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Assessing the Effectiveness of the Beaches Environmental Assessment and Coastal Health (BEACH) Act Notification Program

Final Report

Promoting Environmental Results

Through Evaluation

ACKNOWLEDGEMENTS

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This report was developed under the Program Evaluation Competition, sponsored by EPA's Office of Policy. To access copies of this or other EPA program evaluations, please go to EPA's Evaluation Support Division website at http://www.epa.gov/evaluate.

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EXECUTIVE SUMMARY

BACKGROUND

For the last nine years, EPA has made approximately $10 million in grants per year to eligible coastal and Great Lakes states, territories, and tribes through the Beaches Environmental Assessment and Coastal Health (BEACH) Act. The grants are designed to help implement programs to monitor water quality at their beaches and to notify the public when water quality problems exist. Each swimming season, state and local health and environmental protection agencies monitor bacteria levels in the water and, when levels exceed water quality criteria, notify the public by various means (e.g., through signs at the beach, websites, telephone hot lines). In some cases agencies close beaches (i.e., prevent visitors from entering the water).

EPA is interested in assessing the effectiveness of the notification component of the BEACH Act. This evaluation seeks to address: 1) how grantees are using BEACH Act funding to notify the public of beach conditions; 2) which notification methods are the most effective in reaching the public; and 3) how beachgoers' awareness of beach advisories and closures, understanding of water quality risks, and beach visitation behavior has changed in response to notifications.

The evaluation uses a mixed-method approach that combines interviews with state and local beach managers and other stakeholders, a review of the relevant literature and past studies, and site-specific case studies. Most of the state and local beach programs reviewed in this evaluation have not assessed the effectiveness of their beach notifications, nor have they collected data on how beach notifications influence public awareness and understanding of water quality risks, or behavior in response to notifications. However a few states and localities have conducted surveys of beachgoer perceptions. This information, used in combination with anecdotal information from beach authorities and relevant literature, provides the basis for the findings in this evaluation.

FINDINGS

Findings for each evaluation question are summarized below:

HOW ARE GRANTEES USING BEACH ACT FUNDING TO NOTIFY THE PUBLIC OF BEACH CONDITIONS?

The evaluation finds that states and local beach programs use a combination of methods to notify the public about beach water quality, and that the methods reinforce each other. All of the jurisdictions reviewed in this evaluation use websites as part of their notification programs, and all but one post notification signs on their beaches. After websites and signs, e-mail outreach and press releases are the next-most common notification tools. Several states and local beach managers use social media (e.g., Facebook and Twitter) as a means of

communicating water quality issues with the beachgoing public and expanding the reach of traditional notification methods. In addition to notifying the public about discrete advisories, several states and local beach managers conduct general outreach and education efforts to raise public awareness of water quality issues at beaches and enhance the reach of notifications. Some states also conduct trainings for local beach managers about monitoring and notification issues.

Overall, the states and localities interviewed for this evaluation tend to use, on average, more than four different notification methods, some of which (e.g., signs) are targeted to beachgoers at the beach, and others (e.g., websites) are targeted to potential visitors before they travel to the beach. Beach program managers report that the different notification methods reinforce each other (e.g., coverage in the media or signs at the beach drive traffic to the website). Moreover, general public education and outreach are necessary to build a common understanding of beach water quality issues, risks of contaminated water, and steps that beachgoers can take to stay safe while still enjoying the beach. Educated members of the public are more likely to be aware of, seek out, and abide by beach water quality notification messages.

WHICH NOTIFICATION METHODS ARE THE MOST EFFECTIVE IN TERMS OF REACHING THE PUBLIC?

This evaluation finds that beach signs, the Internet, and television are the most common sources beachgoers use to learn of beach advisories or closings. However, the total target audience for beach notifications can be very large, and therefore it can be difficult to reach the majority of beachgoers. Beach managers are increasingly using social networking tools (e.g., Facebook and Twitter) to expand the reach of their beach notification messages. However, social networking tools typically only reach subscribers. Traditional media approaches (e.g., press releases to local television stations and newspapers) can extend the reach of notification messages to the general public (both residents and tourists). Overall, the evaluation finds that a combination of notification methods is necessary to reach the largest possible share of the beachgoing public.

