	44	5	6	101.94
Lion's Park	Erie	44	0	0	23.70
Old Woman Creek East	Erie	42	0	0	18.99
Old Woman Creek West	Erie	44	1	2	25.50
Pickeral Creek	Erie	44	1	4	54.08
Sawmill Creek	Erie	43	3	3	115.05
Sherod Creek	Erie	44	13	27	240.81
Showse Park	Erie	44	4	13	160.76
Sugar Creek	Erie	44	7	14	120.41
Vermilion East	Erie	44	9	23	248.00
Vermilion West	Erie	43	12	25	240.61
Whites Landing	Erie	44	5	10	158.12
Total		1096	150	340	

Monitoring Data generated by the Cuyahoga County Board of Health

Sample frequency: 1 day per week (avg.)

Beach Name	County	# of Sample Days	# of Times Sample Exceeded Standard	# of Days Advisory Signs Posted	Average E.coli Level Over Sample Period
Arcadia Beach	Cuyahoga	14	5	33	982.93
Bay Park Beach	Cuyahoga	14	0	0	29.82
Clarkwood Beach	Cuyahoga	14	3	20	908.57
Clifton Beach	Cuyahoga	28	4	14	205.39
Columbia Park Beach	Cuyahoga	14	2	11	94.57
Edgecliff Beach	Cuyahoga	13	5	48	462.92
Huntington Beach	Cuyahoga	100	10	10	106.97
Moss Point Beach	Cuyahoga	14	4	27	375.86
Noble Beach	Cuyahoga	14	5	34	700.57
Parklawn Beach	Cuyahoga	15	2	10	115.60
Royal Acres Beach	Cuyahoga	14	3	20	856.43
Sims Beach	Cuyahoga	14	5	34	473.57
Shoreby Club Beach	Cuyahoga	14	5	34	615.21
Shorehaven Beach	Cuyahoga	7	2	59	245.71
Utopia Beach	Cuyahoga	14	3	20	988.93
Wagar Beach	Cuyahoga	15	2	4	146.93
Total		318	60	378	

Monitoring Data generated by the Northeast Ohio Regional Sewer District

Sample frequency: 5 days per week (avg.)

Beach Name	County	# of Sample Days	# of Times Sample Exceeded Standard	# of Days Advisory Signs Posted	Average E.coli Level Over Sample Period
Euclid State Park	Cuyahoga	114	43	43	593.82
Edgewater Beach	Cuyahoga	110	29	29	200.27
Villa Angela State Park	Cuyahoga	114	46	46	780.85
		338	118	118	

NOWCASTING

During the summer of 2009, the Cuyahoga County Board of Health continued a pilot project at Huntington Beach, located on Lake Erie in Bay Village, Ohio. The project, known as a Nowcasting System for Predicting Beach Advisories, evaluates multiple environmental factors such as rainfall, turbidity, wave height, etc. to determine a predicted E. coli concentration and a probability that the E. coli water quality standard will be exceeded. The Nowcast system provides the public with same-day, near real-time water quality data seven days per week.

For 2009, the beach sampling season was divided into two sub-seasons, sub-season 1 and sub-season 2. Sub-season 1 was implemented from May 18, 2009 through July 23, 2009. The probability for sub-season 1 was set at 23% or greater likelihood that the water quality standard would be exceeded an advisory was issued. For sub-season 2, the probability was set at 26% or greater. For both seasons the Nowcast model accurately predicted the water quality 86% of the time, up from 85% in 2008.

As in previous years, it was agreed that water samples would be collected and analyzed for E. coli in the normal fashion in addition to the sample protocol for the Nowcast system. It was also agreed that the Nowcasting predictions would solely be used as the determinant for posting water quality advisories at Huntington Beach. A detailed explanation of the project as well as results of sampling and predictions was available to the public throughout the summer at the following website, www.ohionowcast.info.

This pilot project was expanded in 2008 to include Edgewater State Park beach in the City of Cleveland. The Northeast Ohio Regional Sewer District along with the USGS monitored the pilot project at Edgewater beach. Water samples were also collected at Edgewater Beach to compare with the Nowcast predictive model. The percent probability of exceeding the water quality standard changed during the season. From May 17, 2009 through June 8, 2009, Season 1, the probability was established at 22%. Season 2 ran from June 9, 2009 through August 10, 2009

with a probability of 27%. Season 3 ran from August 11, 2009 through September 7, 2009 and the probability was set at 32%. Overall, the Nowcast model for the Edgewater beach was 76% accurate for 2009, up from 65.8% accuracy in 2008. The NEORSD and the USGS will continue to reevaluate the model parameters in an effort in to improve the predictability of the system.

Additional accomplishments in 2009

In addition to monitoring water quality at beaches along Lake Erie, the Northeast Ohio Regional Sewer District (NEORSD) continued to collaborate with staff of the US Geological Survey (USGS) and the Cleveland Department of Public Health to evaluate rapid analytical techniques, such as Quantitative Polymerase Chain Reaction (qPCR), in water quality analysis. Also, the Erie County General Health District began working with the USGS to conduct Immunomagnetic Separation/ Adenosine Triphosphate (IMS/ATP) method and the qPCR method on 3 of their beaches. These methods where being done as a pilot to help the USGS test the efficacy of the 2-4 hour procedure.

The Cleveland Department of Public Health continued with the development of educational materials for the beach-going public and participated in various outreach activities held along the Lake Erie border. Again this year, the department was a major participant in "National Clean Beaches Week" activities held at beaches within their area, notably, Villa Angela, Euclid Beach and Edgewater Beach. Staff distributed beach-related flyers and information to libraries and recreation centers in the greater Cleveland area. Staff also conducted a survey to determine whether there were any newly developed private or semi-private beaches in the area.

The Ohio Department of Health hired 3 interns for 2009. Two interns where used to collect samples at beaches and transport these samples to labs for analysis. During the timeframe between July 1st and July 15th, these interns traveled to the beaches they were sampling and reevaluated locational data previously on file. These interns also noted any possible sources of contamination that may lead to beach advisories. The interns documented their findings in writing and sketches. The third intern assisted with the results data and notification process. She was also able to review past data for trends as they relate to higher rates of sample exceedance and sample exceedance in correlation to weather, mainly precipitation. Her research found that from 2002-2008, over 50% of the days when an advisory was issued, for all beaches, the weather conditions were rain and/or thunder.

In an effort to spend monies previously unspent, ODH was granted approval from US EPA to begin the development of a web-based beach monitoring application. This application, once developed, will enable the public to have more rapid access to beach sampling information and advisories at the different beaches along the shoreline. In addition, the public will be able to sign up for email alerts regarding sample results at each beach. The process for selecting a vendor is underway. It is expected to have this application in place for the 2010 beach monitoring season.

September 26, 2009

Mr. W. Gene Phillips
Administrator - Contract Manager
Ohio Department of Health
Bureau of Environmental Health
246 North High Street
Columbus, Ohio 43215

Dear Mr. Phillips,

The Northeast Ohio Regional Sewer District (NEORSD) appreciates the opportunity to participate with the Ohio Department of Health's Beach Monitoring Program. This year NEORSD has completed all the work that was stated under Article I , Section A, parts 2 through 4 of Contract #Prev-3-558-04, ADTS#38071

- Item 2 of Article I, of the proposal was a collaborative effort with the United States Geological Survey (USGS) that included sampling, preparation and analysis of various samples collected from local beaches within the greater Cleveland area. These samples were collected and extracted for analysis by real-time quantitative polymerase chain reaction (qPCR) from July 1, 2009 through September 7, 2009. A total of 35 samples were collected, extracted and frozen at -35° Celsius for analysis in late September. Samples were extracted using a two step crude extraction method and analyzed. A total of 24 samples were analyzed.

- Item 2 of Article I, of the proposal includes the collection of samples for daily analysis and reporting of *E. coli* density at Villa Angela and Edgewater beach. There were a total of 414 samples collected for analysis at Edgewater and Villa Angela Beach for *E. coli.* An additional 94 samples were collected from Euclid creek in support of our research efforts not identified within this grant, however directly impact the water quality work performed by the District.

- Item 3 of the proposal allowed NEORSD to assume the responsibility of sampling, analysis and reporting the density of *E. coli* at Euclid Beach. Samples were collected and analyzed seven days a week Monday through Sunday, from July 1, 2009 until September 7, 2009. These samples have been reported electronically to ODH on a daily basis. A total of 207 samples were collected, analyzed during this time period.

Details outlining the activities of this year's project are discussed in the attached report. Included are all the sampling information, analysis bench sheets, and final data from samples collected between July 1, 2009 and September 7, 2009, along with any educational or promotional materials.

Sincerely,

Mark Citriglia
Manager of Analytical Services

Introduction

Microorganisms from urban runoff, combined sewer overflows (CSOs), wildlife, bather shedding, and nonpoint sources are potentially a determinant of illness for individuals swimming in contaminated water. The U.S. Environmental Protection Agency has defined *Escherichia coli (E. coli)* as one of the best indicator organisms at freshwater bathing beaches because the presence of these bacteria indicates that pathogenic microorganisms may also be present. *E. coli* densities were monitored at Edgewater, Euclid, and Villa Angela beach during the recreation season. The data obtained from this sampling was reported to the Ohio Department of Health (ODH) daily and used for public notification of water quality advisories. In addition to beach sampling, water samples were collected at two locations on Euclid Creek to determine the impact on water quality at Villa Angela and Euclid Beaches.

Sampling Summary

Water samples were collected from an east and west location at each of the three beaches. The samples were analyzed separately and a portion of the east and west sample were combined at the laboratory to serve as an integrated grab sample. All samples were collected at a depth of 3 feet at each location and approximately 6-12 inches below the surface (approximately two feet from the bottom). At the time of collection, field parameters were taken and field observations were made pertaining to the beach and water conditions. All observations were recorded on a daily sampling form. All water samples and field parameters were collected as specified in NEORSD SOP 3004 Beach Sampling.

Sampling was performed seven days a week Monday through Sunday from May 17, 2009 until September 7, 2009, for Edgewater, Euclid and Villa Angela Beach. Samples were collected at Euclid Creek from June 1, 2009 to September 5, 2009, Monday through Friday only. Due to increased beach usage samples were collected during Memorial Day, the 4th of July and Labor Day holidays for protection of public health. There were two sampling crews each of which consisted of two NEORSD employees. One crew was assigned to sample Edgewater beach and the second crew was assigned to Euclid and Villa Angela Beach.

A total of 678 samples were collected at two locations from all three beaches from May 17, 2009 through September 7, 2009. A total of 136 samples were collected from the two locations on Euclid creek during the same time frame. The laboratory combined equal portions of water from of the east and west samples collected at each beach (Integrated Grab). There were a total of 339 integrated grab samples for analysis. The data from all the samples are included in the

accompanying binders. Table 1, Sampling Locations summarizes the exact point of sample collection.

Table 1: Sampling Locations

Location	Latitude	Longitude	Description
Edgewater East	N41.4893°	W81.7392°	Eastern half of beach in line with the brick stack on the other side of the freeway.
Edgewater West	N41.4887°	W81.7404°	Western half of beach in line with the large metal pole that is on the other side of the freeway.
Euclid East	N41.5843°	W81.5686°	Eastern half of beach inline with the East side of the pile of stones on the beach.
Euclid West	N41.5838°	W81.5694	Western half of beach between the 2 break walls at the second set of stairs from the structure at Euclid Beach.
Euclid Creek	N41.5831°	W81.5594°	Downstream of Lakeshore Avenue
Euclid Creek	N41.5854°	W81.5641°	Downstream of Wildwood Bridge
Villa Angela East	N41.5851°	W81.5677°	Eastern half of beach mid-distance between the 3rd and 4th break walls.
Villa Angela West	N41.5861°	W81.5667°	Western half of beach at the beginning of the 2nd break wall.

Sampling Results Summary Edgewater

During the period of May 17, 2009 through September 7, 2009, Edgewater Beach had 84 days in which sample results indicated that the bacteria levels were less than the Single Sample Maximum criteria (SSM) of 235 colony forming units per 100 milliliters (cfu/100ml) and 29 days when the levels exceeded the SSM criteria. The geometric mean for this same time period is 97 cfu/100ml[1].

Table 2: Edgewater Sampling Summary

Edgewater Samples	Integrated Grab	East Location	West Location
Count	113	113	113
Samples < SSM of 235 cfu/100ml	84	83	90
Samples > SSM of 235 cfu/100ml	29	29	23
Minimum Density cfu/100ml	12	6	2
Maximum Density cfu/100ml	1340	1683	1360
Geometric mean (5/17 - 9/7)	97	92	85

Sampling Results Summary Villa Angela

During the period of May 17, 2009 through September 7, 2009, Villa Angela Beach had 68 days in which sample results indicated that the bacteria levels were less than the SSM of 235 cfu/100ml and 45 days when the levels

[1] Seasonal geometric mean criterion covers the period of May 1st through October 31st. The federal seasonal geometric criterion is 126 cfu/100ml.

exceeded the SSM. The geometric mean for this same time period is 165 cfu/100ml[2].

Table 3: Villa Angela Sampling Summary

Villa Angela Samples	Integrated Grab	East Location	West Location
Count	113	113	113
Samples < SSM of 235 cfu/100ml	68	62	74
Samples > SSM of 235 cfu/100ml	45	51	39
Minimum Density cfu/100ml	2	2	2
Maximum Density cfu/100ml	21200	8400	27200
Geometric mean (5/17 - 9/7)	165	180	122

Sampling Results Summary Euclid Beach

During the period of May 17, 2009 through September 7, 2009 Euclid Beach had 71 days in which sample results indicated that the bacteria levels were less than the SSM of 235 cfu/100ml and 29 days when the levels exceeded the SSM. The geometric mean for this same time period is 141 cfu/100ml[3].

Table 4: Euclid Beach Sampling Summary

Euclid Beach Samples	Integrated Grab	East Location	West Location
Count	113	113	113
Samples < SSM of 235 cfu/100ml	71	71	68
Samples > SSM of 235 cfu/100ml	42	41	45
Minimum Density cfu/100ml	1	1	1
Maximum Density cfu/100ml	11000	8500	17300
Geometric mean (5/17 - 9/7)	141	126	119

Sampling Results for Euclid Creek

District employees collected samples at two locations along Euclid creek Monday through Friday from June 1, 2009 until September 4, 2009. Samples were collected at EC-1, just north of the footbridge and EC-2, at river mile 0.5. Samples from the two locations along Euclid creek were collected in conjunction with the daily beach samples. A total of 68 samples were collected at each location resulting in a total of 136 samples. Data from these samples are used as part or the District's water quality monitoring program and source tracking efforts are Euclid and Villa Angela beach.

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[2] Seasonal geometric mean criterion covers the period of May 1st through October 31st. The federal seasonal geometric criterion is 126 cfu/100ml.

[3] Ibid

Euclid Creek	EC-1 Bridge	EC-1 0.5
Count	68	68
Minimum Density cfu/100ml	135	185
Maximum Density cfu/100ml	40000	43000
Geometric mean (6/1 - 9/4)	1125	1068

Summary of the Predictive Model "NowCast" – Edgewater Beach

NEORSD employees used a predictive model developed by USGS to predict the water quality at Edgewater Beach. The sampling crews were equipped with a laptop computer and a wireless card, to effectively and efficiently identify water quality issues using this model. The sampling crew entered several variables into the model and posted the appropriate beach signage based on the prediction from the model. The model used water quality variables which are expected to affect *E. coli* densities including turbidity, wave height, water temperature, and rainfall. Upon entering a combination of these variables, the model calculates the probability that the *E. coli* densities will be exceeded. Water quality variables and results from the model are entered onto the NOWCAST Website located at http://www.ohionowcast.info.

The predictive model used by NEORSD personnel was broken into three seasons based on the correlation of the previous years data. Season-1 lasted from May 17, 2009 through June 8, 2009. Season-2 covered the period of June 9, 2009 through August 10, 2007. Season-3 lasted from August 11, 2009 through September 7, 2009. The predictive model developed by the USGS was executed daily throughout each of the seasons. A total of 117 predictions were made using the model, with an overall accuracy of 76%. Using the previous days *E. coli* result to predict water quality resulted in an accuracy of 64%. The models sensitivity, or the ability to accurately predict a water quality exceedence, was 67% overall. Using the previous days *E.coli* result to accurately predict a water quality was only 30% accurate.

NowCast Model

	> 235 cfu/100ml	< 235 cfu/100ml	% Correct	CNE	False +	CE	False -	Sensitivity	Specificity
Season1 May -17 to June 8	7	15	82%	13	2	5	2	71%	87%
Season2 June 9 to August 10	18	45	79%	37	7	12	6	67%	82%
Season3 August 11 - Sept 7	5	27	71%	19	7	3	2	60%	70%
Totals	30	87	**76%**	69	16	20	10	67%	79%

Previous Days *E. Coli*

	> 235 cfu/100ml	< 235 cfu/100ml	% Correct	CNE	False +	CE	False -	Sensitivity	Specificity
Season1 May -17 to June 8	7	15	68%	12	3	3	4	43%	80%
Season2 June 9 to August 10	18	45	61%	32	12	6	12	33%	71%
Season3 August 11 - Sept 7	5	27	69%	22	5	0	5	0%	81%
Totals	30	87	**64%**	66	20	9	21	30%	76%

CE = Correct Exceedence CNE= Correct Non-exceedence
Sensitivity = Number of correct positive predictions over total samples > 235
Specificity = Number of correct negative predictions over the total samples < 235

In support of the objective of enhancing the predictive modeling, USGS, under contract to NEORSD, installed a video camera and provided a live image feed of Edgewater Beach for a portion of the summer. Data access and transmission issues limited the usefulness of the video camera images for the purposes of identifying unique opportunities for data collection efforts. However, a retroactive review of small portions of video footage demonstrated the value of having a record of events at the beach to document conditions which have the potential to affect beach water quality. For example during one storm water ponding on the beach can be detected observed. NEORSD will be continuing to mine the video data collected during 2009 to investigate the mechanisms of beach pollution and use this understanding to enhance predictive modeling. Additionally, NEORSD will seek to solve data transmission issues to enhance the usefulness of the camera for the 2010 season.

Summary of qPCR Activities

A portion of the integrated grab samples have been prepared for Quantitative Polymerase Chain Reaction (QPCR). Samples were collected for qPCR analysis Monday through Friday throughout the beach season. Only a portion of the samples have been analyzed using qPCR due to the cost of reagents. A total of 35 samples were analyzed using qPR and the results compared to the standard plate count method. These samples were extracted using a two step crude extraction method as compared with the multistep purification method utilized in 2006 through 2008. The crude extraction method is simpler (less steps) and less time consuming. This crude extraction method directly parallels the methods used by the USEPA. The correlation of the qPCR data with the membrane filtration data remained similar as in the past years. The qPCR method appears to be a better predictor of water quality than using the E. collie result from the previous day, with the exception of the results obtained from Edgewater beach in 2008. Additionally the qPCR data performed as good if not better than the NowCast model. Interestingly both the NowCast and the qPCR method performed poorly in 2008.

Edgewater Beach

	Correct		False +		False -		Sensitivity		Specificity	
Year	MF	qPCR	MF	qPCR	MF	qPCR	MF	qPCR	MF	qPCR
2006	83% (20/24)	94% (33/35)	8.3% (2/24)	0% (0/35)	8.3% (2/24)	5.7% (2/35)	0% (0/2)	0% (0/2)	91% (20/22)	100% (33/33)
2007	64% (16/25)	75% (21/28)	12% (3/25)	7.1% (2/28)	24% (6/25)	18% (5/28)	33% (4/12)	58% (7/12)	80% (14/16)	88% (14/16)
2008	79% (41/52)	*58%* *(30/52)*	21% (11/52)	8% (4/52)	21% (11/52)	15% (8/52)	50% (11/22)	63% (14/22)	63% (19/30)	90% (27/30)
2009	71% (12/17)	83% (15/18)	11% (2/17)	0% (0/18)	17% (3/17)	17% (3/18)	0% (0/2)	0% (0/3)	80% (12/15)	100% (15/15)

Villa Angela Beach										
	Correct		False +		False -		Sensitivity		Specificity	
Year	MF	qPCR	MF	qPCR	MF	qPCR	MF	qPCR	MF	qPCR
2006	52% (13/25)	78% (28/36)	24% (6/25)	11% (4/36)	24% (6/25)	11% (4/36)	50% (6/12)	76% (13/17)	54% (7/13)	79% (15/19)
2007	73% (24/33)	87% (33/38)	9.1% (3/38)	7.9% (3/38)	18% (6/33)	5.3% (2/38)	70% (14/20)	91% (21/23)	77% (10/13)	80% (12/15)
2008	67% (35/52)	87% 46/53	17% (9/52)	6% (3/53)	17% (9/52)	6% (3/53)	69% (20/29)	86% (25/29)	63% (15/24)	88% (21/24)
2009	73% (11/15)	94% (15/16)	13% (2/15)	0% (0/16)	13% (2/15)	6% (1/16)	0% (0/2)	50% (1/2)	85% (11/15)	100% (14/14)

Sensitivity = Number of correct positive predictions over total samples > 235

Specificity = Number of correct negative predictions over the total samples < 235

Erie County General Health District
420 Superior Street, Sandusky, Ohio 44870
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website: eriecohealthohio.org e-mail: echd@eriecohealthohio.org

Peter T. Schade, MPH, RS
Health Commissioner

Erie County Health Department
2009 Bathing Beach Program

In the 2009 recreational beach sampling season, The Erie County Health Department (ECHD) began sampling 25 coastal beach areas along the Lake Erie shoreline. Testing of these locations continued from May 26, 2009 through September 3, 2009. Twenty-one out of the twenty-five locations had advisories at some point in the recreational season. Our definition of an advisory is 235 E.Coli count or greater. There were a total of 152 advisories issued over the season at various times at twenty-two of the twenty-five beaches. Testing included the 18 hour a colilert method and the standard environmental observations such as wave height, wind direction, turbidity and temperature.

The E.Coli colilert method- Colilert-18 uses Defined Substrate Technology® (DST®) nutrient indicators ONPG and 4-methylumbelliferyl-B-D-glucuronide (MUG) to detect total coliforms and *E. coli*. Coliforms use their *β*-galactosidaseenzyme to metabolize ortho-nitrophenyl-p-D-galactopyranoside ONPG) and change it from colorless to yellow. Results were reported to the local news media, owners/operators of beach areas and to the Ohio Department of Health.

During 2009, the Erie County Health Department (ECHD) worked with the USGS Ohio Water Science Center to test and obtain the capability to analyze samples using IMS/ATP. This method is based on the selective capture of target bacteria by the use of antibodies attached to magnetic beads. A magnet is used to separate the target bacteria bound to the antibody coated beads from the rest of the sample. The bacteria concentration is determined by measuring the amount of ATP present in the sample using bioluminescent assay. In conjunction with this procedure turbidity was routinely analyzed as well. Quantitative Polymerase Chain Reaction (QPCR) samples were collected as well and the analysis was done by the USGS Laboratory. ECHD purchased a Turner Biosystems Luminometer and other miscellaneous equipment and materials to aid to conducting the analysis. As was stated in our 2008 report, these methods are being tested as a pilot to help he USGS test the efficacy of the 2-4 hour procedure. Testing procedures were done in the ECHD Laboratory with oversight by representatives of the USGS Columbus office.

The USGS provided training, supplies, and quality-control samples and ECHD provided the equipment, facility, and technician analytical time. Samples were collected at Erie County beaches (Huron West, Huron East & Vermilion East) 3 days/week and analyzed for *E. coli* by IMS/ATP and by the standard Colilert Quanti-Tray® method (IDEXX Laboratories, Inc., Westbrook, Maine).

Board of Health: Linda Miller-Moore, Board President, Charles G. Adams, M.D., President Pro-Tem, George E. Steinemann, George L. Mylander, Dawn DeMuth, Clifton Frisby, Marsha D. Cooper, M.D., Alice Roehrs, Richard Bulan, Thelma Darden, Larry Holkenborg

IMS/ATP samples were processed using two types of antibody-coated magnetic bead antibody A is a monoclonal antibody and antibody B is a polyclonal antibody. Monoclonal antibodies are produced by one cell line and are specific for a single target. Polyclonal antibodies are produced by immunizing animals and are complex mixtures of different types of antibodies. Specific objectives of our study were to:

- Develop the capability and demonstrate proficiency to analyze samples by use of the IMS/ATP method.
- Compare results obtained from IMS/ATP to results obtained by Colilert
- Compare the use of monoclonal and polyclonal antibodies

After overcoming contamination and incubator problems, the ECHD was able to demonstrate proficiency of the IMS/ATP method. Blank samples were recorded at acceptable levels (data not shown) and split replicate samples for antibody A ($r=0.931$) and antibody B ($r=0.845$) were highly correlated (figure 1). For both antibodies with samples collected from Huron West beach (figure 2), statistically significant relations were found between IMS/ATP results, reported in relative light units per 100 milliliters (RLU/100 mL), and Colilert method results, reported in most-probable number per 100 milliliters (MPN/100 mL).

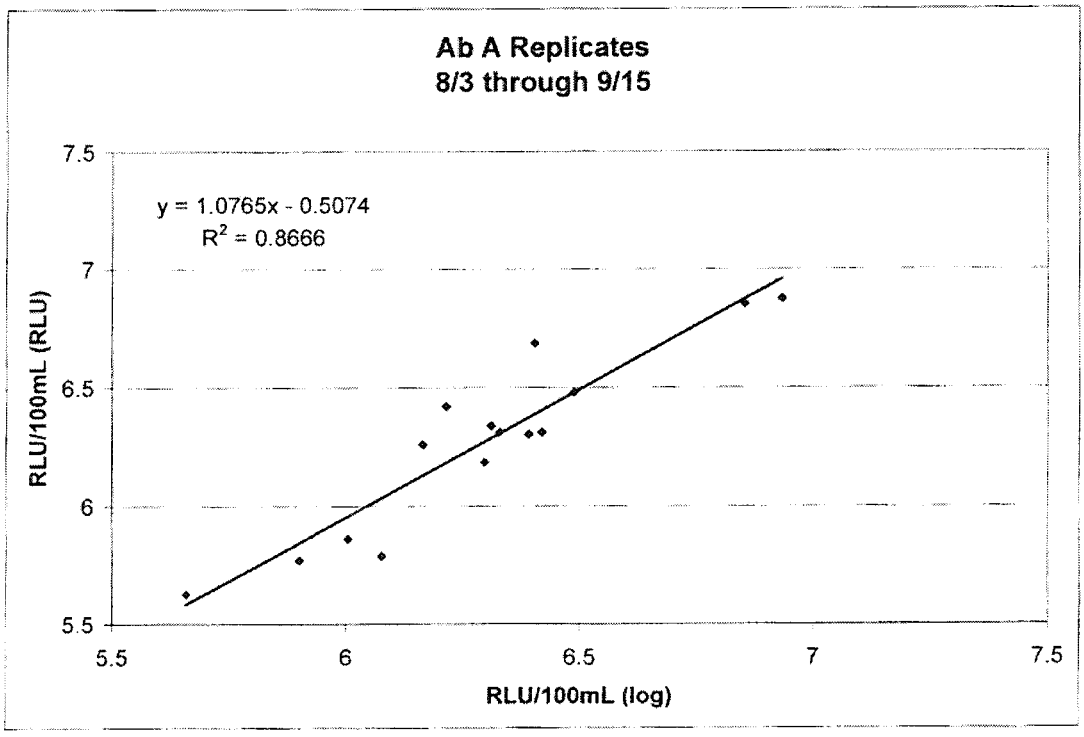

Figure 1

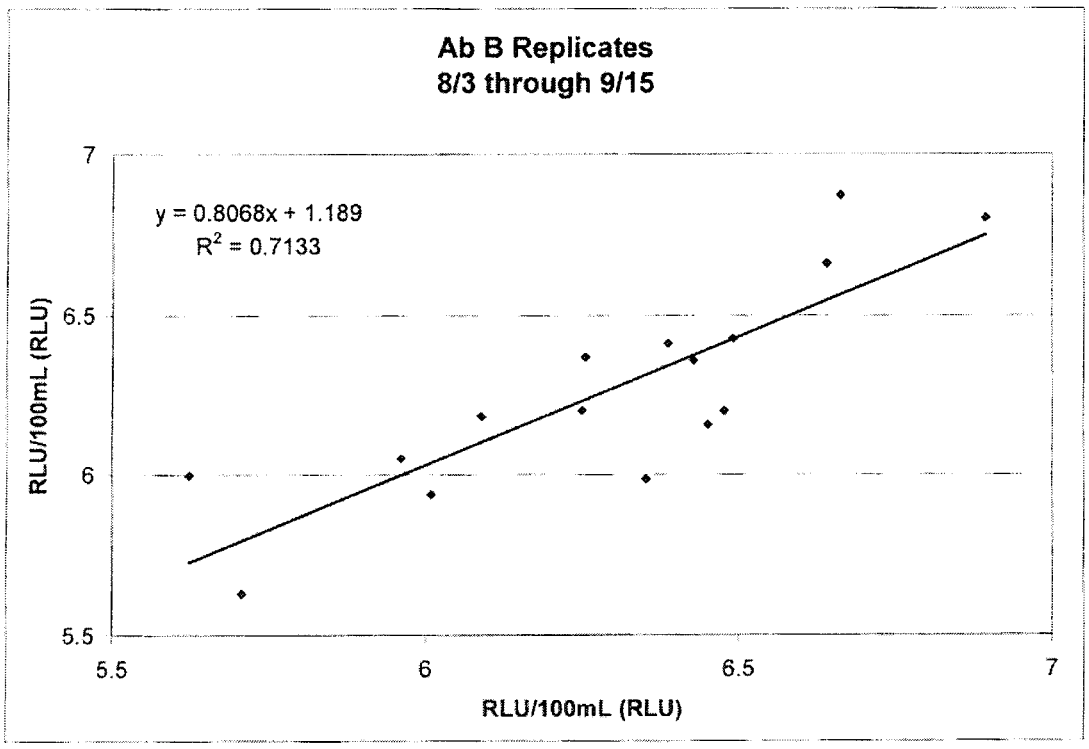

Figure 2

The sampling and testing process was performed using the gold standard Colilert Quanti-Tray method, IMS/ATP using both a monoclonal and polyclonal antibodies with split replicate sampling to assess test repeatability.

The split replicate sampling analysis was conducted using simple linear regression and the antibodies A ($r=0.931$) and B ($r=0.845$) were determined to be highly correlated (figures 1 &2). That is to say, the IMS/ATP test, performed on the same water sample, was identical—indicating the test is reliable. Regression was used again to determine the relationship between the Colilert method and antibody A and B (figures 3 & 4). A statistically significant relationship between both antibodies and the Colilert method was observed.

This analysis was performed using data collected during the last month of water testing ($n=13$ samples). Further water sampling and testing will be required to fully determine the performance of the IMS/ATP method. Overall, these suggest that the IMS/ATP testing method may be equivalent to the Colilert assay, offering a new and easy and rapid testing method for water quality monitoring.

The current standard for recreational water quality monitoring involves culturing water samples—a process that usually takes 24 hours. In an effort to reduce the lag time

between water sampling and obtaining results, the United States Geological Survey (USGS) in partnership with several local health departments is examining a new rapid testing method utilizing an immunological assay.

Immunomagnetic separation/adenosine triphosphate (IMS/ATP) is a rapid testing method which uses magnetic particles coated with *Escherichia coli* specific antibodies. These antibodies are mixed with the beach water sample, separated with a magnet, and then analyzed for *E. coli* produced ATP using light spectroscopy. IMS/ATP water testing can be performed in less than 3 hours which is 8 times faster than traditional methods.

During the summer of 2009, the Erie County Health Department collected and analyzed beach samples using the USGS provided instructions. The sampling and testing process was performed using the gold standard Colilert Quanti-Tray method, IMS/ATP using both a monoclonal and polyclonal antibodies with split replicate sampling to assess test repeatability. Now that proficiency has been demonstrated, more work needs to be done to collect a larger dataset at Huron West and investigate this relation at additional beaches.

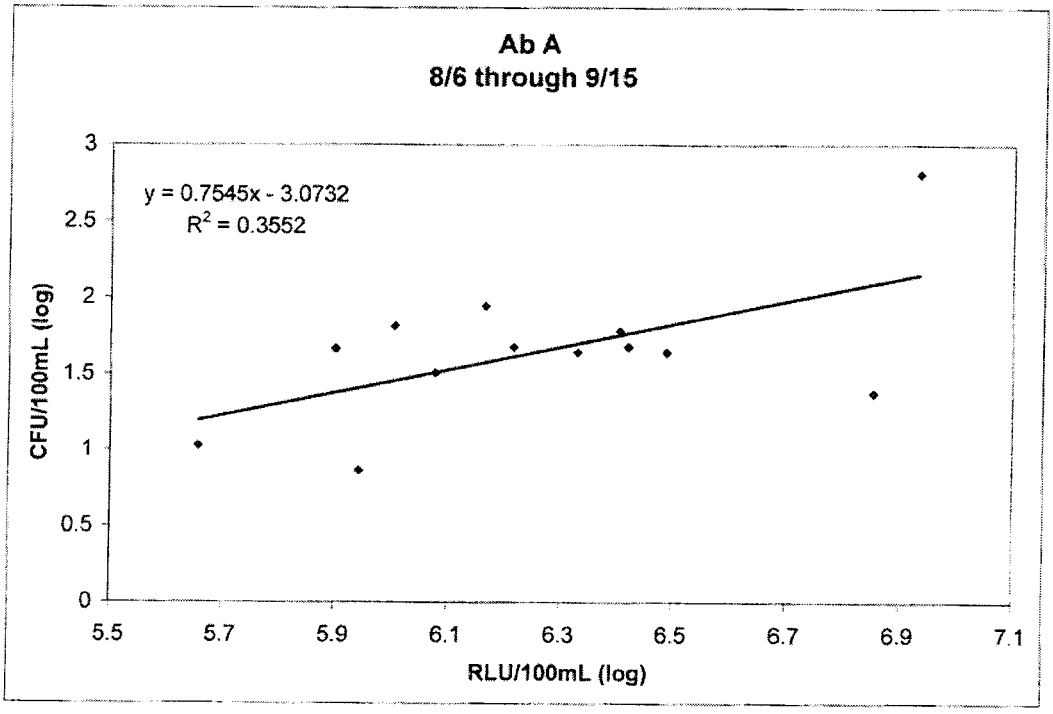

Figure 3

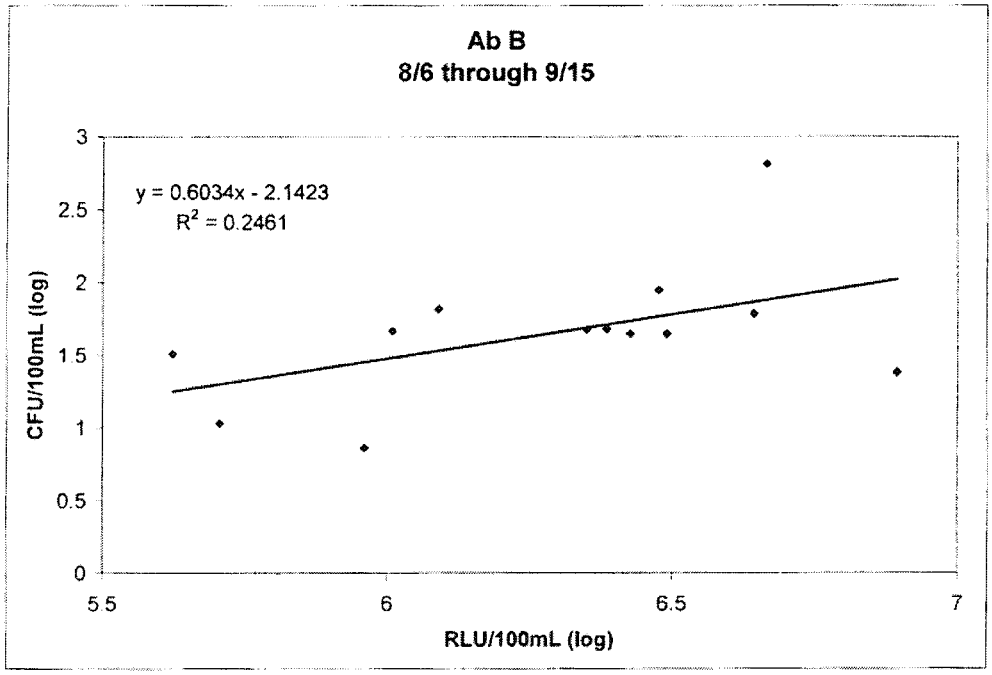

Figure 4

Efforts continued throughout the Summer to identify sources of contamination upstream of the beaches such as Edson Creek on the west side of Vermilion, where high counts of E..Coli were experienced. Examples of sources found and corrected are as follows: bypass of raw sewage from the municipal sewer system, grinder pumps not operating, laundry waste from a residence discharging to creek. ECHD has contracted with the OEPA in July of 2009 to conduct the Semipublic Sewage Program to provide operation and maintenance inspections of all wastewater treatment systems (1-25,000 gallons per day) discharging to waters of the state, thereby lessening the impact of these systems on the Lake Erie watershed. The Village of Bay View in Margaretta Township, which seems to experience the high counts on the far western portion of the county is now under a study to eliminate poorly operating residential and semipublic sewage system influences on the beaches. Funds to install a municipal sanitary sewer system to eliminate household and semipublic wastewater systems discharge to waters of the state are being sought.

ECHD participated in the Vermilion River Watershed Festival as sponsored by the Friends of the Vermilion River, to highlight efforts made to sample and evaluate beaches and do source- tracking.

Submitted by:
Don Killinger R.S.
Program Manager
Erie County Health Department

LAKE COUNTY
Guiding Your Health
GENERAL HEALTH DISTRICT

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Joel F. Lucia, R.S., M.P.H., Health Commissioner

Public Health
Prevent. Promote. Protect.

October 5, 2009

Mr. W. Gene Phillips, RS
Ohio Department of Health
246 North High Street
Columbus, Ohio 43215

Re: October 2009 Bathing Beach Monitoring Program Report

Dear Mr. Phillips:

Enclosed please find a copy of the Lake County General Health District 2009 Bathing Beach Monitoring Program report as specified in the Personal Service Contract between the Ohio Department of Health and the Lake County General Health District. The report recaps the activities of the department to monitor the beach water quality at our Lake Erie beaches for the period from July 1, 2009 through September 6, 2009. I have also enclosed a copy of an invoice in the amount of $19,409.00 as specified in the Personal Service Contract.

Please contact me if you have any questions. I can generally be reached weekdays between 8:00 am and 4:30 pm at (440) 350-2543.

Sincerely,
Lake County General Health District

Nancy Niehus

Nancy Niehus, RS
Supervisor, General Environmental Health Programs

Lake County General Health District
Bathing Beach Monitoring Project
October 2009 Report

Introduction

The Lake County General Health District (Ohio), conducted a monitoring program during the summer of 2009 at Lake County's two recognized public swimming beaches, Mentor Headlands State Park, and Fairport Harbor Lake Metroparks, both located on the southern shore of Lake Erie. The goals were to identify times when *E. coli* bacteria exceeded established standards at these beaches and provide notification to beach management and the public concerning the potential hazard to bathers.

The Supervisor of General Environmental Health Services followed established procedures and provided program oversight throughout the July 1 – September 6, 2009 sampling period. In addition to the Supervisor, either a Registered Sanitarian or Environmental Health Technician conducted the sampling, transportation and analysis of the samples and reported the results. At all times, the samples were in custody of the Lake County General Health District.

Sample Locations

Fairport Harbor Beach is operated by Lake Metroparks and is located off High Street in Fairport Harbor. The GPS coordinates for the western boundary of the bathing area are 41.45539 N 081.16303 W, and 41.45518 N 081.16411W for the eastern boundary. One water sample was collected at Fairport Harbor Beach in front of the middle lifeguard stand at GPS coordinate 41.45535N 081.16492W.

Mentor Headlands Beach is located at the terminus of State Route 44 North, and is operated by the Ohio Department of Natural Resources. Two water samples were collected at this beach from opposite ends of the guarded portion of the beach. The sample identified as Headlands East was collected in front of the easternmost lifeguard stand at GPS coordinate 41.45478N 081.17457W and the Headlands West sample was obtained in front of the westernmost lifeguard stand at GPS coordinate 41.45377N 081.7577W. The boundary of the west end of the entire beach is 41.45295N 081.17691W, the midpoint is 41.45435N 081.17512W, and the east end of the beach is 41.45646N 081.17226W.

Sampling Season

The Health District began collecting beach samples for the Ohio Department of Health on July 1, 2009 and ended for this contract period on September 6, 2009. Samples were collected daily, weekends and holidays inclusive, in the morning generally prior to 9 a.m. before bathers routinely entered the water.

Beach Water Sample Collection Procedures

The following procedures were utilized to collect beach water samples:

1. Label sterilized, single-use 120 ml water sample collection bottles with the name of the sample collection locations and any replicates. Place in cooler with ice packs and an extra bottle in the event of breakage.
2. After arriving at the appropriate beach location, evaluate the conditions and complete the field notes section on the sample collection form. Use an accurately calibrated metal stem thermometer to measure the ambient air temperature.
3. After first assessing the wave height for safety, carefully enter the water to a depth of 3 or 4 feet while causing minimal disruption of the sediment. Measure the water temperature with the metal stem thermometer. With the bottle in one hand and the cap in the other, remove the seal and uncap the bottle, using care to only touch the outside of the bottle, and holding the lid from the outside to keep it free from contaminants also. Invert the bottle and immerse to a depth of 12 to 18 inches below the surface of the water, tilt the bottle toward an upright position, and sweep toward the surface to allow the air to escape and water to enter the bottle. Carefully replace the cap once the container has been filled to the base of the neck and brought out of the water. There should be a small amount of air in the bottle. Immediately place the bottle in the cooler and record the water temperature on the field notes.
4. Return to the Health District after all the samples have been collected and begin the sample analysis.

In-House Beach Water Sample Analysis Procedure

The following procedures were used to analyze the beach water samples:

1. Turn on the incubator, if not already on. Read the thermometer to assure the internal temperature reads 35°C on an accurately calibrated thermometer.
2. Turn on the Idexx Quanti-Tray Sealer to warm up.
3. Wash hands and locate a clean area to prepare the samples.
4. Empty the Colilert presence/absence reagent granules into each water sample bottle. Recap and shake to completely dissolve the granules.
5. Label Quanti-Trays with sample location and date, and note if the sample is a replicate. Pour the entire contents of the prepared sample bottle into the appropriately labeled tray that has been squeezed from the edges to form an opening, taking care not to touch the inside of the tray.
6. Gently tap the cells of the Quanti-Tray to remove any air bubbles.

7. Observe the tray sealer to see if the green light is on to indicate it is ready for operation. Insert the tray with the plastic wells facing down into the rubber template and press the switch for the tray to enter the sealer. Wipe off any water that spilled during the sealing process before sealing the next tray. Turn off the sealing machine when finished.
8. Place Quanti-Trays, wells down, into the incubator. Allow to incubate for 24 hours.
9. Enter data onto the Laboratory Analysis form, including date of sample, time incubation began, and lot number of Colilert reagent. Add field notes to the laboratory binder.
10. Read results in 24 hours. Count the number of large and small wells that fluoresce under ultraviolet light and refer to the Quantitray MPN table to find the most probable number (MPN).
11. Record results on Laboratory Analysis form and Beach Sample result form that is used to communicate results to the clerical staff.

Public Notification and Risk Communication

Sample results were forwarded daily by e-mail or faxed to Lake Metroparks, ODNR Headlands Beach and the Ohio Department of Health. In the event of technical difficulty, telephone calls were placed to communicate results. Beach results were posted daily, weekends and holidays inclusive, on the Lake County General Health District web site at www.LCGHD.org. The clerical staff answered inquiries regarding beach water quality, and the supervisor of General Environmental Health Programs was available to provide detailed information and answer questions relative to beach safety and current conditions.

A beach safety pamphlet was used as an educational tool to inform the public of Lake County General Health District's efforts to sample the beach water. The fact card featured English on one side and Spanish on the other due to the beaches being heavily used by the local Hispanic population. Fact cards were distributed at a number of public locations within Lake County in addition to the beaches.

Measures to Notify the Public

There were only a few water quality standard exceedences in this bathing season that required posting advisory signs to warn bathers of surface water quality. When the bacterial count exceeded the single sample standard of 235 E. coli/100 ml, Health District staff notified staff at the affected beach by telephone, if possible. A request was made to post advisory signs in prominent places visible to the general public upon entering the beach. Each beach is in possession of signs with language as suggested by the Ohio Department of Health, reading:

WATER QUALITY ADVISORY

BACTERIA LEVELS HERE CURRENTLY EXCEED STATE STANDARDS. CHILDREN, ELDERLY, AND THOSE IN ILL HEALTH ARE ADVISED NOT TO BATHE OR SWIM

Due to a growing Hispanic population, Spanish advisory signs are also available for posting in conjunction with the English language signs at the beaches, reading:

AVISO DE CALIDAD DEL AGUA

LOS NIVELES DE BACTERIA EN ESTA AREA SOBREPASAN LAS NORMAS DEL ESTADO DE OHIO. LOS NIÑOS, ANCIANOS, Y LAS PERSONAS QUE TIENE MAL SALUD LAS AVISAMOS QUE NO DEBERIAN BAÑARSE NI NADAR

The Health District verified the presence of the advisory signs when posting was required. The beach supervisors were notified when conditions improved and the advisory signs could be removed.

Beach Sampling Data

Fairport was requested to post advisories ten times during the 68-day sampling period due to exceeding the single sample standard of 235 E. coli /100 ml sample. On three occasions, the advisory was posted for two days and four advisories occurred on a single day.

Headlands East exceeded the standard on four occasions while Headlands West had three exceedences. There were five occurrences when one end of Headlands required advisories when the other did not, and only one day when both ends of the beach required posting an advisory. Due to there being no practical means of delineating one end of the beach from the other, both ends of the beach were posted when either had an exceedence of the single sample criteria, effectively causing six days of posting during this contract period.