In addition to selecting a range of appropriate notification methods, it is important to craft the notification methods within the context of an overall risk communications strategy. As a part of developing this strategy, it is necessary to identify the goal of the program (i.e., to inform or influence the public), identify stakeholders, and earn the trust of key stakeholder groups. Usually risk communication messages are judged first on the basis of whether the source can be trusted, and only secondarily on the basis of the content of the message itself. Once a risk communication plan is in place, it is possible to develop effective beach advisories.

An analysis of beach advisory signs and websites for states and localities reviewed in this evaluation suggests that there is no standard format for beach notification messages at beaches across the country. The content and wording of messages, as well as the level of detail and contextual information provided, varies widely. Part of the reason for this diversity may be that beach programs may tailor the content and format of their communications based

on their target audiences (e.g., residents vs. tourists), and based on the goal of the communications (e.g., to inform vs. to influence beachgoer behavior). While directly contrasting the effectiveness of one approach versus another is not possible, there are features of signs and websites that are likely to be relatively effective in informing and influencing behavior, based on comments from interviewees and the literature. Specifically, this evaluation identifies good practices for beach signs and websites:

- **Beach signs** that are large, durable, and placed in a prominent location are most likely to be effective. Signs should convey meaning using widely-recognized symbols and icons, along with simple text to explain the cause of the advisory or closure. In addition, signs that use a familiar color scale (e.g., red, yellow, green) to indicate risk levels should help beachgoers understand the risk. Signs can briefly highlight consequences of water contact and tips on staying safe (although such explanations will necessarily be very short). Signs should identify the agency responsible for the advisory, as well as a source for more information (e.g., a phone number or website). Where visitors are likely to speak languages other than English, signs should be translated.
- **Websites** can provide considerably more information than signs, and yet designing the websites so that the most relevant information is summarized in a prominent location is important in ensuring that beachgoers can quickly find the information. A review of websites suggests that websites that prominently display a summary of the status of each beach, or a list of all beaches under advisory, are most helpful. Several websites also include other useful features such as allowing users to search for current status and history for a particular beach of interest. Beachgoers may be more likely to be able to understand simple summaries of testing results (e.g., beach open, closed, or under advisory), rather than detailed testing results. In order to help interested beachgoers understand the basis for the beach status, websites can provide information about the day the beach was last sampled, the frequency of monitoring, and an explanation for the cause of any advisories and testing methods. Websites can also provide detailed information about health consequences of contact with contaminated water, and advice on the activities that may be unsafe. Finally, beach websites may provide information about beaches other than water quality (e.g., weather and beach amenities) to draw visitors to the beach website.

TO WHAT EXTENT DO NOTIFICATIONS AFFECT THE AWARENESS OF BEACHGOERS?

While research on beachgoer awareness is limited, the few studies that do exist vary in the percentage of beachgoers that are aware of notifications. For example, awareness of beach signs has varied from 2% to 54%, depending on the survey. Awareness of *any* notification method tends to be higher, for example, one survey in Orange County, California found that 65% of residents and 45% of non-residents were aware of at least one source of information on water quality However, a smaller percentage of beachgoers checks for information about water quality before visiting a beach (approximately 20% of survey respondents or less).This

suggests that simply making sure beachgoers see signs and hear about other notification methods prior to visiting a beach may be the greatest challenge for beach managers.

TO WHAT EXTENT DO NOTIFICATIONS AFFECT THE UNDERSTANDING OF BEACHGOERS?

Very little data are available on the extent to which notifications affect beachgoer understanding of risks. A few studies tested beachgoer understanding of beach signs in particular; these studies suggest that the signs reviewed do communicate effectively to the public. For example, between 72 and 87% of respondents in one small survey in Indiana found redesigned signs to be very understandable, while 63% of survey respondents who were aware of electronic signs in Orange County, California, found the signs helpful and easy to understand.

TO WHAT EXTENT DO NOTIFICATIONS AFFECT THE BEHAVIOR OF BEACHGOERS?

Studies that consider factors influencing beachgoer behavior suggest that beach advisories influence some members of the public, but that weather and water temperature seem to be stronger factors in many individuals' decisions not to swim. Beach attendance data do suggest a relationship between number of visitors and advisory status, but weather also exerts a strong influence on beach attendance. An unknown proportion of individuals choose to visit the beach and enter the water even when advisories are in place. There may be many reasons that individuals choose to contact the water when an advisory is in place, including not only being unaware of the advisory, but also other factors such as not having alternate recreation opportunities, or individuals' belief that they will not get sick.