Frequency of Lake County Beach Advisories July 1-Sept 6, 2009

Lake County Beach	Number of Days Exceeding Standard	Number of Sampling Days	Percentage of Days Advisory was Posted
Fairport	10	68	14.7%
Headlands East	4	68	5.9%
Headlands West	3	68	4.4%

Lake Country General Health District
Bathing Beach Results July 1-September 6, 2009

Date		Fairport	West	East
07/01	LCGHD	24.0	50.4	52.0
07/02	LCGHD	298.7	1011.1	870.4
07/03	LCGHD	533.5	178.2	280.9
07/04	LCGHD	35.0	56.5	41.9
07/05	LCGHD	14.6	17.3	5.2
07/06	LCGHD	34.1	6.3	2.0
07/07	LCGHD	99.0	9.8	30.9
07/08	LCGHD	1.0	24.6	8.5
07/09	LCGHD	18.3	1.0	4.1
07/10	LCGHD	19.7	7.4	9.8
07/11	LCGHD	93.3	67.6	55.6
07/12	LCGHD	313.0	22.3	11.0
07/13	LCGHD	436.0	38.4	13.4
07/14	LCGHD	112.2	125.9	14.6
07/15	LCGHD	3.1	37.9	24.0
07/16	LCGHD	28.8	238.2	191.8
07/17	LCGHD	436.0	125.0	142.1
07/18	LCGHD	86.5	57.6	70.8
07/19	LCGHD	33.2	35.4	39.3
07/20	LCGHD	13.5	8.5	5.1
07/21	LCGHD	11.0	9.6	11.9
07/22	LCGHD	35.9	57.3	52.9
07/23	LCGHD	93.3	68.3	18.3
07/24	LCGHD	111.9	53.0	218.7
07/25	LCGHD	80.9	13.4	21.8
07/26	LCGHD	57.6	18.9	25.6
07/27	LCGHD	139.6	107.6	108.1
07/28	LCGHD	12.0	8.4	8.5
07/29	LCGHD	3.1	3.1	14.5
07/30	LCGHD	52.0	79.4	93.3
07/31	LCGHD	108.6	74.9	249.5
08/01	LCGHD	34.5	40.8	53.8
08/02	LCGHD	32.8	129.6	396.8
08/03	LCGHD	4.1	28.8	38.8
08/04	LCGHD	27.2	360.9	88.4
08/05	LCGHD	166.9	56.3	52.0
08/06	LCGHD	15.8	18.5	10.8
08/07	LCGHD	16.9	22.6	27.5

08/08	LCGHD	105.4	31.8	42.6
08/09	LCGHD	870.4	148.3	127.4
08/10	LCGHD	34.3	23.2	23.7
08/11	LCGHD	71.7	9.7	6.3
08/12	LCGHD	658.6	67.6	98.7
08/13	LCGHD	18.5	5.2	11.0
08/14	LCGHD	20.9	17.5	7.4
08/15	LCGHD	6.3	1.0	1.0
08/16	LCGHD	9.7	4.1	21.6
08/17	LCGHD	17.3	5.2	30.5
08/18	LCGHD	12.0	45.0	54.7
08/19	LCGHD	46.4	39.3	101.2
08/20	LCGHD	18.9	55.6	42.2
08/21	LCGHD	436.0	74.9	77.1
08/22	LCGHD	27.3	23.1	19.9
08/23	LCGHD	41.3	30.9	38.9
08/24	LCGHD	135.4	39.9	72.8
08/25	LCGHD	14.6	13.1	29.2
08/26	LCGHD	85.7	42.6	35.9
08/27	LCGHD	135.4	121.1	25.9
08/28	LCGHD	81.6	105.4	65.0
08/29	LCGHD	601.5	71.7	101.7
08/30	LCGHD	501.2	148.3	178.2
08/31	LCGHD	130.9	3.1	2.0
09/01	LCGHD	48.0	20.1	81.6
09/02	LCGHD	14.6	19.9	14.5
09/03	LCGHD	9.7	1.0	33.2
09/04	LCGHD	27.2	7.4	90.7
09/05	LCGHD	52.0	5.1	95.9
09/06	LCGHD	1.0	8.5	7.4

LAKE COUNTY
GENERAL HEALTH DISTRICT
Guiding Your Health

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Joel F. Lucia, R.S., M.P.H.
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July 6, 2009

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Nancy Niehus, RS
Supervisor, General Environmental Health Programs

Lake County General Health District
Bathing Beach Monitoring Project
July 2009 Report

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There were only a few water quality standard exceedences in this bathing season that required posting advisory signs to warn bathers of surface water quality. When the bacterial count exceeded the single sample standard of 235 E. coli/100 ml, Health District staff notified staff at the affected beach by telephone, if possible. A request was made to post advisory signs in prominent places where visible to the general public upon entering the beach. Each beach is in possession of signs with language as suggested by the Ohio Department of Health, reading:

WATER QUALITY ADVISORY

BACTERIA LEVELS HERE CURRENTLY EXCEED STATE STANDARDS. CHILDREN, ELDERLY, AND THOSE IN ILL HEALTH ARE ADVISED NOT TO BATHE OR SWIM

Due to a growing Hispanic population, five Spanish advisory signs are also available for posting in conjunction with the English language signs at the beaches, reading:

AVISO DE CALIDAD DEL AGUA

LOS NIVELES DE BACTERIA EN ESTA AREA SOBREPASAN LAS NORMAS DEL ESTADO DE OHIO. LOS NIÑOS, ANCIANOS, Y LAS PERSONAS QUE TIENE MAL SALUD LAS AVISAMOS QUE NO DEBERIAN BAÑARSE NI NADAR

The Health District verified the presence of the advisory signs when posting was required. The beach supervisors were notified when conditions improved and the advisory signs could be removed.

Beach Sampling Data

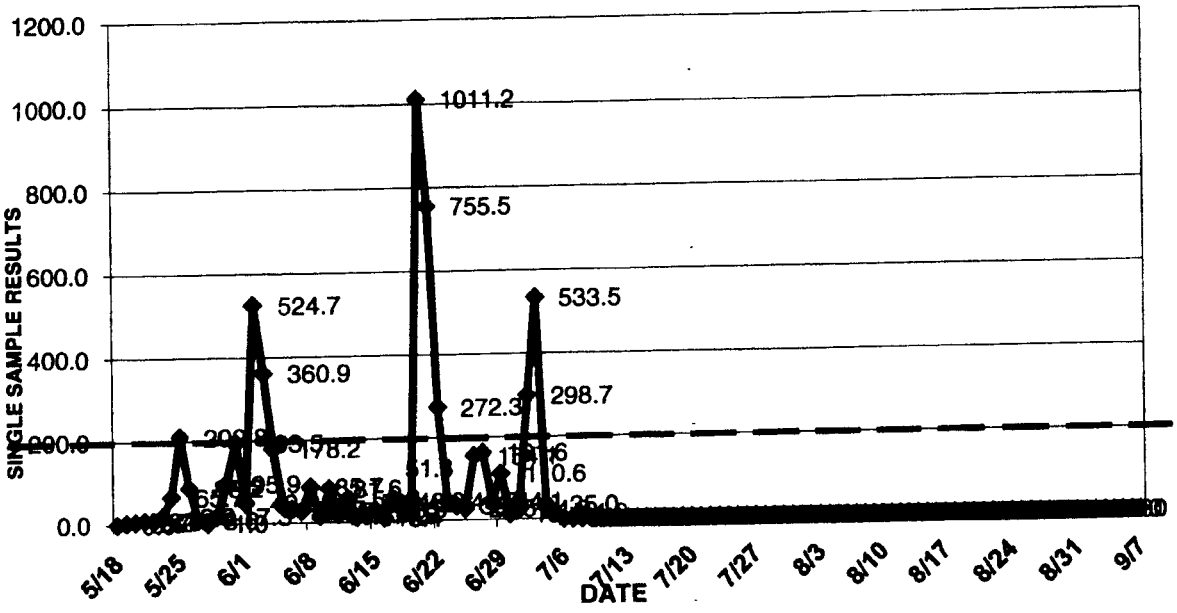
Fairport was requested to post advisories five (5) times during the sampling period due to exceeding the single sample standard of 235 E. coli /100 ml sample. Once the advisory was posted for two days and during the second incident the advisory was posted for a period of three days.

Headlands East exceeded the standard on five (5) occasions while Headlands West had four (4) exceedences. There were three (3) occurrences when one end of Headlands required advisories when the other did not, and three days when both ends showed exceedences. Due to there being no practical means of delineating one end of the beach from the other, both ends of the beach were posted when either had an exceedence of the single sample criteria, effectively causing six (6) days of posting during this contract period.

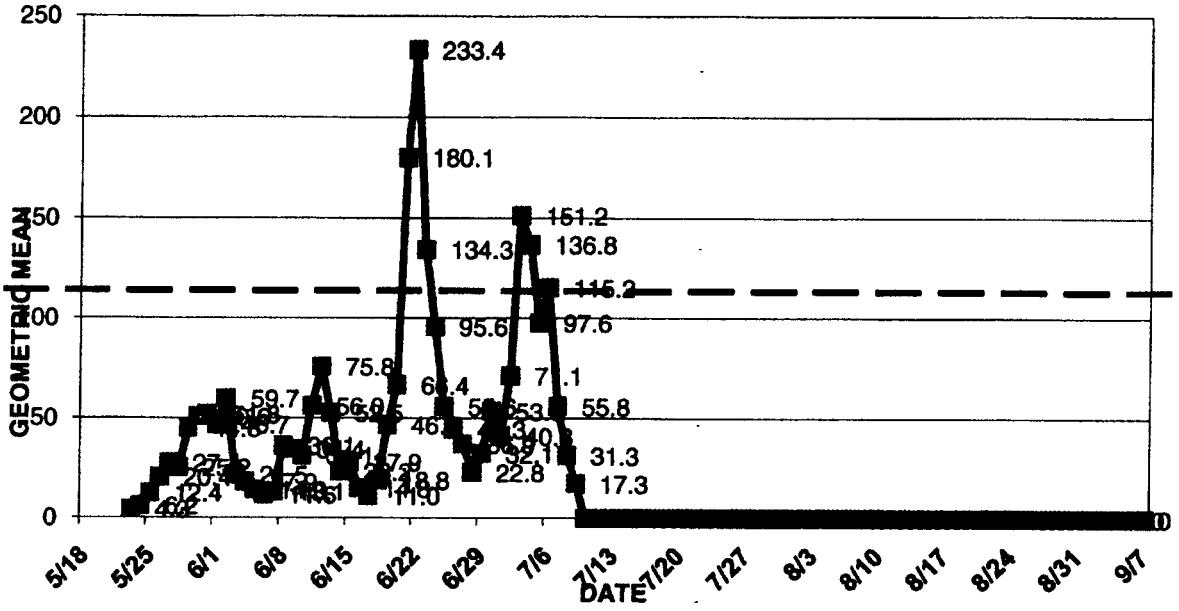
Through the end of June, there was only one day when all 3 Lake County beaches were required to be posted on the same day.

	DATE	SAMPLER	FAIRPORT HARBOR	HEADLANDS WEST	HEADLANDS EAST
WEEK 1	05/18/09	NO SAM	0.0	0.0	0.0
	05/19/09	LCGHD	3.1	3.0	12.0
	05/20/09	LCGHD	5.2	3.1	3.0
	05/21/09	LCGHD	8.5	3.1	2.0
	05/22/09	LCGHD	7.4	5.2	4.1
	05/23/09	LCGHD	18.3	9.7	9.8
	05/24/09	LCGHD	65.7	18.3	1.0
WEEK 2	05/25/09	LCGHD	209.8	104.3	**298.7**
	05/26/09	LCGHD	86.2	36.8	29.5
	05/27/09	LCGHD	8.6	22.8	20.1
	05/28/09	LCGHD	1.0	6.3	12.2
	05/29/09	LCGHD	17.3	**328.2**	228.2
	05/30/09	LCGHD	95.9	191.8	151.5
	05/31/09	LCGHD	193.5	41.3	31.7
WEEK 3	06/01/09	LCGHD	49.6	13.5	7.4
	06/02/09	LCGHD	**524.7**	21.6	39.3
	06/03/09	LCGHD	**360.9**	2.0	5.2
	06/04/09	LCGHD	178.2	75.4	86.2
	06/05/09	LCGHD	41.0	12.2	32.7
	06/06/09	LCGHD	32.7	5.2	12.2
	06/07/09	LCGHD	28.5	40.8	24.7
WEEK 4	06/08/09	LCGHD	85.7	**313.0**	**721.5**
	06/09/09	LCGHD	14.6	59.4	33.6
	06/10/09	LCGHD	81.6	7.4	20.3
	06/11/09	LCGHD	18.9	98.5	21.6
	06/12/09	LCGHD	56.3	185.0	**298.7**
	06/13/09	LCGHD	11.0	49.6	33.1
	06/14/09	LCGHD	14.5	1.0	1.0
WEEK 5	06/15/09	LCGHD	28.5	18.7	11.0
	06/16/09	LCGHD	8.4	4.1	8.6
	06/17/09	LCGHD	48.0	42.8	4.1
	06/18/09	LCGHD	42.6	**721.5**	**870.4**
	06/19/09	LCGHD	51.8	91.7	95.6
	06/20/09	LCGHD	**1011.2**	111.2	149.7
	06/21/09	LCGHD	**755.5**	**601.5**	**601.5**
WEEK 6	06/22/09	LCGHD	**272.3**	156.5	125.9
	06/23/09	LCGHD	45.7	45.5	40.8
	06/24/09	LCGHD	35.0	16.8	139.5
	06/25/09	LCGHD	27.5	7.4	52.9
	06/26/09	LCGHD	154.1	191.8	166.4
	06/27/09	LCGHD	161.6	63.1	24.6
	06/28/09	LCGHD	44.1	4.1	7.4
WEEK 7	06/29/09	LCGHD	110.6	93.3	74.9
	06/30/09	LCGHD	13.4	93.3	98.5

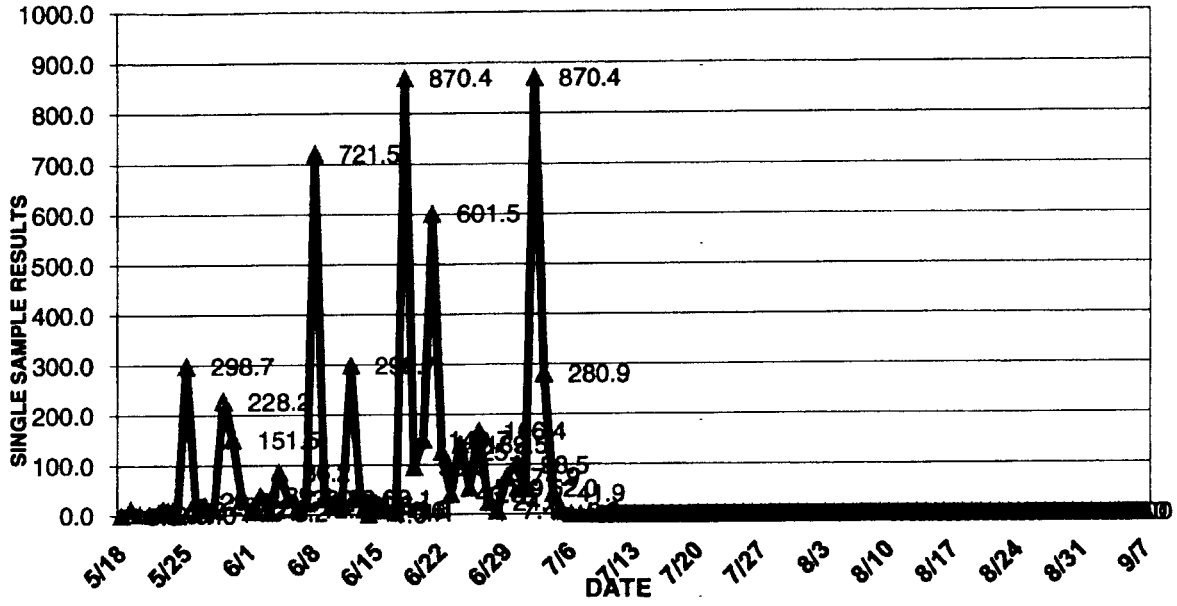
FAIRPORT HARBOR BEACH
RAW LAB RESULTS
2009
E. COLI PER 100 ML



HEADLANDS WEST BEACH
GEOMETRIC MEAN
LAST FIVE SAMPLES
2009
E. COLI PER 100 ML



HEADLANDS EAST BEACH
RAW LAB RESULTS
2009
E. COLI PER 100 ML



Cuyahoga County Board of Health
Bathing Beach Monitoring and Public Notification Project

2009 Recreation Season

FINAL REPORT

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Contents of Final Report

This report serves to inform the Ohio Department of Health of the outcome of the 2009 *Cuyahoga County Board of Health (CCBH) Bathing Beach Monitoring and Public Notification Project* as required by the Contract. Included in this report are bathing beach water quality sampling results for both Contract periods: May 26th, 2009 through June 30th, 2009, and July 1st, 2009 through September 30th, 2009. Also included in this report are the results of the implementation of the *Nowcasting System for Predicting Beach Advisories*, documentation to demonstrate the public notification component of the project, and the results of the beach user surveys that were administered.

Sampling Results

The table below shows bathing beach water quality data for all of the beaches that are associated with this project that are located along the Lake Erie shoreline. The data in the table consists of the beach name, the municipality in which the beach is located, the type of beach based upon its classification, the sampling date, and the *E. coli* bacteria content for each water sample that was collected. The table also indicates if a water quality advisory was issued due to an exceedance of the single sample standard of 235 *E. coli* colonies/100ml.

2009 Water Quality Data for Lake Erie Beaches

Beach	City	Type	Date	E coli	Advisory	Comments
Arcadia Beach	Euclid	Tier 2	27-May-09	390	TRUE	
Arcadia Beach	Euclid	Tier 2	02-Jun-09	8700	TRUE	
Arcadia Beach	Euclid	Tier 2	09-Jun-09	47	FALSE	
Arcadia Beach	Euclid	Tier 2	16-Jun-09	12	FALSE	
Arcadia Beach	Euclid	Tier 2	23-Jun-09	4	FALSE	
Arcadia Beach	Euclid	Tier 2	01-Jul-09	3100	TRUE	
Arcadia Beach	Euclid	Tier 2	07-Jul-09	285	TRUE	
Arcadia Beach	Euclid	Tier 2	14-Jul-09	980	TRUE	
Arcadia Beach	Euclid	Tier 2	21-Jul-09	10	FALSE	
Arcadia Beach	Euclid	Tier 2	28-Jul-09	11	FALSE	
Arcadia Beach	Euclid	Tier 2	04-Aug-09	20	FALSE	
Arcadia Beach	Euclid	Tier 2	11-Aug-09	28	FALSE	
Arcadia Beach	Euclid	Tier 2	18-Aug-09	147	FALSE	
Arcadia Beach	Euclid	Tier 2	25-Aug-09	27	FALSE	
Bay Park Beach	Bay Village	Tier 3	28-May-09	64	FALSE	
Bay Park Beach	Bay Village	Tier 3	01-Jun-09	28	FALSE	
Bay Park Beach	Bay Village	Tier 3	08-Jun-09	62	FALSE	
Bay Park Beach	Bay Village	Tier 3	15-Jun-09	8	FALSE	
Bay Park Beach	Bay Village	Tier 3	22-Jun-09	10	FALSE	
Bay Park Beach	Bay Village	Tier 3	29-Jun-09	77	FALSE	

Bay Park Beach	Bay Village	Tier 3	06-Jul-09	10	FALSE
Bay Park Beach	Bay Village	Tier 3	13-Jul-09	85	FALSE
Bay Park Beach	Bay Village	Tier 3	20-Jul-09	8	FALSE
Bay Park Beach	Bay Village	Tier 3	27-Jul-09	20	FALSE
Bay Park Beach	Bay Village	Tier 3	03-Aug-09	16	FALSE
Bay Park Beach	Bay Village	Tier 3	10-Aug-09	14	FALSE
Bay Park Beach	Bay Village	Tier 3	17-Aug-09	<2	FALSE
Bay Park Beach	Bay Village	Tier 3	25-Aug-09	6	FALSE
Clarkwood Beach	Euclid	Tier 3	27-May-09	18	FALSE
Clarkwood Beach	Euclid	Tier 3	02-Jun-09	10000	TRUE
Clarkwood Beach	Euclid	Tier 3	09-Jun-09	85	FALSE
Clarkwood Beach	Euclid	Tier 3	16-Jun-09	13	FALSE
Clarkwood Beach	Euclid	Tier 3	23-Jun-09	9	FALSE
Clarkwood Beach	Euclid	Tier 3	01-Jul-09	900	TRUE
Clarkwood Beach	Euclid	Tier 3	07-Jul-09	162	FALSE
Clarkwood Beach	Euclid	Tier 3	14-Jul-09	1120	TRUE
Clarkwood Beach	Euclid	Tier 3	21-Jul-09	49	FALSE
Clarkwood Beach	Euclid	Tier 3	28-Jul-09	60	FALSE
Clarkwood Beach	Euclid	Tier 3	04-Aug-09	7	FALSE
Clarkwood Beach	Euclid	Tier 3	11-Aug-09	50	FALSE
Clarkwood Beach	Euclid	Tier 3	18-Aug-09	82	FALSE
Clarkwood Beach	Euclid	Tier 3	25-Aug-09	165	FALSE
Clifton Beach	Lakewood	Tier 2	26-May-09	125	FALSE
Clifton Beach	Lakewood	Tier 2	28-May-09	44	FALSE
Clifton Beach	Lakewood	Tier 2	01-Jun-09	22	FALSE
Clifton Beach	Lakewood	Tier 2	03-Jun-09	47	FALSE
Clifton Beach	Lakewood	Tier 2	08-Jun-09	330	TRUE
Clifton Beach	Lakewood	Tier 2	10-Jun-09	49	FALSE
Clifton Beach	Lakewood	Tier 2	15-Jun-09	34	FALSE
Clifton Beach	Lakewood	Tier 2	17-Jun-09	50	FALSE
Clifton Beach	Lakewood	Tier 2	22-Jun-09	175	FALSE
Clifton Beach	Lakewood	Tier 2	24-Jun-09	21	FALSE
Clifton Beach	Lakewood	Tier 2	29-Jun-09	230	FALSE
Clifton Beach	Lakewood	Tier 2	01-Jul-09	200	FALSE
Clifton Beach	Lakewood	Tier 2	06-Jul-09	18	FALSE
Clifton Beach	Lakewood	Tier 2	08-Jul-09	18	FALSE
Clifton Beach	Lakewood	Tier 2	13-Jul-09	255	TRUE
Clifton Beach	Lakewood	Tier 2	15-Jul-09	39	FALSE
Clifton Beach	Lakewood	Tier 2	20-Jul-09	6	FALSE
Clifton Beach	Lakewood	Tier 2	22-Jul-09	33	FALSE
Clifton Beach	Lakewood	Tier 2	27-Jul-09	160	FALSE
Clifton Beach	Lakewood	Tier 2	29-Jul-09	7	FALSE
Clifton Beach	Lakewood	Tier 2	03-Aug-09	25	FALSE