In addition to the specific evaluation questions above, this evaluation finds there is very limited data which can provide a foundation for a comprehensive evaluation of beach notification programs. While a few programs have conducted targeted studies to identify areas to improve, most programs have not conducted such research, and no programs have conducted a series of studies over time to assess changes in behavior as the beach notification programs evolved. The scarcity of data on effects of beach notification (e.g., large scale surveys of beachgoers and data on beach attendance) substantially limits an evaluation of the outcomes of effectiveness of beach notification programs. Interviews with states and localities suggest that funding is a limiting factor for beach programs, and therefore the paucity of primary research may be due to lack of resources to gather data. Additional research in the form of surveys of beachgoers and tracking attendance records would help assess program effectiveness.

CHAPTER 1 | INTRODUCTION

This report describes a mixed-methods evaluation of the notification component of the Beaches Environmental Assessment and Coastal Health Act (BEACH Act) monitoring and notification program (hereafter, the notification program). This evaluation has been funded as part of EPA's annual Program Evaluation Competition.

The chapter provides background on the notification program, describes the purpose and audience for the evaluation, and identifies the evaluation questions.

1.1 BACKGROUND

Congress enacted the BEACH Act in 2000 as an amendment to the Clean Water Act (CWA) in order to improve the quality of coastal recreation waters. The BEACH Act authorizes EPA to provide grants to eligible coastal and Great Lakes states, territories, and tribes to monitor their coastal beaches for bacteria that indicate the possible presence of disease-causing pathogens, and to notify the public when there is a potential risk to public health (U.S. Congress, 2000).

When pathogens such as bacteria, viruses, and protozoa are present at sufficient levels in swimming water, they can cause adverse health effects for people that have been in contact with the water. One of the most common health effects of poor recreational water quality is gastroenteritis, a condition that can include vomiting, diarrhea, nausea, and stomachaches (Stoner and Dorfman, 2004). Other potential adverse health effects include hepatitis, respiratory illness, and ear, nose, and throat problems.

The BEACH Act notification program is intended to help the public make better informed decisions about beach use, resulting in a reduction in illness from contact with contaminated water. As a part of this program the EPA Office of Water (OW) makes approximately $10 million in grants available each year to eligible coastal and Great Lakes states, territories, and tribes to help them implement their respective monitoring and notification programs. Grants range in value (from under $100,000 to over $500,000 in 2010), and are based on an allocation formula that considers several factors, including 1) beach season length, 2) total miles of shoreline, 3) coastal county population, 4) beach miles, and 5) beach use (U.S. EPA Office of Water, 2010). Among conditions for receiving funding under the BEACH Act, EPA's grant guidance stipulates that states or other grantees must:

- **Develop an overall public notification and risk communication plan** that describes the state, tribal, or local government public notification efforts regarding potential risks associated with recreational contact with water that does not meet applicable standards.
- **Notify relevant government agencies when beach water quality does not meet applicable state standards.** States are required to notify local governments promptly when water quality standards are exceeded. In addition, state, tribal, and local governments must notify EPA annually of exceedances of water quality standards and actions taken to notify the public.
- **Notify the public when beach water quality does not meet standards.** Grantees must promptly notify the public of a water quality standard exceedance when there is no reason to doubt the accuracy of the sample; in some cases grantees may resample for bacterial exceedance of a water quality standard. When a water quality standard is exceeded, grantees must post a sign to notify the public or take other steps that are the functional equivalent of posting a sign.

EPA's grant guidance document discusses the types of notifications that may be issued, the content and wording of advisories or closings, the timing of issuance and lifting of an advisory, and placement of beach signs (U.S. EPA Office of Water, 2002). [1] For example, the guidance suggests that beach managers notify the public using beach signs, mass media (e.g., newspapers, television, and radio), press releases, websites, telephone hotlines, and technical reports. In addition to notifying the public, the guidance recommends that the appropriate agency promptly notify the beach owner, manager, operator, and/or the lifeguards. The guidance also recommends that grantees evaluate their public notification program at various times throughout the risk communication process. [2] The guidance includes a placeholder for supplemental materials under development that will describe effective practices for beach notification.