Clifton Beach	Lakewood	Tier 2	05-Aug-09	1140	TRUE	
Clifton Beach	Lakewood	Tier 2	10-Aug-09	58	FALSE	
Clifton Beach	Lakewood	Tier 2	12-Aug-09	2500	TRUE	
Clifton Beach	Lakewood	Tier 2	17-Aug-09	25	FALSE	
Clifton Beach	Lakewood	Tier 2	25-Aug-09	2	FALSE	
Clifton Beach	Lakewood	Tier 2	26-Aug-09	86	FALSE	
Clifton Beach	Lakewood	Tier 2	19-Aug-09	52	FALSE	
Columbia Park	Bay Village	Tier 3	28-May-09	600	TRUE	
Columbia Park	Bay Village	Tier 3	01-Jun-09	34	FALSE	
Columbia Park	Bay Village	Tier 3	08-Jun-09	32	FALSE	
Columbia Park	Bay Village	Tier 3	15-Jun-09	11	FALSE	
Columbia Park	Bay Village	Tier 3	22-Jun-09	31	FALSE	
Columbia Park	Bay Village	Tier 3	29-Jun-09	62	FALSE	
Columbia Park	Bay Village	Tier 3	06-Jul-09	19	FALSE	
Columbia Park	Bay Village	Tier 3	13-Jul-09	360	TRUE	
Columbia Park	Bay Village	Tier 3	20-Jul-09	14	FALSE	
Columbia Park	Bay Village	Tier 3	27-Jul-09	14	FALSE	
Columbia Park	Bay Village	Tier 3	03-Aug-09	21	FALSE	
Columbia Park	Bay Village	Tier 3	10-Aug-09	106	FALSE	
Columbia Park	Bay Village	Tier 3	17-Aug-09	17	FALSE	
Columbia Park	Bay Village	Tier 3	25-Aug-09	3	FALSE	
Edgecliff Beach	Euclid	Tier 3	27-May-09	40	FALSE	
Edgecliff Beach	Euclid	Tier 3	02-Jun-09	368	TRUE	
Edgecliff Beach	Euclid	Tier 3	23-Jun-09	28	FALSE	
Edgecliff Beach	Euclid	Tier 3	24-Jun-09	25	FALSE	
Edgecliff Beach	Euclid	Tier 3	01-Jul-09	2700	TRUE	
Edgecliff Beach	Euclid	Tier 3	07-Jul-09	66	FALSE	
Edgecliff Beach	Euclid	Tier 3	08-Jul-09	11	FALSE	
Edgecliff Beach	Euclid	Tier 3	14-Jul-09	660	TRUE	
Edgecliff Beach	Euclid	Tier 3	21-Jul-09	18	FALSE	
Edgecliff Beach	Euclid	Tier 3	28-Jul-09	24	FALSE	
Edgecliff Beach	Euclid	Tier 3	04-Aug-09	16	FALSE	
Edgecliff Beach	Euclid	Tier 3	11-Aug-09	396	TRUE	
Edgecliff Beach	Euclid	Tier 3	18-Aug-09	1683	TRUE	
Edgecliff Beach	Euclid	Tier 3	25-Aug-09	8	FALSE	
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Huntington Beach	Bay Village	Tier 1	21-May-09	5	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	22-May-09	105	FALSE	*See Nowcast Data

Huntington Beach	Bay Village	Tier 1	23-May-09	37	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	24-May-09	6	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	25-May-09	49	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	26-May-09	48	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	27-May-09	29	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	28-May-09	260	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	29-May-09	305	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	30-May-09	325	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	31-May-09	590	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	01-Jun-09	60	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	02-Jun-09	48	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	03-Jun-09	61	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	04-Jun-09	32	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	05-Jun-09	24	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	06-Jun-09	9	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	07-Jun-09	10	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	08-Jun-09	43	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	09-Jun-09	41	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	10-Jun-09	17	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	11-Jun-09	25	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	12-Jun-09	84	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	13-Jun-09	14	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	14-Jun-09	5	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	15-Jun-09	43	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	16-Jun-09	10	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	17-Jun-09	11	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	18-Jun-09	135	FALSE	*See Nowcast Data

Huntington Beach	Bay Village	Tier 1	19-Jun-09	No Sample	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	20-Jun-09	133	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	21-Jun-09	80	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	22-Jun-09	36	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	23-Jun-09	15	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	24-Jun-09	34	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	25-Jun-09	12	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	26-Jun-09	240	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	27-Jun-09	265	FALSE	*See Nowcast Data
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Huntington Beach	Bay Village	Tier 1	30-Jun-09	179	FALSE	*See Nowcast Data
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Huntington Beach	Bay Village	Tier 1	03-Jul-09	96	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	04-Jul-09	49	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	05-Jul-09	19	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	06-Jul-09	19	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	07-Jul-09	215	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	08-Jul-09	24	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	09-Jul-09	20	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	10-Jul-09	31	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	11-Jul-09	No Sample	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	12-Jul-09	No Sample	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	13-Jul-09	81	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	14-Jul-09	130	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	15-Jul-09	27	FALSE	*See Nowcast Data

Huntington Beach	Bay Village	Tier 1	16-Jul-09	226	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	17-Jul-09	33	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	18-Jul-09	No Sample	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	19-Jul-09	No Sample	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	20-Jul-09	6	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	21-Jul-09	58	FALSE	*See Nowcast Data
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Huntington Beach	Bay Village	Tier 1	26-Jul-09	No Sample	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	27-Jul-09	66	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	28-Jul-09	12	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	29-Jul-09	31	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	30-Jul-09	10	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	31-Jul-09	66	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	01-Aug-09	No Sample	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	02-Aug-09	No Sample	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	03-Aug-09	38	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	04-Aug-09	14	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	05-Aug-09	268	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	06-Aug-09	48	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	07-Aug-09	12	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	08-Aug-09	22	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	09-Aug-09	77	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	10-Aug-09	58	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	11-Aug-09	23	FALSE	*See Nowcast Data

Huntington Beach	Bay Village	Tier 1	12-Aug-09	205	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	13-Aug-09	30	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	14-Aug-09	14	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	15-Aug-09	23	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	16-Aug-09	21	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	17-Aug-09	38	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	18-Aug-09	21	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	19-Aug-09	102	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	20-Aug-09	43	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	21-Aug-09	106	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	22-Aug-09	8	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	23-Aug-09	280	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	24-Aug-09	40	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	25-Aug-09	9	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	26-Aug-09	20	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	27-Aug-09	81	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	28-Aug-09	126	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	29-Aug-09	318	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	30-Aug-09	51	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	31-Aug-09	79	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	01-Sep-09	7	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	02-Sep-09	9	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	03-Sep-09	28	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	04-Sep-09	14	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	05-Sep-09	20	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	06-Sep-09	49	FALSE	*See Nowcast Data
Huntington Beach	Bay Village	Tier 1	07-Sep-09	71	FALSE	*See Nowcast Data

Moss Point Beach	Euclid	Tier 3	27-May-09	77	FALSE
Moss Point Beach	Euclid	Tier 3	02-Jun-09	40	FALSE
Moss Point Beach	Euclid	Tier 3	09-Jun-09	245	TRUE
Moss Point Beach	Euclid	Tier 3	16-Jun-09	21	FALSE
Moss Point Beach	Euclid	Tier 3	23-Jun-09	18	FALSE
Moss Point Beach	Euclid	Tier 3	01-Jul-09	2800	TRUE
Moss Point Beach	Euclid	Tier 3	07-Jul-09	205	FALSE
Moss Point Beach	Euclid	Tier 3	14-Jul-09	840	TRUE
Moss Point Beach	Euclid	Tier 3	21-Jul-09	66	FALSE
Moss Point Beach	Euclid	Tier 3	28-Jul-09	74	FALSE
Moss Point Beach	Euclid	Tier 3	04-Aug-09	48	FALSE
Moss Point Beach	Euclid	Tier 3	11-Aug-09	52	FALSE
Moss Point Beach	Euclid	Tier 3	18-Aug-09	740	TRUE
Moss Point Beach	Euclid	Tier 3	25-Aug-09	36	FALSE
Noble Beach	Euclid	Tier 3	27-May-09	64	FALSE
Noble Beach	Euclid	Tier 3	02-Jun-09	2600	TRUE
Noble Beach	Euclid	Tier 3	09-Jun-09	190	FALSE
Noble Beach	Euclid	Tier 3	16-Jun-09	2	FALSE
Noble Beach	Euclid	Tier 3	23-Jun-09	48	FALSE
Noble Beach	Euclid	Tier 3	01-Jul-09	324	TRUE
Noble Beach	Euclid	Tier 3	07-Jul-09	41	FALSE
Noble Beach	Euclid	Tier 3	14-Jul-09	210	FALSE
Noble Beach	Euclid	Tier 3	21-Jul-09	20	FALSE
Noble Beach	Euclid	Tier 3	28-Jul-09	6	FALSE
Noble Beach	Euclid	Tier 3	04-Aug-09	335	TRUE
Noble Beach	Euclid	Tier 3	11-Aug-09	1060	TRUE
Noble Beach	Euclid	Tier 3	18-Aug-09	4900	TRUE
Noble Beach	Euclid	Tier 3	25-Aug-09	8	FALSE
Parklawn Beach	Rocky River	Tier 2	28-May-09	54	FALSE
Parklawn Beach	Rocky River	Tier 2	01-Jun-09	34	FALSE
Parklawn Beach	Rocky River	Tier 2	08-Jun-09	310	TRUE
Parklawn Beach	Rocky River	Tier 2	15-Jun-09	3	FALSE
Parklawn Beach	Rocky River	Tier 2	22-Jun-09	56	FALSE
Parklawn Beach	Rocky River	Tier 2	29-Jun-09	47	FALSE
Parklawn Beach	Rocky River	Tier 2	06-Jul-09	64	FALSE
Parklawn Beach	Rocky River	Tier 2	13-Jul-09	840	TRUE
Parklawn Beach	Rocky River	Tier 2	16-Jul-09	215	FALSE
Parklawn Beach	Rocky River	Tier 2	20-Jul-09	2	FALSE
Parklawn Beach	Rocky River	Tier 2	27-Jul-09	64	FALSE
Parklawn Beach	Rocky River	Tier 2	03-Aug-09	13	FALSE
Parklawn Beach	Rocky River	Tier 2	10-Aug-09	20	FALSE
Parklawn Beach	Rocky River	Tier 2	17-Aug-09	4	FALSE
Parklawn Beach	Rocky River	Tier 2	25-Aug-09	8	FALSE

Royal Acres Beach	Euclid	Tier 3	27-May-09	21	FALSE
Royal Acres Beach	Euclid	Tier 3	02-Jun-09	10200	TRUE
Royal Acres Beach	Euclid	Tier 3	09-Jun-09	65	FALSE
Royal Acres Beach	Euclid	Tier 3	16-Jun-09	12	FALSE
Royal Acres Beach	Euclid	Tier 3	23-Jun-09	21	FALSE
Royal Acres Beach	Euclid	Tier 3	01-Jul-09	680	TRUE
Royal Acres Beach	Euclid	Tier 3	07-Jul-09	195	FALSE
Royal Acres Beach	Euclid	Tier 3	14-Jul-09	385	TRUE
Royal Acres Beach	Euclid	Tier 3	21-Jul-09	155	FALSE
Royal Acres Beach	Euclid	Tier 3	28-Jul-09	62	FALSE
Royal Acres Beach	Euclid	Tier 3	04-Aug-09	24	FALSE
Royal Acres Beach	Euclid	Tier 3	11-Aug-09	58	FALSE
Royal Acres Beach	Euclid	Tier 3	18-Aug-09	71	FALSE
Royal Acres Beach	Euclid	Tier 3	25-Aug-09	41	FALSE
Shoreby Club Beach	Bratenahl	Tier 2	27-May-09	3	FALSE
Shoreby Club Beach	Bratenahl	Tier 2	02-Jun-09	5800	TRUE
Shoreby Club Beach	Bratenahl	Tier 2	09-Jun-09	15	FALSE
Shoreby Club Beach	Bratenahl	Tier 2	16-Jun-09	15	FALSE
Shoreby Club Beach	Bratenahl	Tier 2	23-Jun-09	6	FALSE
Shoreby Club Beach	Bratenahl	Tier 2	01-Jul-09	335	TRUE
Shoreby Club Beach	Bratenahl	Tier 2	07-Jul-09	325	TRUE
Shoreby Club Beach	Bratenahl	Tier 2	14-Jul-09	225	FALSE
Shoreby Club Beach	Bratenahl	Tier 2	21-Jul-09	6	FALSE
Shoreby Club Beach	Bratenahl	Tier 2	28-Jul-09	1300	TRUE
Shoreby Club Beach	Bratenahl	Tier 2	04-Aug-09	195	FALSE
Shoreby Club Beach	Bratenahl	Tier 2	11-Aug-09	328	TRUE
Shoreby Club Beach	Bratenahl	Tier 2	18-Aug-09	340	TRUE
Shoreby Club Beach	Bratenahl	Tier 2	25-Aug-09	1	FALSE
Shorehaven Beach	Euclid	Tier 3	27-May-09	51	FALSE
Shorehaven Beach	Euclid	Tier 3	02-Jun-09	660	TRUE
Shorehaven Beach	Euclid	Tier 3	09-Jun-09	160	FALSE
Shorehaven Beach	Euclid	Tier 3	16-Jun-09	19	FALSE
Shorehaven Beach	Euclid	Tier 3	23-Jun-09	15	FALSE
Shorehaven Beach	Euclid	Tier 3	07-Jul-09	215	FALSE
Shorehaven Beach	Euclid	Tier 3	14-Jul-09	600	TRUE
Sims Beach	Euclid	Tier 3	27-May-09	110	FALSE
Sims Beach	Euclid	Tier 3	02-Jun-09	2900	TRUE
Sims Beach	Euclid	Tier 3	09-Jun-09	88	FALSE
Sims Beach	Euclid	Tier 3	16-Jun-09	27	FALSE
Sims Beach	Euclid	Tier 3	23-Jun-09	21	FALSE
Sims Beach	Euclid	Tier 3	01-Jul-09	1617	TRUE
Sims Beach	Euclid	Tier 3	07-Jul-09	65	FALSE
Sims Beach	Euclid	Tier 3	14-Jul-09	245	TRUE

Sims Beach	Euclid	Tier 3	21-Jul-09	29	FALSE
Sims Beach	Euclid	Tier 3	28-Jul-09	138	FALSE
Sims Beach	Euclid	Tier 3	04-Aug-09	114	FALSE
Sims Beach	Euclid	Tier 3	11-Aug-09	124	FALSE
Sims Beach	Euclid	Tier 3	18-Aug-09	860	TRUE
Sims Beach	Euclid	Tier 3	25-Aug-09	11	FALSE
Utopia Beach	Euclid	Tier 2	27-May-09	12	FALSE
Utopia Beach	Euclid	Tier 2	02-Jun-09	10200	TRUE
Utopia Beach	Euclid	Tier 2	09-Jun-09	52	FALSE
Utopia Beach	Euclid	Tier 2	16-Jun-09	4	FALSE
Utopia Beach	Euclid	Tier 2	23-Jun-09	12	FALSE
Utopia Beach	Euclid	Tier 2	01-Jul-09	2500	TRUE
Utopia Beach	Euclid	Tier 2	07-Jul-09	56	FALSE
Utopia Beach	Euclid	Tier 2	14-Jul-09	900	TRUE
Utopia Beach	Euclid	Tier 2	21-Jul-09	4	FALSE
Utopia Beach	Euclid	Tier 2	28-Jul-09	5	FALSE
Utopia Beach	Euclid	Tier 2	04-Aug-09	3	FALSE
Utopia Beach	Euclid	Tier 2	11-Aug-09	2	FALSE
Utopia Beach	Euclid	Tier 2	18-Aug-09	70	FALSE
Utopia Beach	Euclid	Tier 2	25-Aug-09	25	FALSE
Wagar Beach	Rocky River	Tier 2	28-May-09	25	FALSE
Wagar Beach	Rocky River	Tier 2	01-Jun-09	51	FALSE
Wagar Beach	Rocky River	Tier 2	08-Jun-09	210	FALSE
Wagar Beach	Rocky River	Tier 2	15-Jun-09	64	FALSE
Wagar Beach	Rocky River	Tier 2	22-Jun-09	69	FALSE
Wagar Beach	Rocky River	Tier 2	29-Jun-09	185	FALSE
Wagar Beach	Rocky River	Tier 2	06-Jul-09	384	TRUE
Wagar Beach	Rocky River	Tier 2	13-Jul-09	840	TRUE
Wagar Beach	Rocky River	Tier 2	16-Jul-09	220	FALSE
Wagar Beach	Rocky River	Tier 2	20-Jul-09	7	FALSE
Wagar Beach	Rocky River	Tier 2	27-Jul-09	48	FALSE
Wagar Beach	Rocky River	Tier 2	03-Aug-09	40	FALSE
Wagar Beach	Rocky River	Tier 2	10-Aug-09	50	FALSE
Wagar Beach	Rocky River	Tier 2	17-Aug-09	8	FALSE
Wager Beach	Rocky River	Tier 2	25-Aug-09	3	FALSE

Regularly scheduled testing for the above beaches began the week of May 25th, 2009. Sampling at Huntington Beach, where the *Nowcast* system for predicting beach advisories is being used, began the week of May 18th, 2009; this beach is sampled 7 days a week throughout the recreation season. All remaining beaches were sampled once or twice a week. Beach Act funds are not being used at the Shoreby Club Beach; however, the water quality data is provided above since it is a monitored Lake Erie beach.
As indicated in the RFP, afternoon sampling was also being conducted at Huntington Beach in order to determine if afternoon data is significant to the *Nowcast* model. The

table below provides the actual raw *E. coli* data from the afternoon samples that were collected over the course of the recreation season. Samples were collected 4 days a week, Monday through Thursday. This data is not being used at this time for advisory reporting, but rather by the U.S. Geological Survey for statistical review.

2009 Afternoon Water Quality Data for Huntington Beach

Date	E Coli (Central)	E Coli (West)	E Coli Avg
18-May-09	6	9	8
19-May-09	8	2	5
20-May-09	4	4	4
21-May-09	3	37	20
26-May-09	115	115	115
27-May-09	2	6	4
28-May-09	248	249	249
01-Jun-09	21	38	30
02-Jun-09	139	120	130
03-Jun-09	13	52	33
04-Jun-09	26	20	23
08-Jun-09	40	28	34
09-Jun-09	14	13	14
10-Jun-09	18	16	17
11-Jun-09	154	15	85
15-Jun-09	5	38	22
16-Jun-09	43	36	40
17-Jun-09	5	27	16
18-Jun-09	54	64	59
22-Jun-09	220	40	130
23-Jun-09	8	45	27
24-Jun-09	5	34	20
25-Jun-09	317	44	181
29-Jun-09	12	16	14
30-Jun-09	228	219	224
01-Jul-09	7	8	8
02-Jul-09	31	17	24
06-Jul-09	26	35	31
07-Jul-09	34	62	48
08-Jul-09	25	24	25
09-Jul-09	55	51	53
05-Aug-09	263	194	229
06-Aug-09	20	16	18
10-Aug-09	29	30	30
11-Aug-09	32	9	21
12-Aug-09	108	93	101
13-Aug-09	42	5	24
17-Aug-09	18	35	27

18-Aug-09	23	46	35
19-Aug-09	24	33	29
20-Aug-09	34	14	24

Note: There is a gap in the sampling data in the above table between the dates of July 9th, 2009 through August 5th, 2009 due to a contract requirement issued by the Ohio Department of Health to cease sampling activities during that time frame.

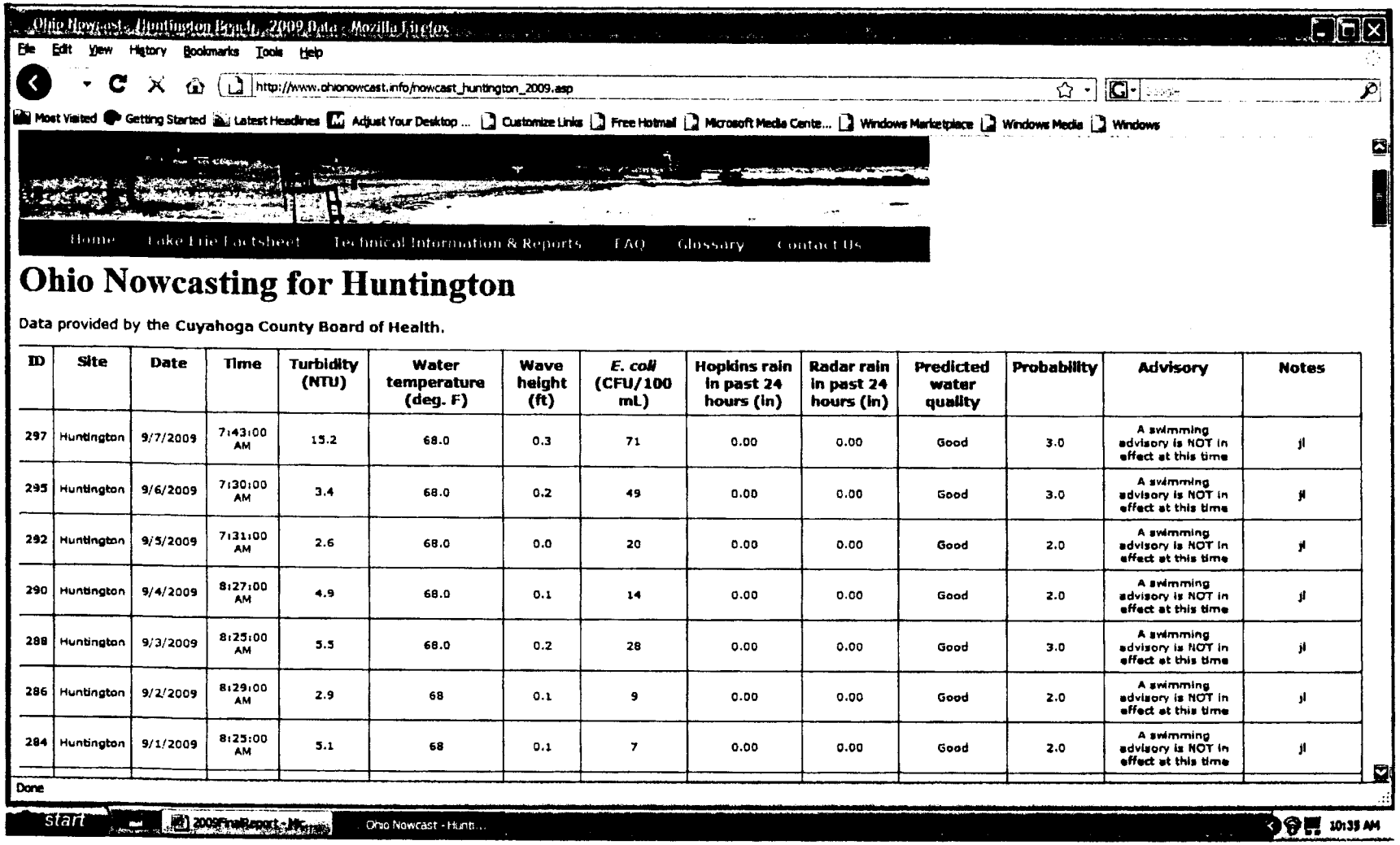
Nowcasting System for Predicting Beach Advisories

The tables provided on the following pages contain the *Nowcast* results for Huntington Beach over the course of both contract periods. Data is provided on the predicted water quality each day, the probability that the water quality standard will be exceeded, advisory information, and the actual *E. coli* result. Data pertaining to turbidity, water temperature, wave height, and rainfall amounts is also provided. These tables were obtained directly from the *Nowcast* website, www.ohionowcast.info. Due to formatting errors, the tables were copied directly from the website and they appear below as images from the website.

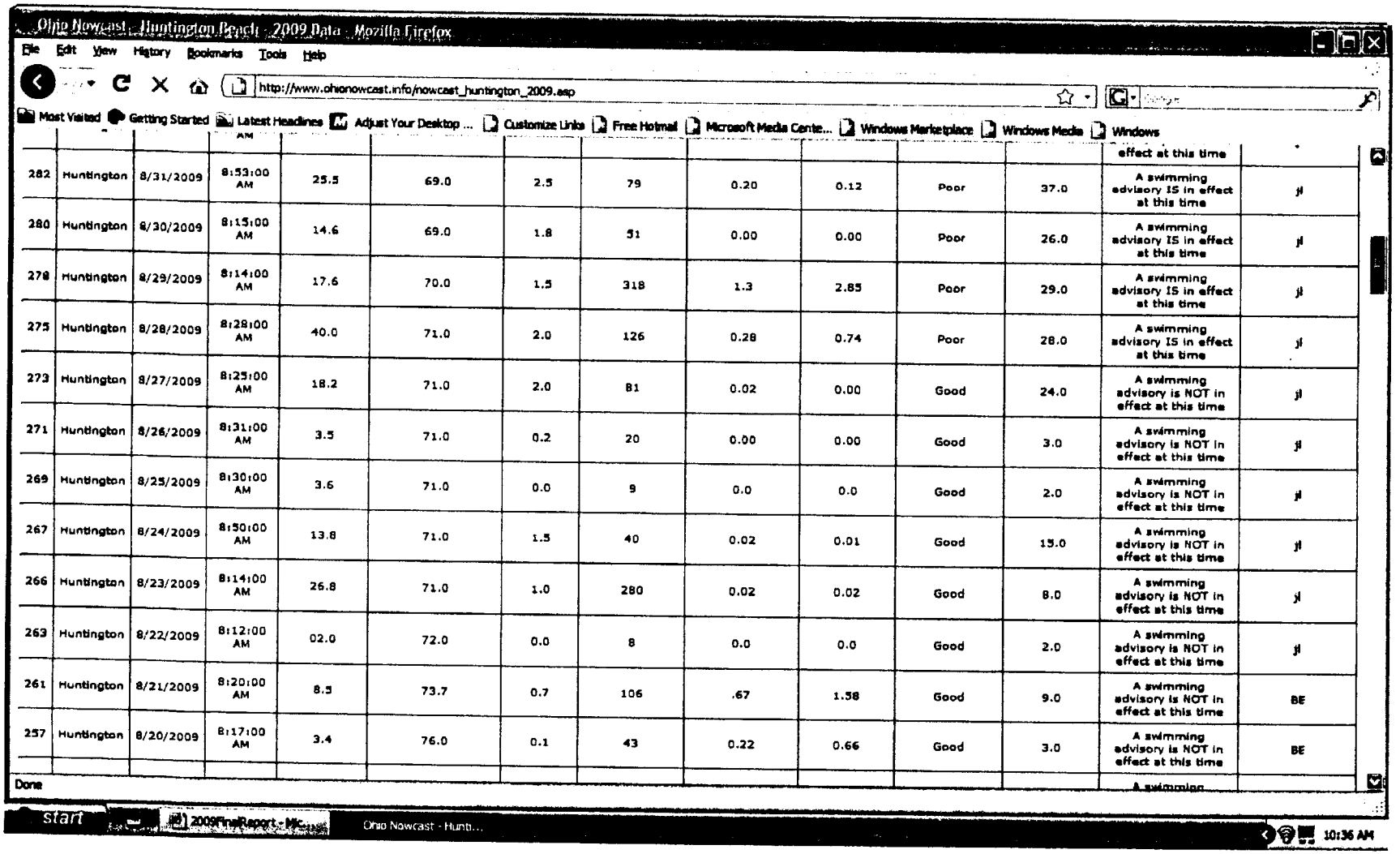
The recreation season was divided into 2 "subseasons", for which the Nowcast model varied to some degree. Subseason 1 consisted of the time frame from May 18th, 2009 through July 23rd, 2009. The model parameters during this subseason consisted of the following: rainfall amounts and turbidity. A water quality advisory was issued when the probability of exceeding the water quality standard was at or above a threshold of 23%. Subseason 2 consisted of the time frame from July 24th, 2009 through September 7th, 2009. The model parameters during this subseason consisted of the following parameters: rainfall amounts and wave height. A water quality advisory was issued when the probability of exceeding the water quality standard was at or above a threshold of 26%.

A recent review of the 2009 recreational season data by the USGS shows that the *Nowcast* model accurately predicted water quality conditions 86% of the season. The remaining 14% of the data was inaccurate and consists of a combination of false positive and false negative results. A false positive result was a prediction of poor water quality when it was actually good, as determined by water sample analysis. A false negative result was a prediction of good water quality when it was actually poor, as determined by water sample analysis.

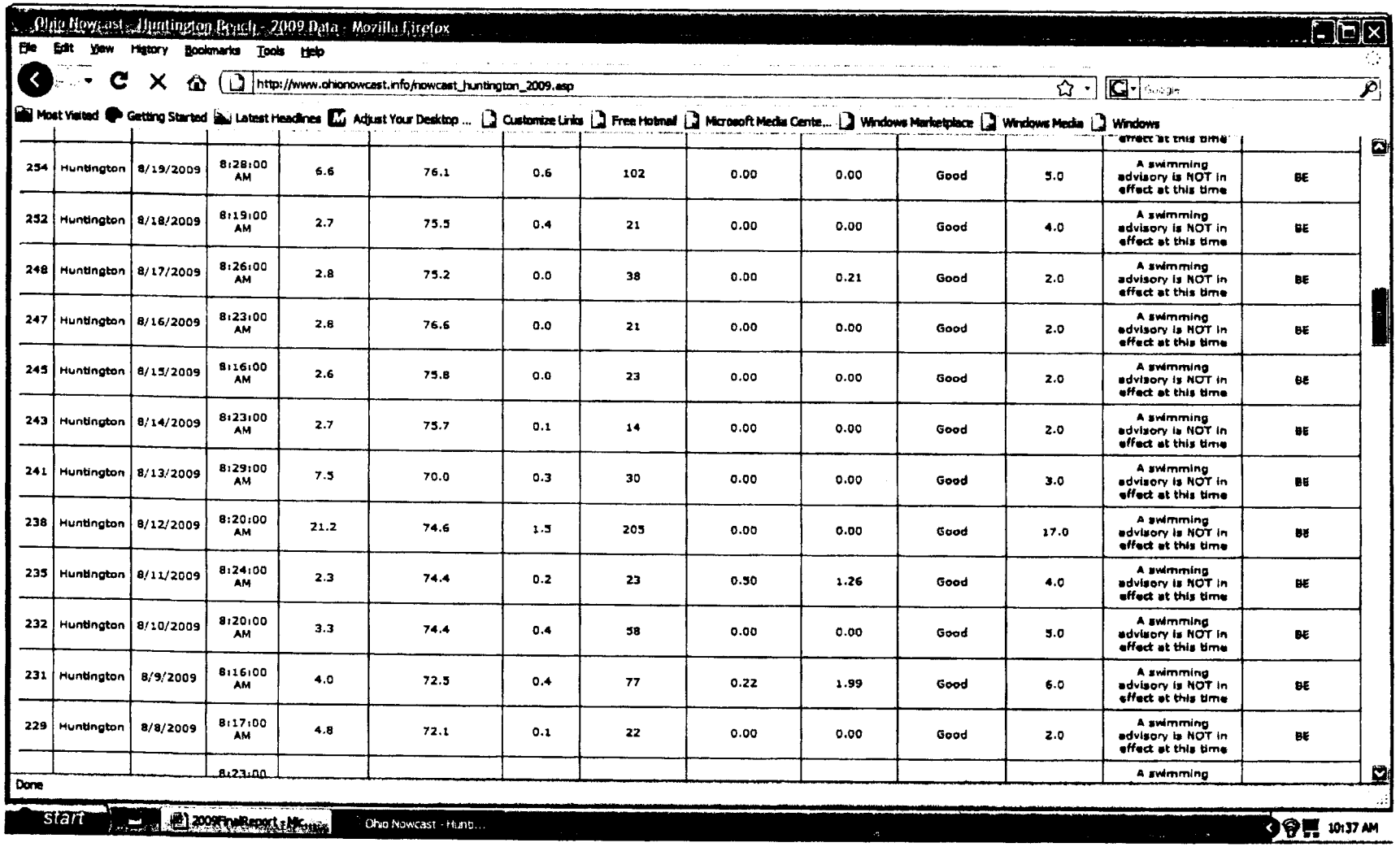
For 2009, a total of 100 actual water samples were collected. Eleven of those samples had an associated false positive prediction. Three samples had an associated false negative prediction. Steps will therefore continue to be taken to further refine and improve the Huntington Beach model. The CCBH, in conjunction with the USGS, will continue to work to enhance the model in order to reduce the number of false positive and false negative results.



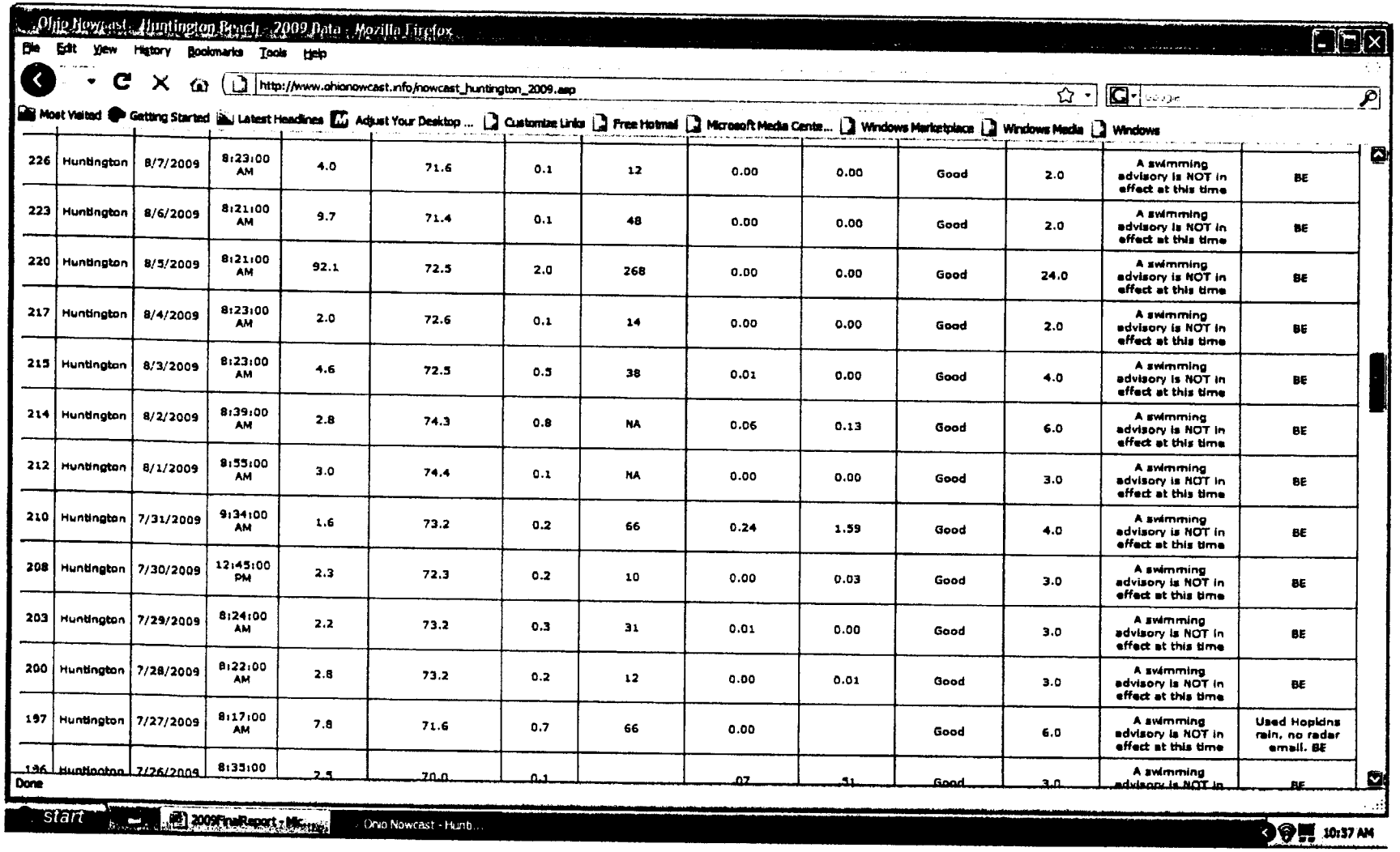
ID	Site	Date	Time	Turbidity (NTU)	Water temperature (deg. F)	Wave height (ft)	*E. coli* (CFU/100 mL)	Hopkins rain in past 24 hours (in)	Radar rain in past 24 hours (in)	Predicted water quality	Probability	Advisory	Notes
297	Huntington	9/7/2009	7:43:00 AM	15.2	68.0	0.3	71	0.00	0.00	Good	3.0	A swimming advisory is NOT in effect at this time	jl
295	Huntington	9/6/2009	7:30:00 AM	3.4	68.0	0.2	49	0.00	0.00	Good	3.0	A swimming advisory is NOT in effect at this time	jl
292	Huntington	9/5/2009	7:31:00 AM	2.6	68.0	0.0	20	0.00	0.00	Good	2.0	A swimming advisory is NOT in effect at this time	jl
290	Huntington	9/4/2009	8:27:00 AM	4.9	68.0	0.1	14	0.00	0.00	Good	2.0	A swimming advisory is NOT in effect at this time	jl
288	Huntington	9/3/2009	8:25:00 AM	5.5	68.0	0.2	28	0.00	0.00	Good	3.0	A swimming advisory is NOT in effect at this time	jl
286	Huntington	9/2/2009	8:29:00 AM	2.9	68	0.1	9	0.00	0.00	Good	2.0	A swimming advisory is NOT in effect at this time	jl
284	Huntington	9/1/2009	8:25:00 AM	5.1	68	0.1	7	0.00	0.00	Good	2.0	A swimming advisory is NOT in effect at this time	jl



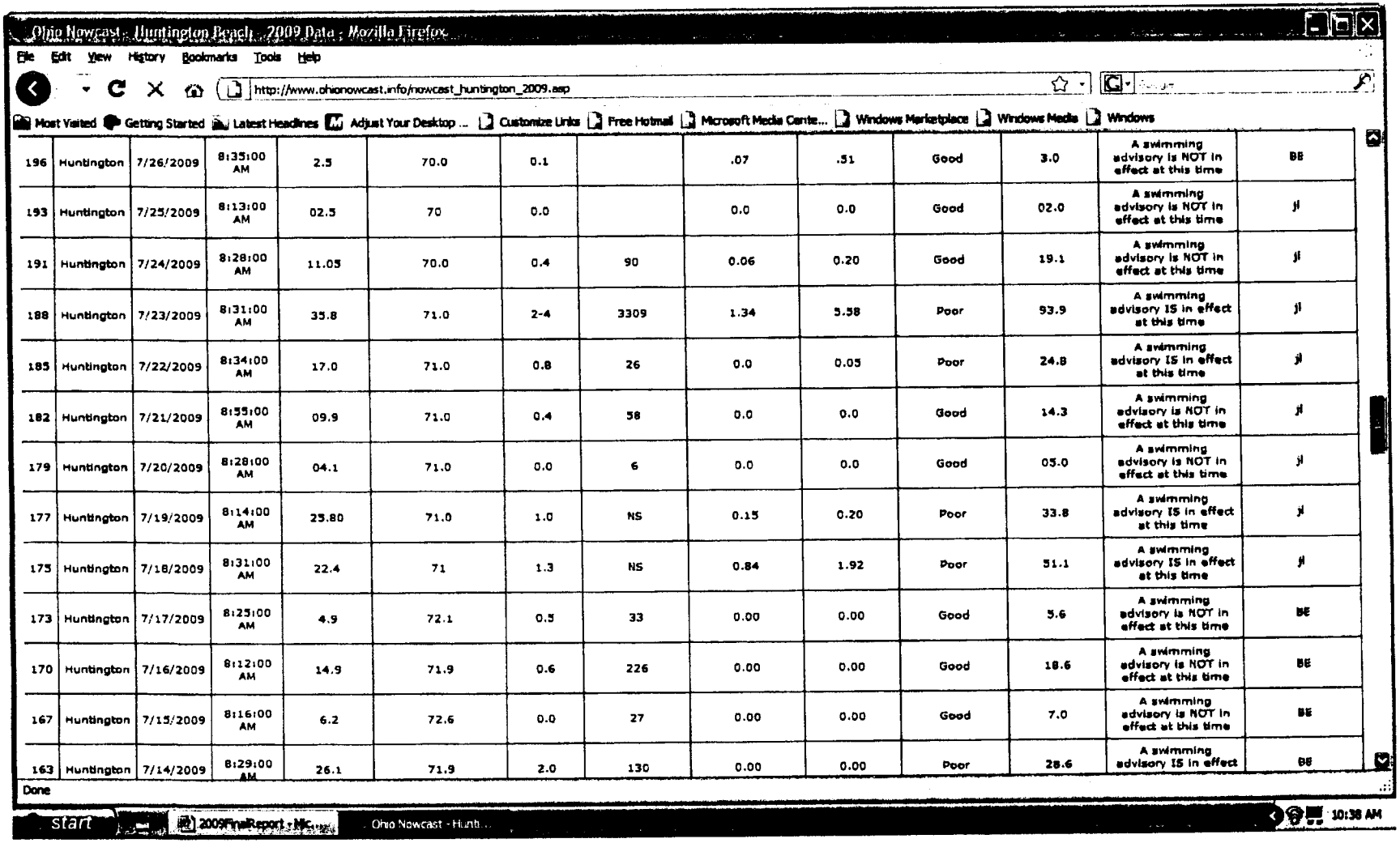
			AM									effect at this time	
282	Huntington	8/31/2009	8:53:00 AM	25.5	69.0	2.5	79	0.20	0.12	Poor	37.0	A swimming advisory IS in effect at this time	jl
280	Huntington	8/30/2009	8:15:00 AM	14.6	69.0	1.8	51	0.00	0.00	Poor	26.0	A swimming advisory IS in effect at this time	jl
278	Huntington	8/29/2009	8:14:00 AM	17.6	70.0	1.5	318	1.3	2.85	Poor	29.0	A swimming advisory IS in effect at this time	jl
275	Huntington	8/28/2009	8:28:00 AM	40.0	71.0	2.0	126	0.28	0.74	Poor	28.0	A swimming advisory IS in effect at this time	jl
273	Huntington	8/27/2009	8:25:00 AM	18.2	71.0	2.0	81	0.02	0.00	Good	24.0	A swimming advisory is NOT in effect at this time	jl
271	Huntington	8/26/2009	8:31:00 AM	3.5	71.0	0.2	20	0.00	0.00	Good	3.0	A swimming advisory is NOT in effect at this time	jl
269	Huntington	8/25/2009	8:30:00 AM	3.6	71.0	0.0	9	0.0	0.0	Good	2.0	A swimming advisory is NOT in effect at this time	jl
267	Huntington	8/24/2009	8:50:00 AM	13.8	71.0	1.5	40	0.02	0.01	Good	15.0	A swimming advisory is NOT in effect at this time	jl
266	Huntington	8/23/2009	8:14:00 AM	26.8	71.0	1.0	280	0.02	0.02	Good	8.0	A swimming advisory is NOT in effect at this time	jl
263	Huntington	8/22/2009	8:12:00 AM	02.0	72.0	0.0	8	0.0	0.0	Good	2.0	A swimming advisory is NOT in effect at this time	jl
261	Huntington	8/21/2009	8:20:00 AM	8.5	73.7	0.7	106	.67	1.58	Good	9.0	A swimming advisory is NOT in effect at this time	BE
257	Huntington	8/20/2009	8:17:00 AM	3.4	76.0	0.1	43	0.22	0.66	Good	3.0	A swimming advisory is NOT in effect at this time	BE



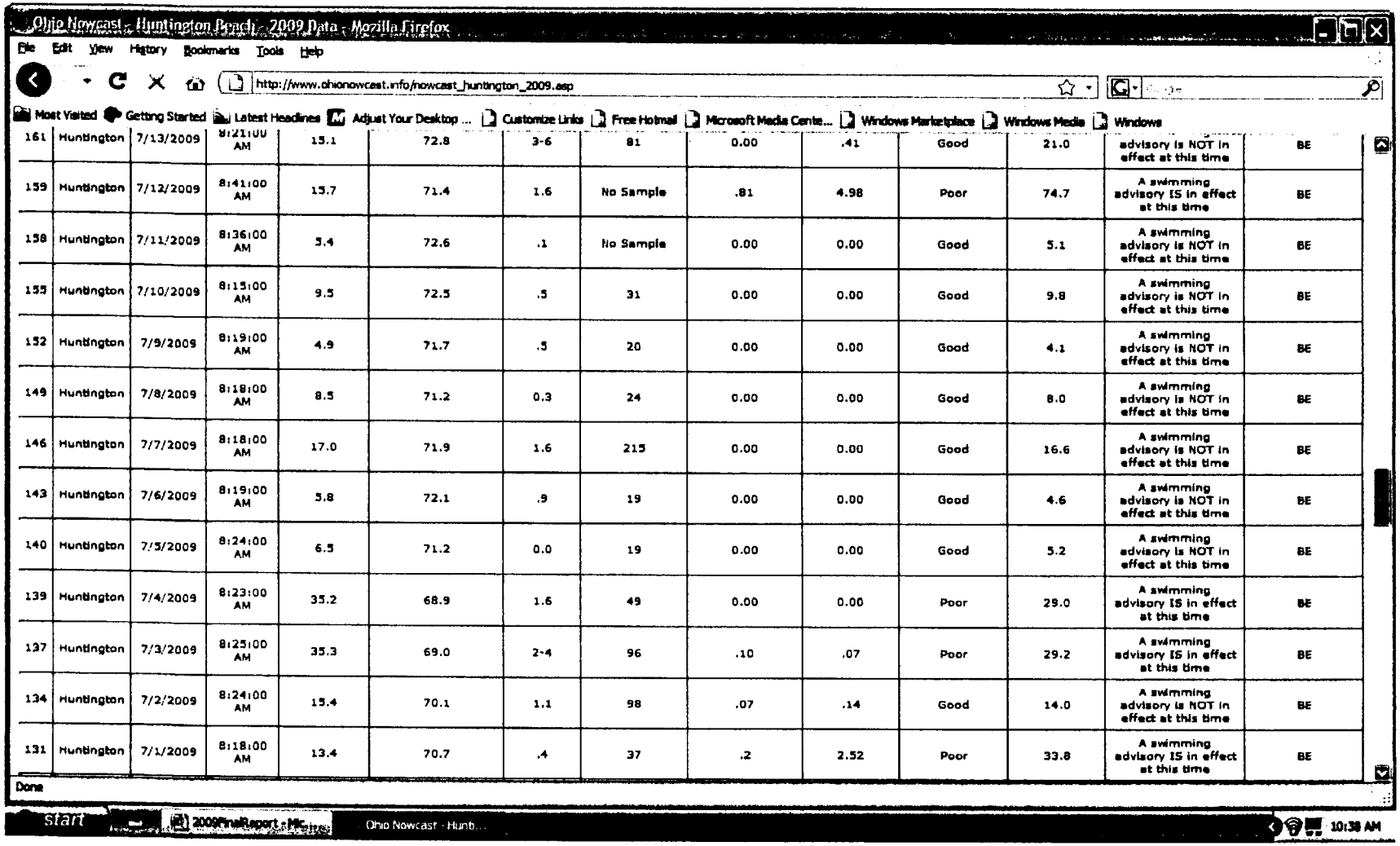
254	Huntington	8/19/2009	8:28:00 AM	6.6	76.1	0.6	102	0.00	0.00	Good	5.0	A swimming advisory is NOT in effect at this time	BE
252	Huntington	8/18/2009	8:19:00 AM	2.7	75.5	0.4	21	0.00	0.00	Good	4.0	A swimming advisory is NOT in effect at this time	BE
248	Huntington	8/17/2009	8:26:00 AM	2.8	75.2	0.0	38	0.00	0.21	Good	2.0	A swimming advisory is NOT in effect at this time	BE
247	Huntington	8/16/2009	8:23:00 AM	2.8	76.6	0.0	21	0.00	0.00	Good	2.0	A swimming advisory is NOT in effect at this time	BE
245	Huntington	8/15/2009	8:16:00 AM	2.6	75.8	0.0	23	0.00	0.00	Good	2.0	A swimming advisory is NOT in effect at this time	BE
243	Huntington	8/14/2009	8:23:00 AM	2.7	75.7	0.1	14	0.00	0.00	Good	2.0	A swimming advisory is NOT in effect at this time	BE
241	Huntington	8/13/2009	8:29:00 AM	7.5	70.0	0.3	30	0.00	0.00	Good	3.0	A swimming advisory is NOT in effect at this time	BE
238	Huntington	8/12/2009	8:20:00 AM	21.2	74.6	1.5	205	0.00	0.00	Good	17.0	A swimming advisory is NOT in effect at this time	BE
235	Huntington	8/11/2009	8:24:00 AM	2.3	74.4	0.2	23	0.50	1.26	Good	4.0	A swimming advisory is NOT in effect at this time	BE
232	Huntington	8/10/2009	8:20:00 AM	3.3	74.4	0.4	58	0.00	0.00	Good	5.0	A swimming advisory is NOT in effect at this time	BE
231	Huntington	8/9/2009	8:16:00 AM	4.0	72.5	0.4	77	0.22	1.99	Good	6.0	A swimming advisory is NOT in effect at this time	BE
229	Huntington	8/8/2009	8:17:00 AM	4.8	72.1	0.1	22	0.00	0.00	Good	2.0	A swimming advisory is NOT in effect at this time	BE
			8:23:00									A swimming	