When indicator bacterial levels exceed the state or tribal water quality standard, the appropriate state or local authorities may either issue and advisory or close the beach, depending on state-specific protocols. EPA guidance strongly recommends that states and tribes consider beach closures when a sewage spill or major leaks are suspected.

In 2009 (the most recent year for which data are available), of the 3,819 coastal beaches that were monitored, 1,642 (43%) had at least one advisory or closure. States and territories reported 6,203 notification actions during the 2009 swimming season. Most actions (88%)

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[1] Note that the complete original guidance, dating back to 2002, is available online, as are more recent updates.

[2] Regarding evaluation, the guidance notes that it is important to include activities, benchmarks, and milestones that require formative, process, and summary evaluation data to be collected and used. Factors to be evaluated include whether the notification program meets the needs of the audiences and the objectives of the agency.

lasted a week or less. EPA calculates that in 2009, beaches were under an advisory or closed about 5% of the time (U.S. EPA Office of Water, 2009).[3]

The basic structure and design of the BEACH Act notification program, from EPA's perspective, is captured in the logic model shown in Exhibit 1. Key components of the logic model include:

- **Resources**: basic inputs of funds, staffing, and knowledge dedicated to the program. For example, the notification program draws on approximately $10 million in BEACH Act grants, which cover monitoring and notification.
- **Activities/Outputs:** specific actions taken to achieve program goals and the immediate products that result. For example, EPA issues BEACH Act grants and develops grant guidance and performance criteria, as discussed above. EPA also collects beach notification and closure data from states, analyzes the data, and produces an annual report and a corresponding database with information on beach closings and advisories.
- **Target Audiences:** groups that the program seeks to influence. The principal target audience for the notification program is the beachgoing public, however additional important audiences include local authorities and beach managers; EPA Regional beach coordinators; and state, tribal, and territorial officials.
- **Short-Term Outcomes:** intended changes in awareness, attitudes, understanding, knowledge, and skills resulting from program outputs. For example, the notification program seeks to inform the public when beach advisories are issued, and to shape public understanding and awareness of the risks of contact with waterborne pathogens, and why beachgoers should abide by beach advisories and closures.
- **Intermediate Outcomes:** involve changes in behavior resulting from short-term outcomes. Under the beach notification program, awareness and understanding about beach advisories and closures supports informed decisions about avoiding contact with contaminated water.
- **Long-Term Outcomes:** outcomes that parallel the overarching goals of the program and include reduced illness associated with exposure to contaminated water.
- **Contextual/External Factors:** factors that may affect program performance but are not directly controlled by the program or partner agencies that implement the program. For example, updated water quality standards and monitoring test methods would determine action thresholds for notification, which could in turn affect the implementation and outcomes of the notification program.

[3] To calculate total available "beach days," EPA multiplies the duration of each state's and territory's beach season (in days) by the number of beaches in the state or territory, and sums for all states and territories. EPA then counts the number of beach days with notification actions, and calculates this as a percentage of total beach days.

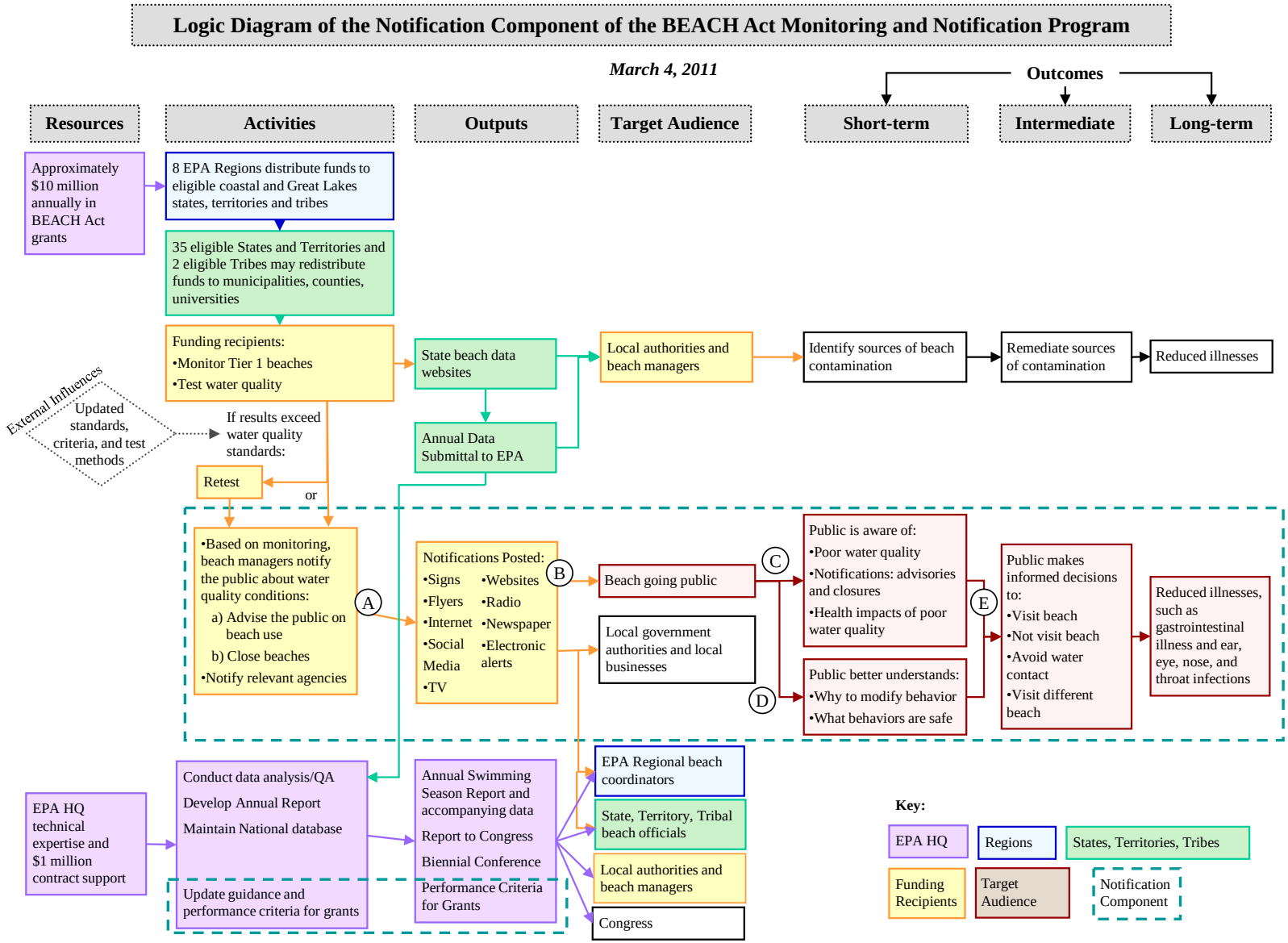
Notes on the logic model:

1) States and territories are the primary recipients of BEACH Act grants; certain tribes are also eligible to apply for funding.[4] These direct funding recipients may use the funds themselves to implement BEACH Act monitoring and notification programs, or they may distribute some of their funds to municipalities, counties, and universities for program implementation. In Exhibit 1, the term *funding recipients* indicates both direct and indirect funding recipients.

2) The evaluation questions are aimed at assessing components of the notification program identified in the logic model, as indicated by the circled letters in Exhibit 1. Corresponding evaluation questions, identified by the letters in the middle column in Exhibit 2, are presented in page 7 of this report.

[4] To receive BEACH Act grants, tribes, like states and territories, must have coastal and Great Lakes recreational waters next to beaches or similar points of access used by the public. In addition, a tribe must demonstrate that it meets the "treatment in the same manner as a state" criteria contained in section 518(e) of the Clean Water Act. Two tribes currently meet these criteria and receive grants from EPA under the BEACH Act.

EXHIBIT 1 LOGIC MODEL FOR THE BEACH ACT NOTIFICATION PROGRAM



1.2 EVALUATION PURPOSE AND AUDIENCE

This evaluation seeks to address the effectiveness of the beach notification program, and to the extent possible, the relative effectiveness of various notification methods. The evaluation is intended to help policy makers and beach managers understand, and potentially improve, public notification of beach conditions so as to ultimately help the public make better informed decisions about beach use.

Evidence of the effectiveness of various notification methods could be used to supplement or update the existing grant guidance. In addition, states, territories, tribes, and local governments could use information from the evaluation to develop or improve their individual program strategies. Finally, the evaluation identifies where additional research could help further understanding of the program effectiveness. Therefore, key audiences for this evaluation include BEACH Act staff at EPA Headquarters, EPA Regional beach program coordinators, state, local, and tribal officials involved in implementing beach notification programs, and researchers.