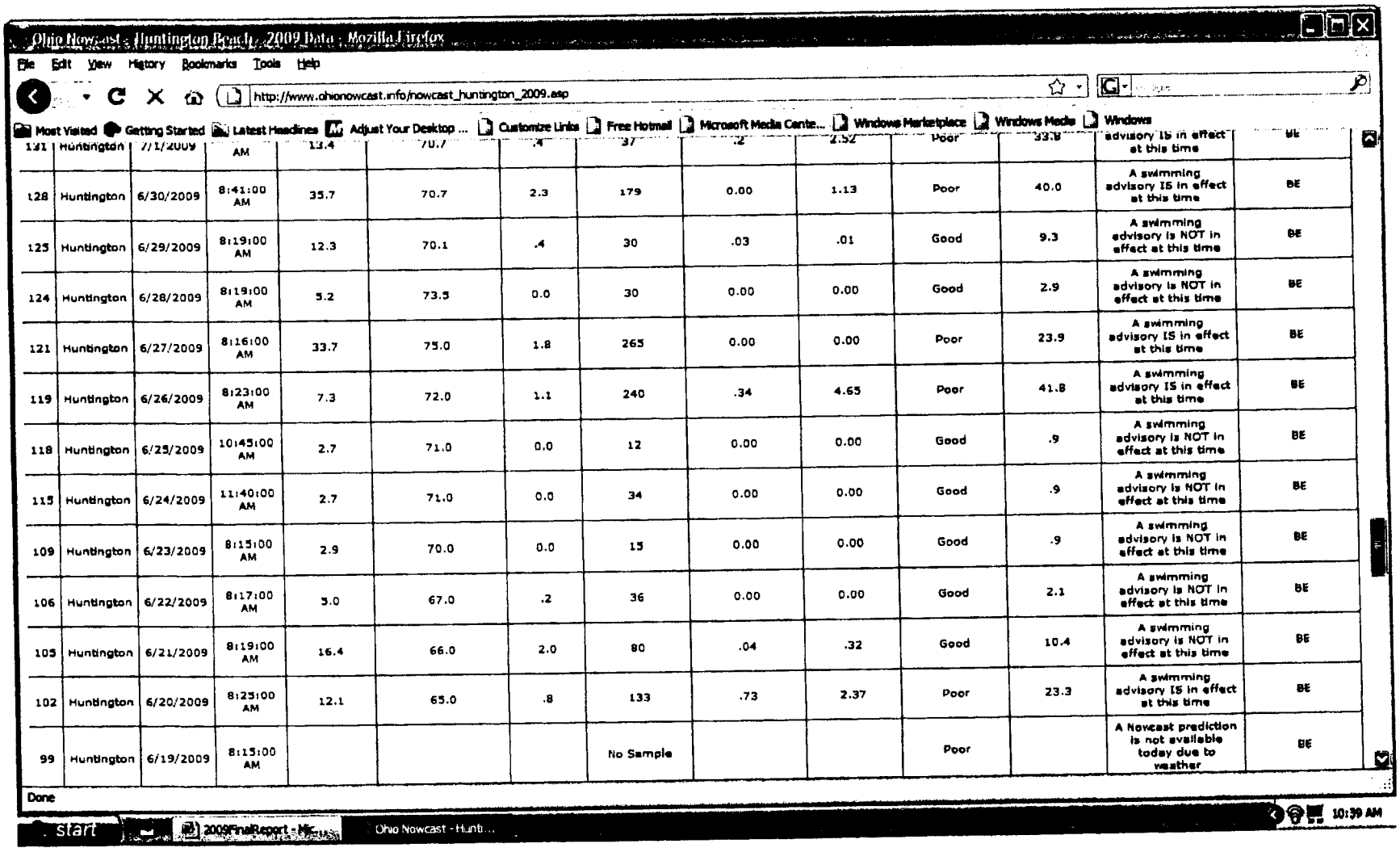
226	Huntington	8/7/2009	8:23:00 AM	4.0	71.6	0.1	12	0.00	0.00	Good	2.0	A swimming advisory is NOT in effect at this time	BE
223	Huntington	8/6/2009	8:21:00 AM	9.7	71.4	0.1	48	0.00	0.00	Good	2.0	A swimming advisory is NOT in effect at this time	BE
220	Huntington	8/5/2009	8:21:00 AM	92.1	72.5	2.0	268	0.00	0.00	Good	24.0	A swimming advisory is NOT in effect at this time	BE
217	Huntington	8/4/2009	8:23:00 AM	2.0	72.6	0.1	14	0.00	0.00	Good	2.0	A swimming advisory is NOT in effect at this time	BE
215	Huntington	8/3/2009	8:23:00 AM	4.6	72.5	0.5	38	0.01	0.00	Good	4.0	A swimming advisory is NOT in effect at this time	BE
214	Huntington	8/2/2009	8:39:00 AM	2.8	74.3	0.8	NA	0.06	0.13	Good	6.0	A swimming advisory is NOT in effect at this time	BE
212	Huntington	8/1/2009	8:55:00 AM	3.0	74.4	0.1	NA	0.00	0.00	Good	3.0	A swimming advisory is NOT in effect at this time	BE
210	Huntington	7/31/2009	9:34:00 AM	1.6	73.2	0.2	66	0.24	1.59	Good	4.0	A swimming advisory is NOT in effect at this time	BE
208	Huntington	7/30/2009	12:45:00 PM	2.3	72.3	0.2	10	0.00	0.03	Good	3.0	A swimming advisory is NOT in effect at this time	BE
203	Huntington	7/29/2009	8:24:00 AM	2.2	73.2	0.3	31	0.01	0.00	Good	3.0	A swimming advisory is NOT in effect at this time	BE
200	Huntington	7/28/2009	8:22:00 AM	2.8	73.2	0.2	12	0.00	0.01	Good	3.0	A swimming advisory is NOT in effect at this time	BE
197	Huntington	7/27/2009	8:17:00 AM	7.8	71.6	0.7	66	0.00		Good	6.0	A swimming advisory is NOT in effect at this time	Used Hopkins rain, no radar email. BE
196	Huntington	7/26/2009	8:35:00	2.5	70.0	0.1		07	51	Good	3.0	A swimming	BE



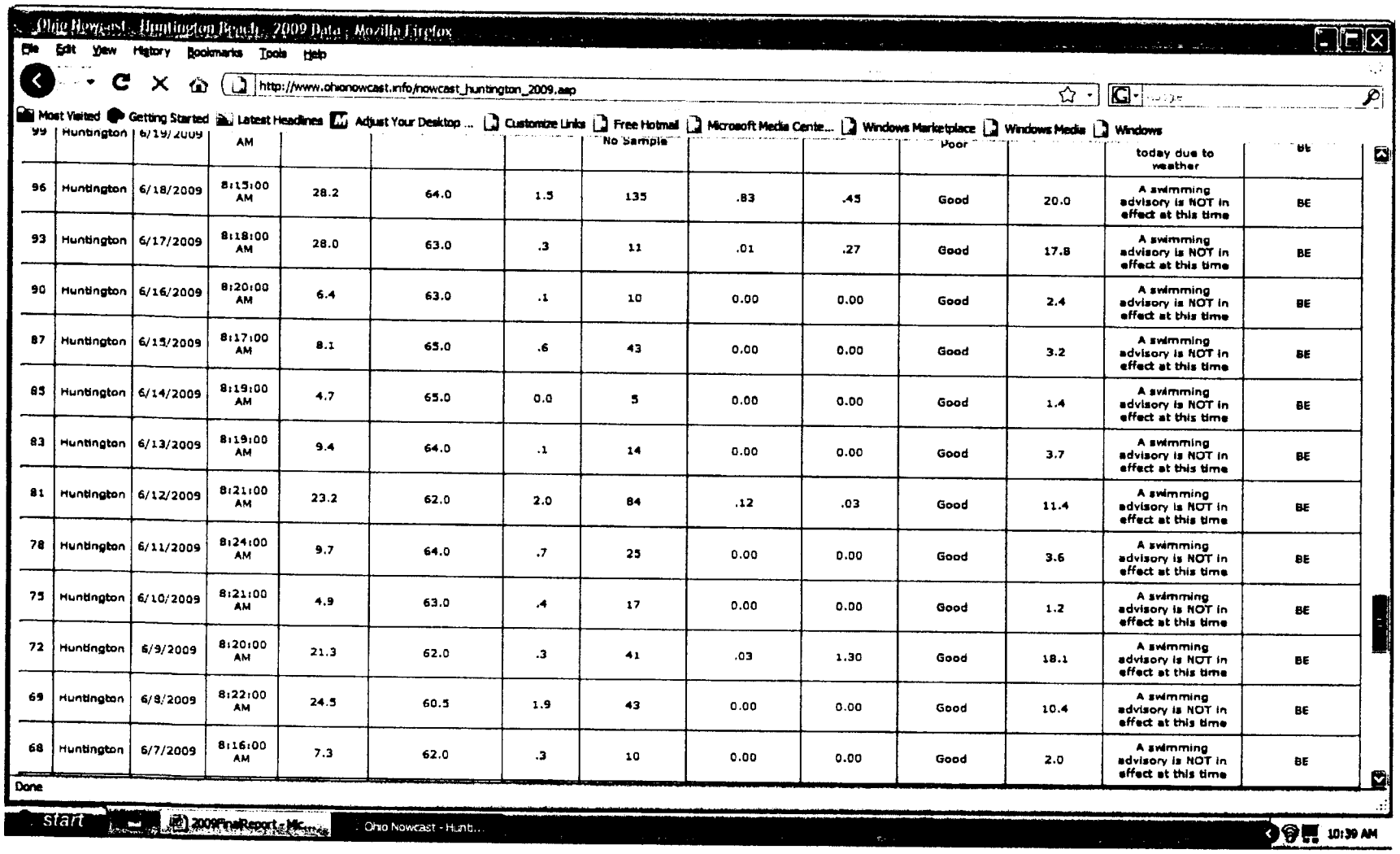
196	Huntington	7/26/2009	8:35:00 AM	2.5	70.0	0.1		.07	.51	Good	3.0	A swimming advisory is NOT in effect at this time	BE
193	Huntington	7/25/2009	8:13:00 AM	02.5	70	0.0		0.0	0.0	Good	02.0	A swimming advisory is NOT in effect at this time	jl
191	Huntington	7/24/2009	8:28:00 AM	11.05	70.0	0.4	90	0.06	0.20	Good	19.1	A swimming advisory is NOT in effect at this time	jl
188	Huntington	7/23/2009	8:31:00 AM	35.8	71.0	2-4	3309	1.34	5.58	Poor	93.9	A swimming advisory IS in effect at this time	jl
185	Huntington	7/22/2009	8:34:00 AM	17.0	71.0	0.8	26	0.0	0.05	Poor	24.8	A swimming advisory IS in effect at this time	jl
182	Huntington	7/21/2009	8:55:00 AM	09.9	71.0	0.4	58	0.0	0.0	Good	14.3	A swimming advisory is NOT in effect at this time	jl
179	Huntington	7/20/2009	8:28:00 AM	04.1	71.0	0.0	6	0.0	0.0	Good	05.0	A swimming advisory is NOT in effect at this time	jl
177	Huntington	7/19/2009	8:14:00 AM	25.80	71.0	1.0	NS	0.15	0.20	Poor	33.8	A swimming advisory IS in effect at this time	jl
175	Huntington	7/18/2009	8:31:00 AM	22.4	71	1.3	NS	0.84	1.92	Poor	51.1	A swimming advisory IS in effect at this time	jl
173	Huntington	7/17/2009	8:25:00 AM	4.9	72.1	0.5	33	0.00	0.00	Good	5.6	A swimming advisory is NOT in effect at this time	BE
170	Huntington	7/16/2009	8:12:00 AM	14.9	71.9	0.6	226	0.00	0.00	Good	18.6	A swimming advisory is NOT in effect at this time	BE
167	Huntington	7/15/2009	8:16:00 AM	6.2	72.6	0.0	27	0.00	0.00	Good	7.0	A swimming advisory is NOT in effect at this time	BE
163	Huntington	7/14/2009	8:29:00 AM	26.1	71.9	2.0	130	0.00	0.00	Poor	28.6	A swimming advisory IS in effect	BE



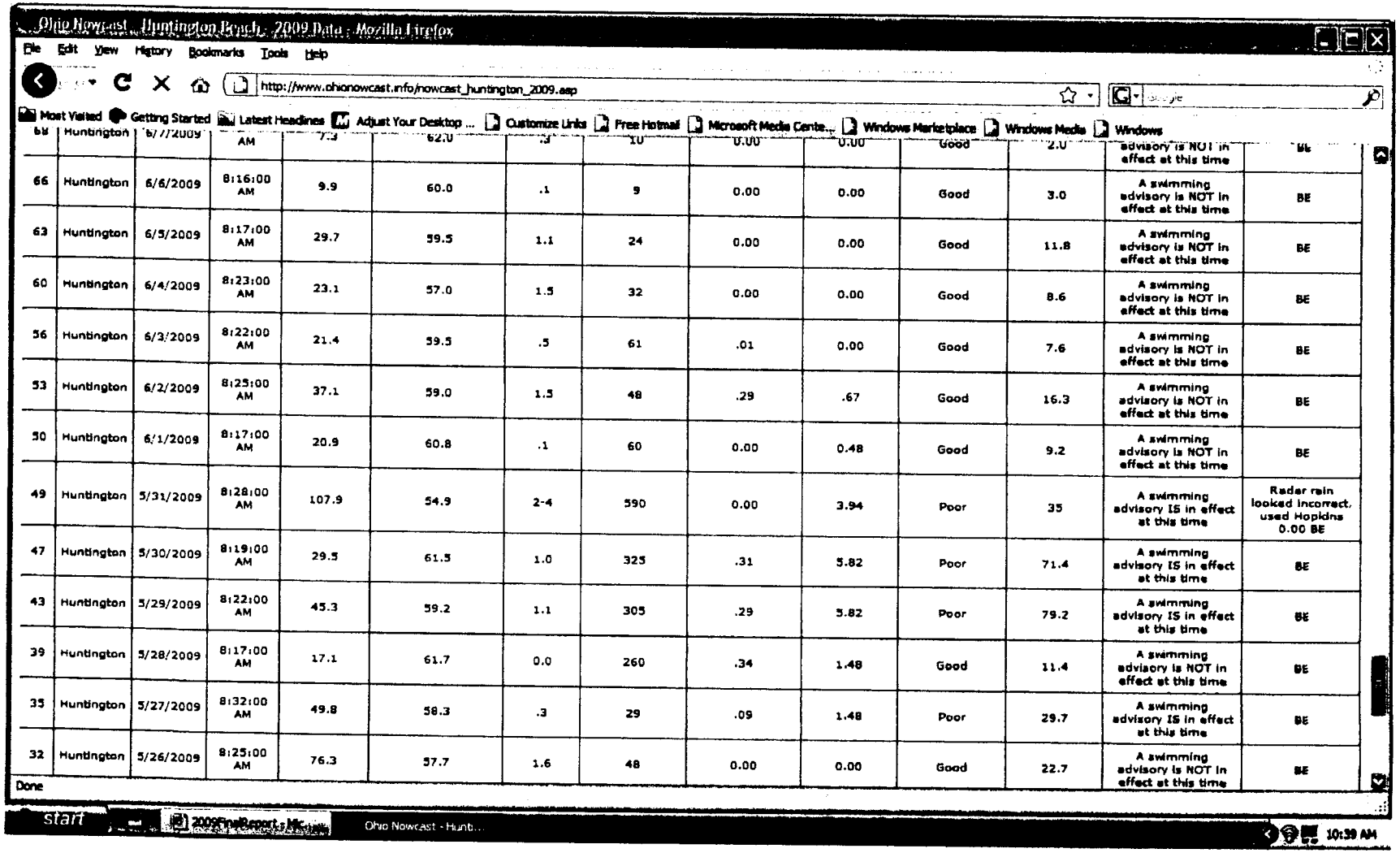
161	Huntington	7/13/2009	8:21:00 AM	15.1	72.8	3-6	81	0.00	.41	Good	21.0	advisory is NOT in effect at this time	BE
159	Huntington	7/12/2009	8:41:00 AM	15.7	71.4	1.6	No Sample	.81	4.98	Poor	74.7	A swimming advisory IS in effect at this time	BE
158	Huntington	7/11/2009	8:36:00 AM	5.4	72.6	.1	No Sample	0.00	0.00	Good	5.1	A swimming advisory is NOT in effect at this time	BE
155	Huntington	7/10/2009	8:15:00 AM	9.5	72.5	.5	31	0.00	0.00	Good	9.8	A swimming advisory is NOT in effect at this time	BE
152	Huntington	7/9/2009	8:19:00 AM	4.9	71.7	.5	20	0.00	0.00	Good	4.1	A swimming advisory is NOT in effect at this time	BE
149	Huntington	7/8/2009	8:18:00 AM	8.5	71.2	0.3	24	0.00	0.00	Good	8.0	A swimming advisory is NOT in effect at this time	BE
146	Huntington	7/7/2009	8:18:00 AM	17.0	71.9	1.6	215	0.00	0.00	Good	16.6	A swimming advisory is NOT in effect at this time	BE
143	Huntington	7/6/2009	8:19:00 AM	5.8	72.1	.9	19	0.00	0.00	Good	4.6	A swimming advisory is NOT in effect at this time	BE
140	Huntington	7/5/2009	8:24:00 AM	6.5	71.2	0.0	19	0.00	0.00	Good	5.2	A swimming advisory is NOT in effect at this time	BE
139	Huntington	7/4/2009	8:23:00 AM	35.2	68.9	1.6	49	0.00	0.00	Poor	29.0	A swimming advisory IS in effect at this time	BE
137	Huntington	7/3/2009	8:25:00 AM	35.3	69.0	2-4	96	.10	.07	Poor	29.2	A swimming advisory IS in effect at this time	BE
134	Huntington	7/2/2009	8:24:00 AM	15.4	70.1	1.1	98	.07	.14	Good	14.0	A swimming advisory is NOT in effect at this time	BE
131	Huntington	7/1/2009	8:18:00 AM	13.4	70.7	.4	37	.2	2.52	Poor	33.8	A swimming advisory IS in effect at this time	BE



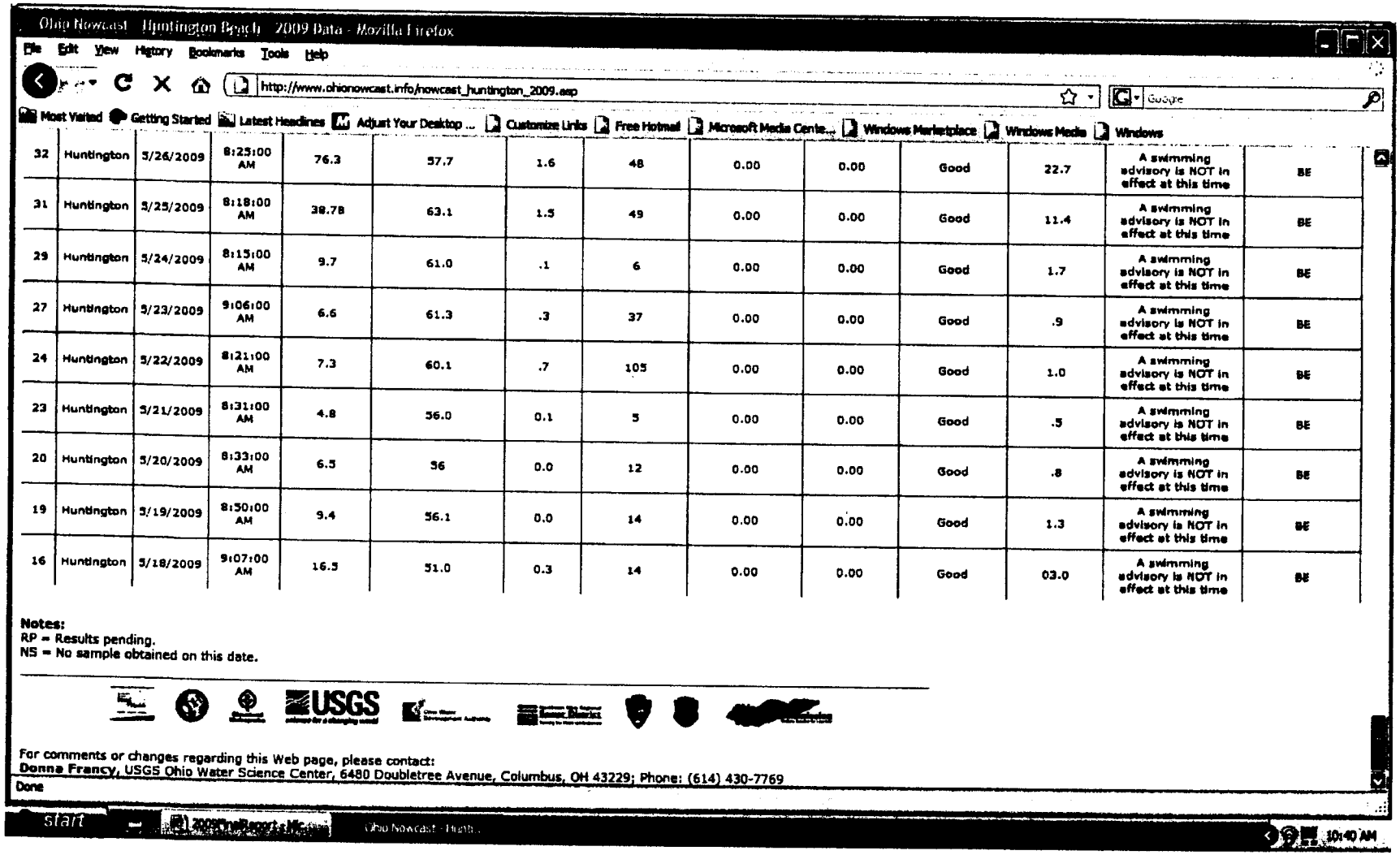
131	Huntington	7/1/2009	AM	13.4	70.7	.4	37	.2	2.52	Poor	33.8	advisory IS in effect at this time	BE
128	Huntington	6/30/2009	8:41:00 AM	35.7	70.7	2.3	179	0.00	1.13	Poor	40.0	A swimming advisory IS in effect at this time	BE
125	Huntington	6/29/2009	8:19:00 AM	12.3	70.1	.4	30	.03	.01	Good	9.3	A swimming advisory is NOT in effect at this time	BE
124	Huntington	6/28/2009	8:19:00 AM	5.2	73.5	0.0	30	0.00	0.00	Good	2.9	A swimming advisory is NOT in effect at this time	BE
121	Huntington	6/27/2009	8:16:00 AM	33.7	75.0	1.8	265	0.00	0.00	Poor	23.9	A swimming advisory IS in effect at this time	BE
119	Huntington	6/26/2009	8:23:00 AM	7.3	72.0	1.1	240	.34	4.65	Poor	41.8	A swimming advisory IS in effect at this time	BE
118	Huntington	6/25/2009	10:45:00 AM	2.7	71.0	0.0	12	0.00	0.00	Good	.9	A swimming advisory is NOT in effect at this time	BE
115	Huntington	6/24/2009	11:40:00 AM	2.7	71.0	0.0	34	0.00	0.00	Good	.9	A swimming advisory is NOT in effect at this time	BE
109	Huntington	6/23/2009	8:15:00 AM	2.9	70.0	0.0	15	0.00	0.00	Good	.9	A swimming advisory is NOT in effect at this time	BE
106	Huntington	6/22/2009	8:17:00 AM	5.0	67.0	.2	36	0.00	0.00	Good	2.1	A swimming advisory is NOT in effect at this time	BE
103	Huntington	6/21/2009	8:19:00 AM	16.4	66.0	2.0	80	.04	.32	Good	10.4	A swimming advisory is NOT in effect at this time	BE
102	Huntington	6/20/2009	8:25:00 AM	12.1	65.0	.8	133	.73	2.37	Poor	23.3	A swimming advisory IS in effect at this time	BE
99	Huntington	6/19/2009	8:15:00 AM				No Sample			Poor		A Nowcast prediction is not available today due to weather	BE