1.3 EVALUATION QUESTIONS

Overall, this evaluation seeks to answer the following:

1. How are grantees using BEACH Act funding to notify the public of beach conditions;
2. Which notification methods are the most effective in reaching the public; and
3. How has beachgoers' awareness of beach advisories and closures, understanding of water quality risks, and beach visitation behavior changed in response to notifications.

EPA's Office of Water developed a preliminary set of evaluation questions, which the evaluation contractors (Industrial Economics and Abt Associates Inc.), working in concert with EPA's Evaluation Support Division, helped refine. The evaluators also developed a corresponding set of detailed research questions. Exhibit 2 presents the evaluation questions and research questions. The letter code in the middle column indicates the node in the logic model shown in Exhibit 1 which the evaluation question seeks to inform. References to notification "methods" in Exhibit 2 are meant to cover both the notification type (signs, internet, etc.) and the design and content of the notification (e.g., what combinations of text and graphics are used).

EXHIBIT 2. OVERARCHING EVALUATION QUESTIONS AND CORRESPONDING RESEARCH QUESTIONS

OVERARCHING EVALUATION QUESTION	CONNECTION TO THE LOGIC MODEL	DETAILED RESEARCH QUESTIONS
How are grantees using BEACH Act funding to notify the public of beach conditions?	A	A.1 What methods are used by local beach officials to notify the public regarding beach conditions?
		A.2 Which methods are the most and least common?
		A.3 What factors influence local officials to choose one method of notification vs. another (e.g., funding, program history)?
Which notification methods are the most effective in terms of reaching the public?	B	B.1 How do beachgoers most often learn of beach advisories or closings?
		B.2 What is the estimated audience reached by each method?
		B.3 Do the notification methods differ in terms of the types of audiences they are reaching?
To what extent do notifications affect the awareness of beachgoers?	C	C.1 Does awareness of poor water quality, presence of notifications, or potential health impacts vary by notification method?
To what extent do notifications affect the understanding of beachgoers?	D	D.1 Does public understanding of why to modify behavior and what behaviors are safe vary by notification method?
To what extent do notifications affect the behavior of beachgoers?	E	E.1 Are there observable changes (e.g., since 2000) in the number of beach visits or activities beachgoers engage in for beaches subject to advisories or closures?
		E.2 How do beachgoers change their behavior when their preferred beach is under an advisory or closure (e.g., by not visiting the beach, visiting a different beach, or avoiding contact with the water)?
		E.3 Does beachgoer behavior vary by notification type?
		E.4 What other factors, aside from notification methods, may influence public behavior (e.g., beach management characteristics, such as presence of lifeguards or another "official" presence on the beach; beach location characteristics such as number of access points to the beach).

The remainder of this report is organized as follows:

- Chapter 2 describes the evaluation methodology, including sources of data and types of analysis conducted, as well as the limitations of this approach.
- Chapter 3 summarizes relevant information from the general literature on risk communication and from studies that addressed the specific challenges of communicating environmental risk. The purpose of the literature review is to provide a foundation for assessing the effectiveness of the different notification tools and their applications.
- Chapter 4 discusses the findings from our evaluation research. The discussion is organized by the three primary evaluation questions and presents overall findings of the research, informed by interviews, prior studies, and site- and issue-specific discussions drawing from experience of selected beach programs.
- Chapter 5 provides the evaluation's conclusions.

Supporting material such as interview guides, contacts, and references are included in the Appendices.

CHAPTER 2 | METHODOLOGY

The study is designed as a mixed-method evaluation that combines interviews with information compiled from existing studies, surveys and the published literature. This chapter describes the sources and types of data compiled as part of the evaluation, how the data were analyzed, and the inherent limits of the analysis.

2.1 DATA SOURCES AND ANALYTIC APPROACH

The evaluation draws on multiple data sources in order to answer the evaluation questions. Key sources of information include: 1) interviews and e-mail correspondence with knowledgeable stakeholders from EPA regions, states, tribes, counties and localities, U.S. territories and other organizations, 2) existing beach user surveys and other studies that examine the effects of beach notifications on public awareness and behavior, 3) existing studies from the broader literature that provide additional insight on effective methods of communicating health risks to the public, and 4) national and state-level data on beach notifications and beach attendance. The sections below describe each of these data sources and how they contribute to answering the evaluation questions.