99	Huntington	6/19/2009	AM				No Sample			Poor		today due to weather	BE
96	Huntington	6/18/2009	8:15:00 AM	28.2	64.0	1.5	135	.83	.45	Good	20.0	A swimming advisory is NOT in effect at this time	BE
93	Huntington	6/17/2009	8:18:00 AM	28.0	63.0	.3	11	.01	.27	Good	17.8	A swimming advisory is NOT in effect at this time	BE
90	Huntington	6/16/2009	8:20:00 AM	6.4	63.0	.1	10	0.00	0.00	Good	2.4	A swimming advisory is NOT in effect at this time	BE
87	Huntington	6/15/2009	8:17:00 AM	8.1	65.0	.6	43	0.00	0.00	Good	3.2	A swimming advisory is NOT in effect at this time	BE
85	Huntington	6/14/2009	8:19:00 AM	4.7	65.0	0.0	5	0.00	0.00	Good	1.4	A swimming advisory is NOT in effect at this time	BE
83	Huntington	6/13/2009	8:19:00 AM	9.4	64.0	.1	14	0.00	0.00	Good	3.7	A swimming advisory is NOT in effect at this time	BE
81	Huntington	6/12/2009	8:21:00 AM	23.2	62.0	2.0	84	.12	.03	Good	11.4	A swimming advisory is NOT in effect at this time	BE
78	Huntington	6/11/2009	8:24:00 AM	9.7	64.0	.7	25	0.00	0.00	Good	3.6	A swimming advisory is NOT in effect at this time	BE
75	Huntington	6/10/2009	8:21:00 AM	4.9	63.0	.4	17	0.00	0.00	Good	1.2	A swimming advisory is NOT in effect at this time	BE
72	Huntington	6/9/2009	8:20:00 AM	21.3	62.0	.3	41	.03	1.30	Good	18.1	A swimming advisory is NOT in effect at this time	BE
69	Huntington	6/8/2009	8:22:00 AM	24.5	60.5	1.9	43	0.00	0.00	Good	10.4	A swimming advisory is NOT in effect at this time	BE
68	Huntington	6/7/2009	8:16:00 AM	7.3	62.0	.3	10	0.00	0.00	Good	2.0	A swimming advisory is NOT in effect at this time	BE



68	Huntington	6/7/2009	AM	7.3	62.0	.3	10	0.00	0.00	Good	2.0	advisory is NOT in effect at this time	BE
66	Huntington	6/6/2009	8:16:00 AM	9.9	60.0	.1	9	0.00	0.00	Good	3.0	A swimming advisory is NOT in effect at this time	BE
63	Huntington	6/5/2009	8:17:00 AM	29.7	59.5	1.1	24	0.00	0.00	Good	11.8	A swimming advisory is NOT in effect at this time	BE
60	Huntington	6/4/2009	8:23:00 AM	23.1	57.0	1.5	32	0.00	0.00	Good	8.6	A swimming advisory is NOT in effect at this time	BE
56	Huntington	6/3/2009	8:22:00 AM	21.4	59.5	.5	61	.01	0.00	Good	7.6	A swimming advisory is NOT in effect at this time	BE
53	Huntington	6/2/2009	8:25:00 AM	37.1	59.0	1.5	48	.29	.67	Good	16.3	A swimming advisory is NOT in effect at this time	BE
50	Huntington	6/1/2009	8:17:00 AM	20.9	60.8	.1	60	0.00	0.48	Good	9.2	A swimming advisory is NOT in effect at this time	BE
49	Huntington	5/31/2009	8:28:00 AM	107.9	54.9	2-4	590	0.00	3.94	Poor	35	A swimming advisory IS in effect at this time	Radar rain looked incorrect, used Hopkins 0.00 BE
47	Huntington	5/30/2009	8:19:00 AM	29.5	61.5	1.0	325	.31	5.82	Poor	71.4	A swimming advisory IS in effect at this time	BE
43	Huntington	5/29/2009	8:22:00 AM	45.3	59.2	1.1	305	.29	5.82	Poor	79.2	A swimming advisory IS in effect at this time	BE
39	Huntington	5/28/2009	8:17:00 AM	17.1	61.7	0.0	260	.34	1.48	Good	11.4	A swimming advisory is NOT in effect at this time	BE
35	Huntington	5/27/2009	8:32:00 AM	49.8	58.3	.3	29	.09	1.48	Poor	29.7	A swimming advisory IS in effect at this time	BE
32	Huntington	5/26/2009	8:25:00 AM	76.3	57.7	1.6	48	0.00	0.00	Good	22.7	A swimming advisory is NOT in effect at this time	BE



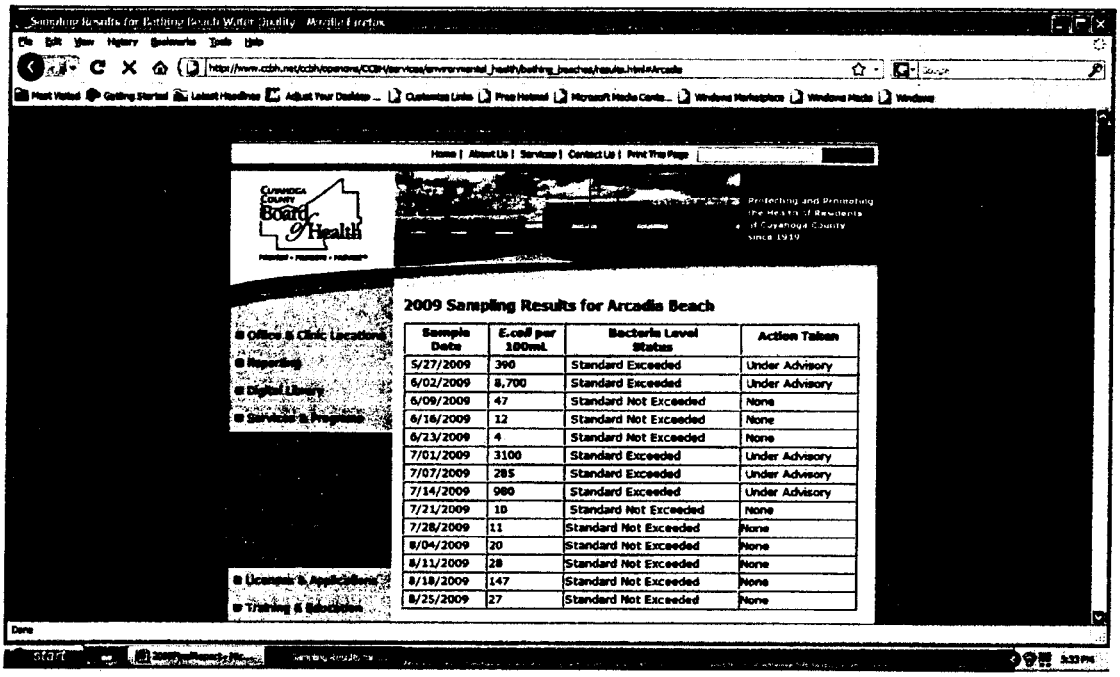
32	Huntington	5/26/2009	8:25:00 AM	76.3	57.7	1.6	48	0.00	0.00	Good	22.7	A swimming advisory is NOT in effect at this time	BE
31	Huntington	5/25/2009	8:18:00 AM	38.78	63.1	1.5	49	0.00	0.00	Good	11.4	A swimming advisory is NOT in effect at this time	BE
29	Huntington	5/24/2009	8:15:00 AM	9.7	61.0	.1	6	0.00	0.00	Good	1.7	A swimming advisory is NOT in effect at this time	BE
27	Huntington	5/23/2009	9:06:00 AM	6.6	61.3	.3	37	0.00	0.00	Good	.9	A swimming advisory is NOT in effect at this time	BE
24	Huntington	5/22/2009	8:21:00 AM	7.3	60.1	.7	105	0.00	0.00	Good	1.0	A swimming advisory is NOT in effect at this time	BE
23	Huntington	5/21/2009	8:31:00 AM	4.8	56.0	0.1	5	0.00	0.00	Good	.5	A swimming advisory is NOT in effect at this time	BE
20	Huntington	5/20/2009	8:33:00 AM	6.5	56	0.0	12	0.00	0.00	Good	.8	A swimming advisory is NOT in effect at this time	BE
19	Huntington	5/19/2009	8:30:00 AM	9.4	56.1	0.0	14	0.00	0.00	Good	1.3	A swimming advisory is NOT in effect at this time	BE
16	Huntington	5/18/2009	9:07:00 AM	16.5	51.0	0.3	14	0.00	0.00	Good	03.0	A swimming advisory is NOT in effect at this time	BE

Notes:
RP = Results pending.
NS = No sample obtained on this date.

Public Notification

The public notification component of this project consisted of providing timely water quality data on the Cuyahoga County Board of Health website, www.ccbh.net, in addition to emailing beach operators and other stakeholders their water quality data as soon as it is received from the contract lab, the Northeast Ohio Regional Sewer District. For Royal Acres Beach, the beach operator received a weekly telephone call due to lack of computer/email access.

An example of how water quality data appeared on the CCBH website is provided below:



2009 Sampling Results for Arcadia Beach

Sample Date	E.coli per 100mL	Bacteria Level Status	Action Taken
5/27/2009	390	Standard Exceeded	Under Advisory
6/02/2009	8,700	Standard Exceeded	Under Advisory
6/09/2009	47	Standard Not Exceeded	None
6/16/2009	12	Standard Not Exceeded	None
6/23/2009	4	Standard Not Exceeded	None
7/01/2009	3100	Standard Exceeded	Under Advisory
7/07/2009	285	Standard Exceeded	Under Advisory
7/14/2009	980	Standard Exceeded	Under Advisory
7/21/2009	10	Standard Not Exceeded	None
7/28/2009	11	Standard Not Exceeded	None
8/04/2009	20	Standard Not Exceeded	None
8/11/2009	28	Standard Not Exceeded	None
8/18/2009	147	Standard Not Exceeded	None
8/25/2009	27	Standard Not Exceeded	None

The CCBH also electronically submitted an Excel spreadsheet, developed by the Ohio Department of Health (ODH), to the ODH several times a week, as results were received, in order to satisfy contract requirements. This data was further used for public notification via the Beach Monitoring Section of the ODH website.

An educational fact sheet, specific to the *Nowcast* system, was kept on display at Huntington Beach in an outdoor brochure/literature holder in an easily accessible location to the public. This fact sheet was re-stocked as needed and an example of the fact sheet is provided on the following page. A general water quality brochure was also kept stocked at Huntington Beach. A copy of this brochure is included as an attachment to the electronic version of this Final Report due to formatting conflicts, and a hard copy of the brochure is included with the hard copy of this Final Report.

Nowcasting Beach Advisories

Fact Sheet for the general public

How safe it is to swim at Lake Erie bathing beaches?

To find out, local agencies monitor (sample) the beaches to determine bacteria levels. The bacterium, *E. coli*, is found in sewage and other animal wastes. Because the results for *E. coli* levels take at least 24 hours by traditional methods, we are using other quickly-obtained measurements to predict when *E. coli* levels may be high. This is called a "Nowcast".

How does the Nowcast work?

The Nowcast system is similar to a weather forecast, but instead of forecasting future weather conditions, the Nowcast system estimates current conditions. A computer model, which takes into account current weather and environmental conditions, is used to estimate bacteria levels. The computer model will predict the likelihood that *E. coli* bacteria levels may be GOOD (low) or POOR (high), and whether or not a Water Quality Advisory should be issued. This information is provided to the public for use in planning beach activities.

Where is the Nowcast system being used?

In Ohio, the Nowcast is being used at Huntington Beach in Bay Village and at Edgewater Beach in Cleveland during 2008. Research is being done to identify other beaches that may be suitable for the Nowcast.

What is the water quality standard for *E. coli*?

The Ohio bathing water standard for *E. coli* is 235 colony forming units (cfu) per 100 milliliters of beach water tested. If the computer model predicts that *E. coli* bacteria levels may be below 235, a **GOOD Water Quality Nowcast** will be made. If the computer model predicts that *E. coli* bacteria levels may be high, a **POOR Water Quality Nowcast** will be made and a Water Quality Advisory will be issued.

What is a Water Quality Advisory?

A Water Quality Advisory is a public notification, typically in the form of a sign posted at the beach, to advise the public that current water quality conditions are not acceptable for swimming due to high bacteria levels. A Water Quality Advisory remains in effect until another measurement is made that indicates that bacteria levels are within acceptable limits.

What illnesses may result from contact with the water?

There is a potential for illness to occur when bacteria levels are high. Gastrointestinal upset, including nausea, vomiting, abdominal cramps, and diarrhea may occur as a result of swallowing contaminated water. There is also a potential for developing upper respiratory infections, in addition to ear and eye infections. Skin infections may also occur if an open wound is not properly protected. Children, the elderly, and individuals with weakened immune systems are most at risk for becoming ill when bacteria levels are high.

How often is the Nowcast system used and where can information be obtained?

The Nowcast system is being used 7 days a week, from Memorial Day through Labor Day. Health officials will make each day's water quality Nowcast by 9:30a.m., based on conditions observed in the morning. Signs will be posted at the entrances to the beach area, reflecting each day's Nowcast. The Nowcast system is Internet-based, providing near real-time, same-day, water quality information to the public. Nowcasts do not consider predicted weather changes. Water quality can quickly change from Good to Poor in response to rain and wind storm conditions.

FOR MORE INFORMATION ON NOWCAST:

Visit the Nowcast website at www.ohionowcast.info

Contact the Cuyahoga County Board of Health: (216) 201-2000, www.ccbh.net

Contact the USGS, Ohio Water Science Center: (614) 430-7700, http://oh.water.usgs.gov

Northeast Ohio Regional Sewer District's Beach Water Quality Information Line: (216) 432-7301

Project Partners

Cuyahoga County Board of Health

Prevent • Promote • Protect

ODH

Cleveland Metroparks

Northeast Ohio Regional Sewer District

Protecting Your Health and Environment

USGS

OHIO WATER DEVELOPMENT AUTHORITY

CDPH

Cleveland Department of Public Health

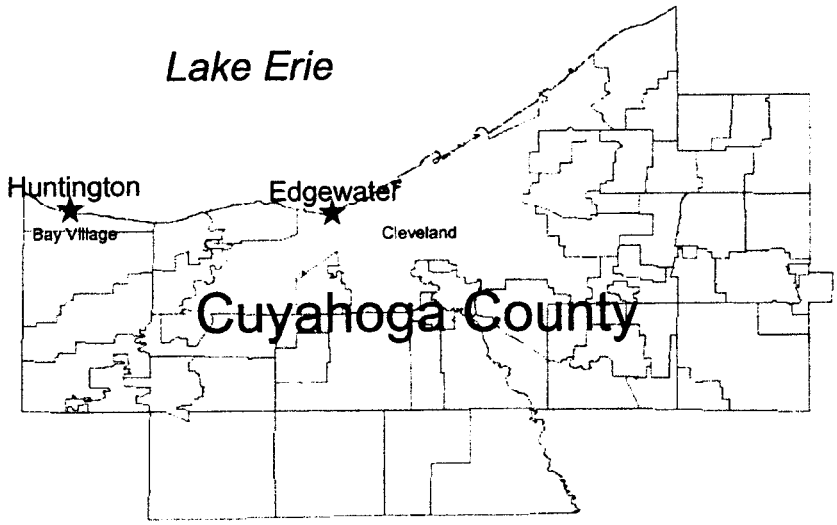
Beach User Surveys

Beach User Surveys were again administered during the 2009 recreation season. The beach survey data was automatically entered and stored into a Microsoft Access Database as the surveys were administered. The CCBH Epidemiology and Surveillance Service Area has reviewed the data and has generated a descriptive analysis of the data. Several hypotheses related to the public's concerns, awareness, and potential illness episodes were tested. Traditional descriptive statistics were used in conjunction with bi-variate techniques (e.g. Chi-Square Analyses) on the data. A total of 268 surveys were administered.

The *Summary Report of Findings and a Select Look at Data from 2005 – 2009* is included on the following pages.

The 2009 Beach User Survey for Cuyahoga County, Ohio:
Summary Report of Findings and a Select Look at Data from 2005-2009

Date of Report: September 21, 2009



This summary report represents the final analyses conducted for the 2009 Beach User Survey. It includes: a general overview of the findings; a list of seven suppositions and three hypotheses that were evaluated; seven tables that contain the descriptive statistics for the survey (Tables 1-7), two figures pertaining to the NOWCAST system (Figures 1-2); and four tables generated from the hypotheses testing (Tables 8-11). It also compares results of the current survey with the 2008 beach user survey and a comparison of select items over the past five years.

This report was produced by the Office of Epidemiology, Surveillance, and Informatics at the Cuyahoga County Board of Health.

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I. GENERAL OVERVIEW

A total of 268 people completed the survey during the months of June (n=20), July (n=77) and August (n=171). There were three additional persons who only provided partial responses to the survey and were excluded from the analyses. Most survey respondents were: white (86%); non-Hispanic (94%); female (65%); and between the ages of 16-50 years old (93%) [Table 1]. Approximately one out of two respondents was aware of water quality signs being posted at the beach. Among those that were aware of the signs, 63% indicated that they pay attention to the signs [Table 2]. Approximately three out of four respondents indicated that they were concerned or very concerned with the impact that industrial/chemical pollutions have on beach water quality. Similar levels of concern were also expressed with the impact that sanitary sewage from system overflows and aging infrastructure has on beach water quality [Table 3]. Approximately 7% of the respondents indicated that they have heard of the NOWCAST system [Table 7]. Among those that have heard of NOWCAST, 100% were comfortable with the predictions [Figure 2].

Seventy three percent of the respondents indicated that they sun bathe and 81% indicated that they had partial (i.e. wading) or full body contact with the water during normal weather conditions [Table 5]. Only five percent (n=14) of the respondents reported becoming ill after swimming at the beach. Among the ill respondents, five indicated that they saw a physician for their illness; ten indicated that the nature of the illness was gastrointestinal in nature; and 71% of the ill respondents indicated that they swallowed water while swimming at the beach [Table 6].

The results of this year's survey suggest that the awareness and knowledge of water quality issues appears to be lower than respondents from past years. Possible explanations for this may be that there were larger percentages of the younger respondents (16.8% less than 16 years old) and this year's survey contained a large number of respondents from Edgewater Beach (51.9%) which typically have not contributed large numbers of respondents for the survey.

II. SUMMARY OF SURVEY CHANGES

This year there were no changes to the survey compared to 2008.

III. METHODS

The survey was administered at two local beaches on the shores of Lake Erie, Ohio. These beaches included one beach located in the City of Cleveland (Edgewater) and Huntington Beach located in the City of Bay Village. Employees from the City of Cleveland Department of Public Health and the Cuyahoga County Board of Health (CCBH) used electronic tablets to capture survey responses. The respondents were selected by convenience sampling. These responses were stored in a *Microsoft Office ACCESS 2003* database and exported in *SPSS v15.0 for Windows* for analyses.

Descriptive statistics (e.g. frequencies) as well as bivariate analyses were used during the analyses. Where appropriate, statistical significance associated with hypotheses testing was determined by *chi-square* or *Fisher Exact* tests at the $p < 0.05$ level.

IV. EVALUATION OF SUPPOSITIONS/HYPOTHESES

Prior to data analysis, the following suppositions and hypotheses were generated (evaluation of the results is italicized):

Suppositions

S1. **Individuals that know there are water quality signs posted on the beach should pay attention to the signs.** *Among the 137 respondents that reported being aware of the water quality signs, 83% indicated that they pay attention to the signs (Table 2).*

S2. **Individuals that pay attention to the signs should understand what the signs mean.** *Among the 113 respondents that reported paying attention to the signs, 60% indicated that they understand the signs (Table 2).*

S3. **Individuals that visit the bathing beach section of the CCBH website reported that the website does influence their decision to go to the beach.** *Among the seven respondents that reported visiting the Beach section of the CCBH web site, six indicated that it influenced their decision to go to the beach (Table 4).*

S4. **Individuals that reported becoming ill after swimming reported swallowing lake water while swimming at the beach.** *Among the 14 respondents that reported becoming ill after swimming at the beach, 71% of the respondents indicated that they swallowed water while swimming at the beach (Table 6).*

S5. **Individuals that had never heard of the NOWCAST system for predicting beach advisories were informed that it is an internet-based system; these individuals should use the internet to check current water quality conditions before they go to the beach.** *Among the 248 respondents that reported not being aware of the NOWCAST system, 49% indicated that they would use the internet to check current water conditions before going to the beach (Table 7).*

S6. **Individuals that have heard of the NOWCAST system for predicting beach advisories understand the concept of predicting water quality.** *Among the 19 respondents that reported being aware of the NOWCAST system, 63% indicated that they understand the concept of predicting water quality (Figure 2).*

S7. **Individuals that understand the NOWCAST system are comfortable with water quality predictions being made.** *Among the 12 respondents that reported understanding the NOWCAST system, all respondents indicated that they were comfortable with the water quality predictions being made (Figure 2).*

Hypotheses

H1. **Individuals that understand what the water quality signs mean should not swim in the lake if a water quality advisory has been issued.** *The results from the current survey provided little statistical support ($p > 0.50$) for this hypothesis (among those that understand the sign content, 11% reported that they swam compared to 6% among those that do not understand the content) – see Table 8.*

H2. **Individuals that understand what the water quality signs mean should not swim in the lake after heavy rains.** *Among this year's respondents, there is no evidence to suggest that understanding the content of a swimming advisory sign decreased the likelihood that individuals swam after a heavy rain (among those that understood the sign content, 27.9% still reported that they waded or had full body contact with water after a heavy rain compared to 17.6% among those that do not understand the content).*

H3. **Individuals that reported becoming ill after swimming at the beach reported that they swim with full body water contact.** *Among this year's respondents, there is no evidence that suggests that swimming which involves full body contact with water may be associated with illness. Among those that reported full body contact, 3.8% reported becoming ill after swimming at the beach compared to 6.6% that report wading or no contact, (see Table 1). This relationship was also explored by excluding individuals who indicated that they did not have any contact with the water. Specifically, 3.8% reported becoming ill among those reporting full contact compared to 8.0% who reported partial (e.g. wading) contact with the water (see Table 11).*

V. RESULTS

Table 1. Demographics

Variable	*N = 268* n (%)
Month/Year Surveyed	
June 2009	20 (7.5)
July 2009	77 (28.7)
August 2009	171 (63.8)
Beach Location	
Edgewater Beach	139 (51.9)
Huntington Beach	129 (48.1)
Age(in years)	
Under 16	45 (16.8)
16-20	53 (19.8)
21-30	89 (33.2)
31-40	36 (13.4)
41-50	26 (9.7)
Over 50	18 (6.7)
Missing/Refused	1 (0.4)
Gender	
Female	175 (65.3)
Male	92 (34.3)
Missing/Refused	1 (0.4)
Race	
Asian or Pacific Islander	6 (2.2)
Black/African American	30 (11.2)
White	231 (86.2)
Missing/Refused	1 (0.4)
Ethnicity	
Hispanic/Latino	17 (6.3)
Non-Hispanic	251 (93.7)

Table 2. Beach Water Quality Awareness and Practices

Variable	*N = 268* n (%)
Know there are Water Quality Signs Posted	
Yes	137 (51.1)
No	131 (48.9)
Among those Aware of Signs (n=137): Pay Attention to Posted Sign	
Yes	113 (82.5)
No	24 (17.5)
Among those Aware of Signs (n=137): Understand Posted Signs	
Yes	86 (62.8)
No	51 (37.2)
Among those Aware of Signs (n=137): Swim in Lake even if Advisory Posted	
Yes	12 (8.8)
No	125 (91.2)
Among those that Pay Attention to the Posted Signs (n=113): Understand Posted Signs	
Yes	68 (60.8)
No	45 (39.2)

Table 3. Type of Water Quality Concerns and Level of Concern

Type of Water Quality Concern	*Level of Concern (N = 268)* Not Concerned n (%)	Of Little Concern n (%)	Moderately Concerned n (%)	Concerned n (%)	Very Concerned n (%)
Storm Water Runoff	45 (16.8)	32 (11.9)	78 (29.1)	83 (31.0)	30 (11.2)
Industrial/Chemical Pollution	12 (4.5)	17 (6.3)	33 (12.3)	102 (38.1)	104 (38.8)
Animal Waste (Birds, etc...)	29 (10.8)	38 (14.2)	57 (21.3)	92 (34.3)	52 (19.4)
Sanitary Sewage from System Overflow	6 (2.2)	6 (2.2)	43 (16.0)	102 (38.1)	111 (41.4)
Other Bathers (e.g. fecal accidents)	18 (6.7)	27 (10.1)	67 (25.0)	99 (36.9)	57 (21.3)

Table 4. Information Sources

Variable	*N = 268* n (%)
Ever visited CCBH website	
Yes	14 (5.2)
No	254 (94.8)
Among CCBH website visitors (n=14)	
Visit "Beach Section"	
Yes	7 (50.0)
No	7 (50.0)
If Yes, does it effect your decision (n=7)	
Yes	6 (85.7)
No	1 (14.3)

Table 5. Beach Activities

Variable	*N = 268* N (%)
Do you sun bathe	
Yes	187 (69.8)
No	81 (30.2)
Do you play in the sand	
Yes	136 (50.7)
No	132 (49.3)
Contact with Water During Normal Weather	
No Contact	50 (18.7)
Wading	87 (32.5)
Swimming with Full Body Contact	131 (48.9)
Contact with Water After Heavy Rains	
No Contact	203 (75.7)
Wading	23 (8.6)
Swimming with Full Body Contact	42 (15.7)
What time of day do you visit beach	
Morning (8am to noon)	11 (4.1)
Afternoon (noon to 3pm)	172 (64.2)
Mid-afternoon (3pm to 6pm)	60 (22.4)
Early Evening (After 6:00pm)	25 (9.3)
How much time do you spend in the water	
< 15 minutes	124 (46.3)
15-30 minutes	65 (24.3)
30-45 minutes	45 (16.8)
45-60 minutes	14 (5.2)
> 60 minutes	20 (7.4)
How many times do you visit beach each year	
Everyday	2 (0.8)
Once a Week	46 (17.2)
Few Times a Week	97 (36.2)
Once a Month	51 (19.0)
Few Times a Month	36 (13.4)
Once a Year	36 (13.4)

Table 6. Illness Information

Variable	*N = 268* n (%)
Did you ever become ill after swimming at beach	
Yes	14 (5.2)
No	254 (94.8)
If ill, did you see a physician (n=14)	
Yes	5 (35.7)
No	9 (64.3)
If ill, nature of illness (n=14)	
Gastrointestinal	10 (71.4)
Upper Respiratory	0 (0.0)
Ears, Nose, and Throat Infection	1 (7.1)
Skin Infection	3 (21.23
Other	1 (11.1)
If ill, did you swallow water while swimming at beach (n=14)	
Yes	10 (71.4)
No	4 (28.6)
If ill and saw doctor, mentioned swimming at beach (n=5)	
Yes	5 (100.0)
No	0 (0.0)

Table 7. NOWCAST Information	*N = 268*
Variable	n (%)
Did you ever hear of NOWCAST	
Yes	19 (7.1)
No	249 (92.9)
If never heard of NOWCAST, would you use internet to check water conditions (n = 249)	
Yes	123 (49.4)
No	126 (50.6)

Figure 1.

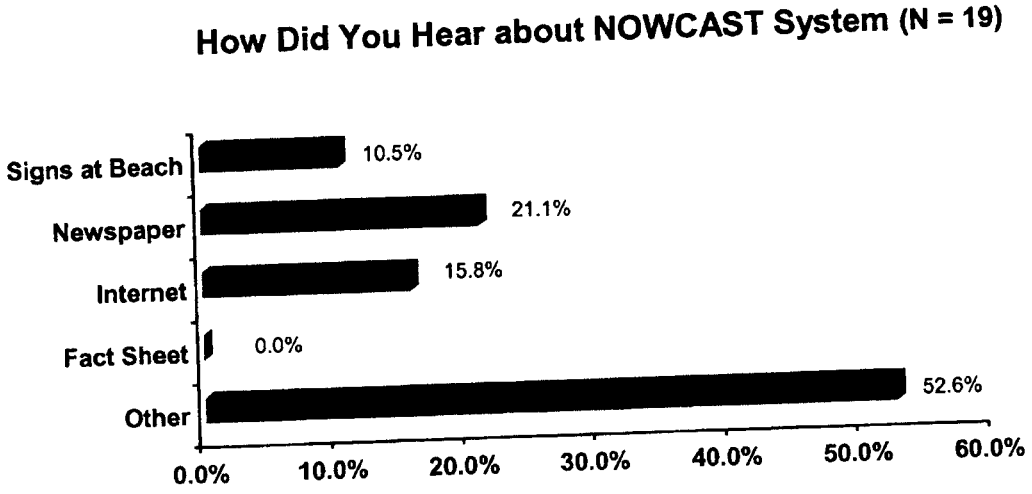

Figure 2.

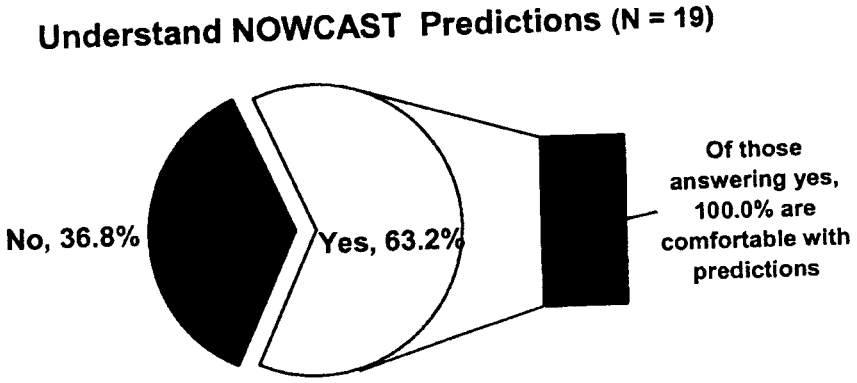

Table 8 – Hypothesis #1.
Association[1] Between Understanding Content of Water Quality Signs and Swimming When a Water Advisory is Posted[2]

	Swimming When a Water Advisory is Posted N = 137†	
Understand Content Of Water Quality Sign	Yes n (row %)	No n (row %)
Yes	9 (10.5)	77 (89.5)
No	3 (5.9)	48 (94.1)

[1] Fisher's exact test used, p-value > 0.50.
† Among respondents reporting that they are aware of water quality signs.

Table 9 – Hypothesis #2.
Association[1] Between Understanding Content of Water Quality Signs and Swimming After Heavy Rains[2]

	Swimming After Heavy Rains N = 137†	
Understand Content Of Water Quality Sign	Wading or Full Body Contact n (row %)	No Contact with Water n (row %)
Yes	24 (27.9)	62 (72.1)
No	9 (17.6)	42 (82.4)

[1]Fisher's exact test used, p-value > 0.20.
†Among respondents reporting that they are aware of water quality signs.

Table 10 – Hypothesis #3 (Original).
Association[1] Between Full Body Contact with Water and Reporting Becoming Ill After Swimming at the Beach

	Reported Becoming Ill after Swimming at the Beach N = 268	
Water Contact during Normal Weather	Yes n (row %)	No n (row %)
Full Body Contact	5 (3.8)	126 (96.2)
Wading or No Contact	9 (6.6)	128 (93.4)

[1] Fisher's exact test used, p-value > 0.40.

Table 11 – Hypothesis #3 (Expanded).
Association[1] Between Full Body versus Partial (Wading) Contact with Water and Reporting Becoming Ill After Swimming at the Beach

	Reported Becoming Ill after Swimming at the Beach N = 218[†]	
Water Contact during Normal Weather	Yes n (row %)	No n (row %)
Full Body Contact	5 (3.8)	126 (96.2)
Wading	7 (8.0)	80 (92.0)

[1]Fisher's exact test used, p-value > 0.20.
[†]Excludes 50 who reported no contact with water during normal weather including two who still reported becoming ill.

VI. COMPARISONS TO 2008 BEACH USERS SURVEY

Demographics
There were some differences in the demographic characteristics between the 2009 and 2008 surveys. Specifically, there were a smaller percentage of females (65% compared to 72%) and Hispanics/Latinos (6% vs. 15%). Additionally the 2009 respondents were younger. For example, the percentage of respondents less than 16 years of age was 17% in 2009 compared to 5% in 2008 and 33% vs. 15% for respondents 21-30 years old. These differences may be due to the fact that there was a large increase in the percentage of respondents from Edgewater Beach in 2009 (51%) compared to 2008 (8%).

Water Quality Awareness and Associated Behaviors
Awareness of water quality signs was lower this year (51.1%) compared to last year (64.9%). Additionally, among respondents aware of the signs there appeared to be marked decrease in the understanding of the water quality signs. Specifically, 62.8% reported understanding the signs compared to 93.5% last year. Furthermore, among all respondents 24.3% reported swimming after a heavy rain this year compared to 8.3% last year.

Water Quality Concerns
Concerns about the water quality due to sanitary sewage from system overflow and industrial/chemical pollution remained the largest areas of concern among respondents. Specifically, 79% reported being "concerned" or "very concerned" about sanitary sewage (compared to 82% in 2008) and 77% of respondents reported being "concerned" or "very concerned" about industrial/chemical pollution (compared to 75% in 2008).

Information Sources
There was a small increase in the percentage of respondents who reported visiting the Cuyahoga County Board of Health website (5.2% in 2009 vs. 8.3% in 2008) and specifically visiting the beach section of the site (50.0% in 2009 vs. 66.7% in 2008).

Beach Activities
There were some differences in beach activities reported this year compared to last year. Specifically, respondents reported more full body contact with the water (48.9% in 2009 vs. 33.3% in 2008) and less sun bathing (68.9% in 2009 vs. 83.3% in 2008).

Illness Information
The percentage of respondents who reported becoming ill after swimming at the beach was similar to last year (5.2% in 2009 compared to 6.3% in 2008) and the percentage of ill respondents who reported seeking medical attention was 35.7% in the current survey compared to 33.3% last year. Gastrointestinal illness accounted for 71.4% of the reported illness this year while ears, nose, and throat was the main type of illness (44.4%) last year.

NOWCAST Information
Respondent awareness of the NOWCAST system was much lower this year (7.1%) compared to last year (25.7%). Signs at the beach only accounted for 10% of the information source for NOWCAST this year compared to 37.8% last year.

VII. A Select Look At Data from 2005-2009

The following trends appear to exist:

- The percentage of the beach survey respondents aware of the water quality signs has been decreasing over the past two years (Figure 3).
- The percentage of the beach survey respondents who pay attention to the water quality signs has been fairly constant over the past five years (Figure 4).
- The percentage of the beach survey respondents who understand the water quality signs was significantly lower in 2005 and 2009 compared to 2006-2008 (Figure 5).
- The percentage of the beach survey respondents who were aware of the NOWCAST system was significantly lower in 2009 compared to 2006-2008 (Figure 6).
- The percentage of the beach survey respondents who reported becoming ill after going to the beach has been relatively low with a high reported in 2006 (Figure 7).
- The percentage of the beach survey respondents who reported visiting the Cuyahoga County Board of Health website remains low (Figure 8).

Figure 3.

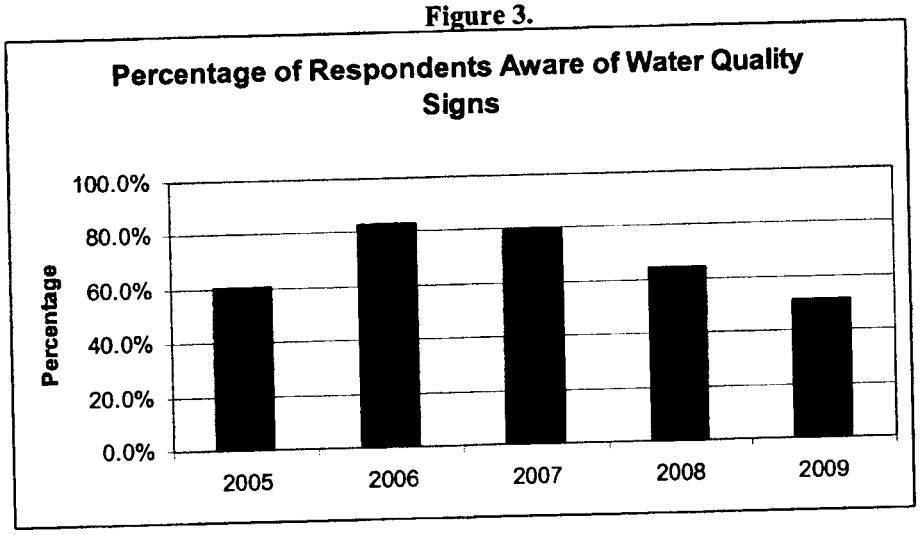

Figure 4.

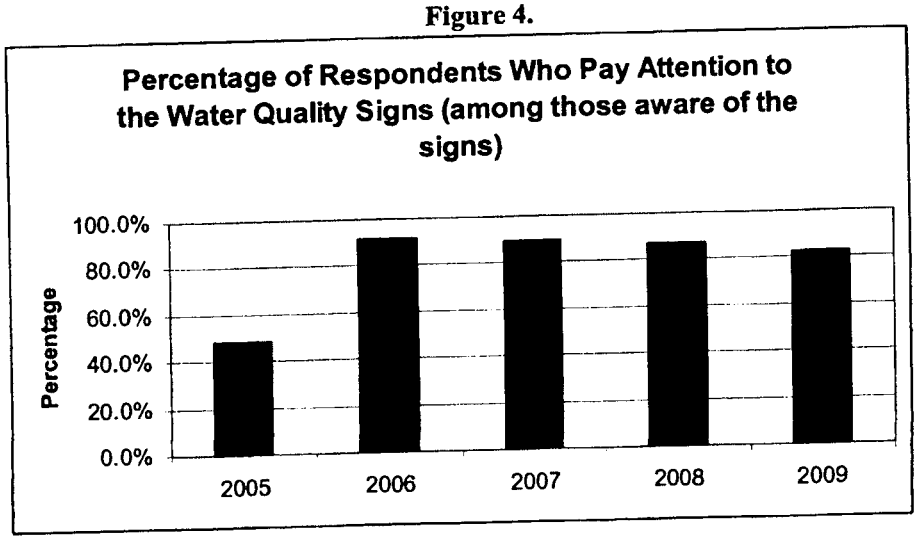

Figure 5.

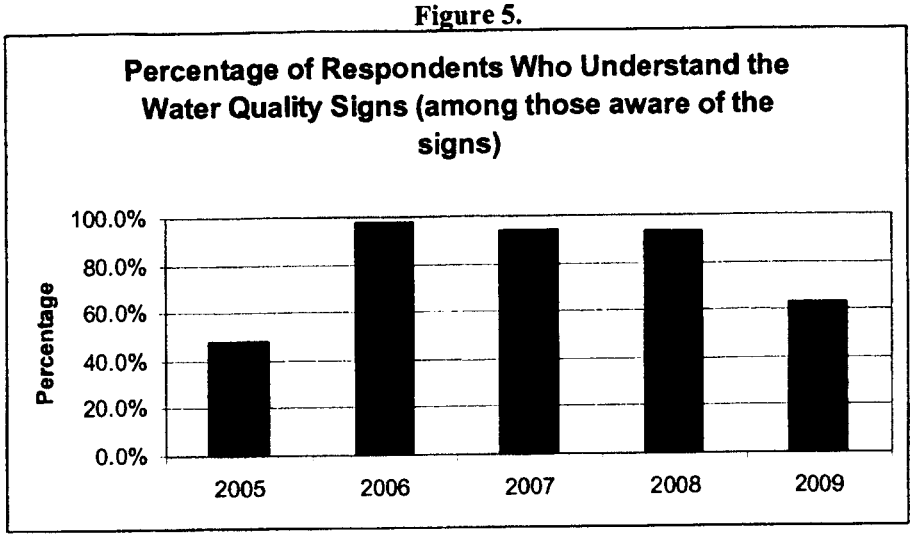

Figure 6.

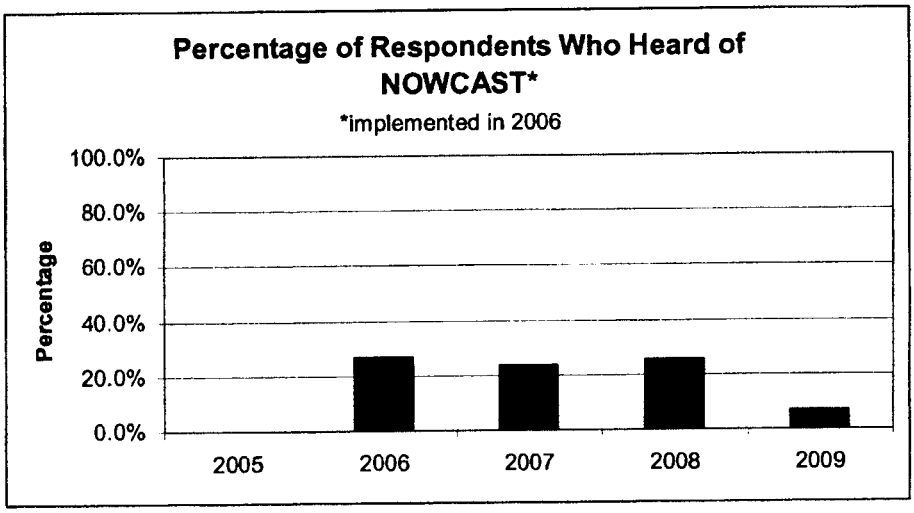

Figure 7.

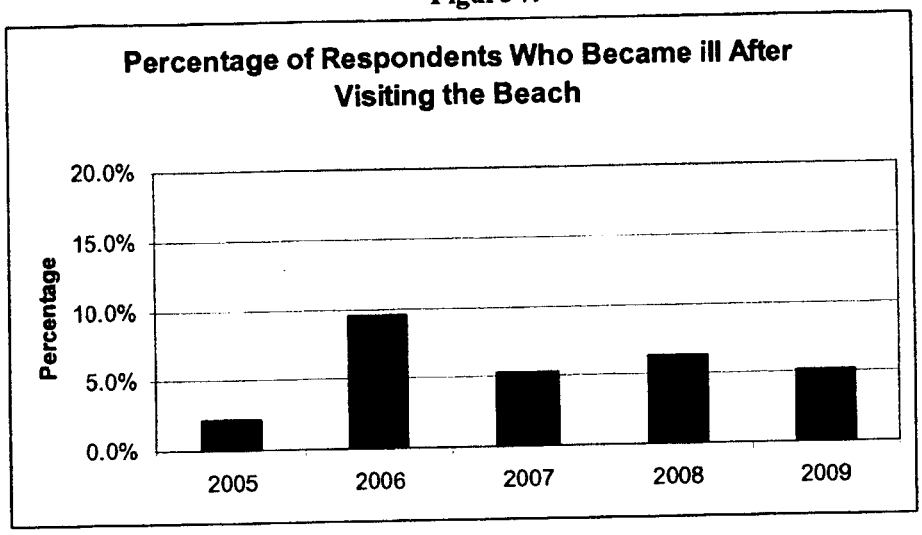
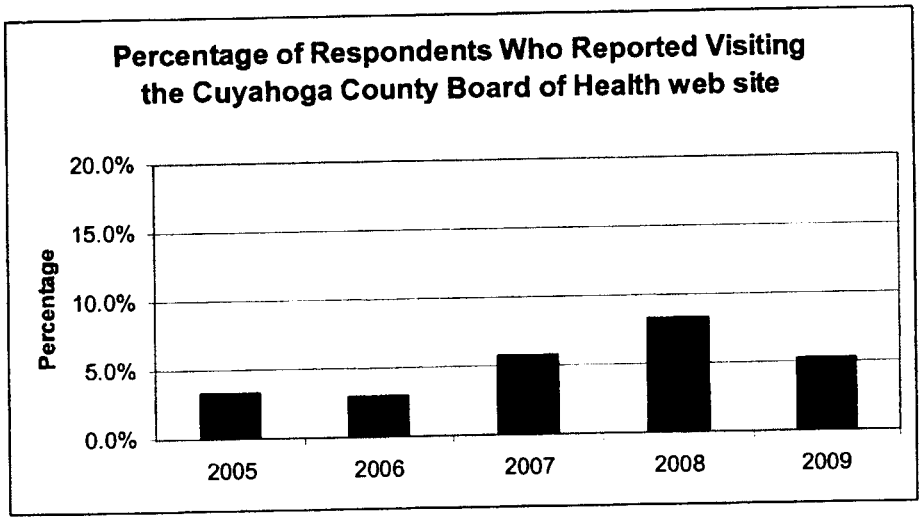
Figure 8.