2.1.1 INTERVIEWS AND CORRESPONDENCE

The evaluation draws on the experience and perspectives of stakeholders with personal knowledge about notification program implementation and its effects on the public. We[5] conducted nine structured interviews in each of two primary groups of interviewees: 1) state contacts, and 2) tribal, county, or local authorities and beach managers. We used a distinct interview guide with different questions for each group of interviewees. Hereafter we refer to both county and local interviews as "local" interviews (to contrast them with state interviews). However most of the local interviews were in fact at the county level and three were at the city or town level.

In addition to helping answer the research questions, we also used the interviews to identify additional data sources (e.g., other interviewees, studies of beachgoer attitudes and behavior conducted at specific beaches, or data sets on beach attendance).

Answers to all of the research questions identified in Exhibit 2 are informed by interview responses. State, tribal, and local interviewees provided responses based on their direct experience in implementing some or all notifications for beaches within their jurisdiction. Their perspectives directly informed research questions A.1, A.2, and A.3.

Since restrictions of the Paperwork Reduction Act prevented us from interviewing beachgoers directly about their awareness, understanding, and response to beach notifications, we asked state, tribal, and local authorities, as well as EPA Regional beach

[5] Throughout this report, "we" refers to the evaluation contractors IEc and Abt Associates Inc.

program coordinators, about their perceptions of the public's response to beach notifications. Insights from these interviewees inform evaluation questions B, C, D, and E and complement information available in existing studies and surveys.

We used a snowball sampling method to select candidates for the interviews,[6] beginning with EPA regional beach program coordinators. This is a multi-step process, as described below.

- **Step 1:** We asked EPA regional beach coordinators from the eight EPA Regions involved in the notification program for information on state, territorial, and tribal government contacts in their Region that they believe would be most likely to have relevant information about how notifications are conducted and how they influence the awareness, understanding, and behavior of the beachgoing public. We also asked for contacts within local governments, universities, non-governmental organizations (NGOs), or other organizations in their Region that are knowledgeable about the beach notification program or may have information about how notifications affect the public. Finally, we also requested information on any studies or surveys conducted in the Region that could offer data relevant to beach notification and beachgoer perceptions and behavior to supplement the studies that had already been identified by EPA and through literature search.
- **Step 2:** We selected nine state government contacts to interview based on the recommendations of EPA Regional beach coordinators. Interviewees were selected from the list of recommended contacts so as to include at least one state from each EPA region, with a preference for those locations that regional coordinators suggested are particularly active in the notification program and informed about its effects on beachgoers. We then conducted telephone interviews to gather state contacts' perspectives on the research questions, and to ask for contacts at local levels (e.g., local authorities and beach managers) that would be knowledgeable about beach notifications and their effects on public behavior. In addition, we requested information on any studies or surveys in the state that are relevant to beach notification and beachgoer perceptions and behavior. Interviews with the state government contacts followed a standard interview guide provided in Appendix C. Interviews ranged from 30 to 75 minutes.
- **Step 3:** We selected nine tribal and local beach managers from the candidates identified by regional contacts and state interviewees. Our first priority was to identify interviewees that regions or state contacts suggested might have access to local data, surveys, or studies on public responses to beach notifications. From among those localities, we further classified potential local beach contacts according to types of notification methods used and EPA region. Tribal and local beach contacts were selected to ensure maximum representation across regions and notification methods. In selecting candidates for interviews, we considered characteristics of the local beach

[6] Snowball sampling can be used when the desired sample characteristic is uncommon in the general population. In this case, the sample characteristic is specialized knowledge about the BEACH Act notification program. Snowball sampling relies on referrals from initial subjects to generate additional subjects for possible interviews.

monitoring and notification program, particularly concerning activities that were distinct from the state program, and also considered existing studies and the degree to which the beach notification program was either well-established or new. We conducted telephone interviews to gather information on notification program implementation and the public's response. We also collected any available data on public responses to beach notifications. Interviews with the tribal and local beach program contacts were conducted following the standard interview guide provided in Appendix D. Interviews ranged from 30 to 90 minutes.

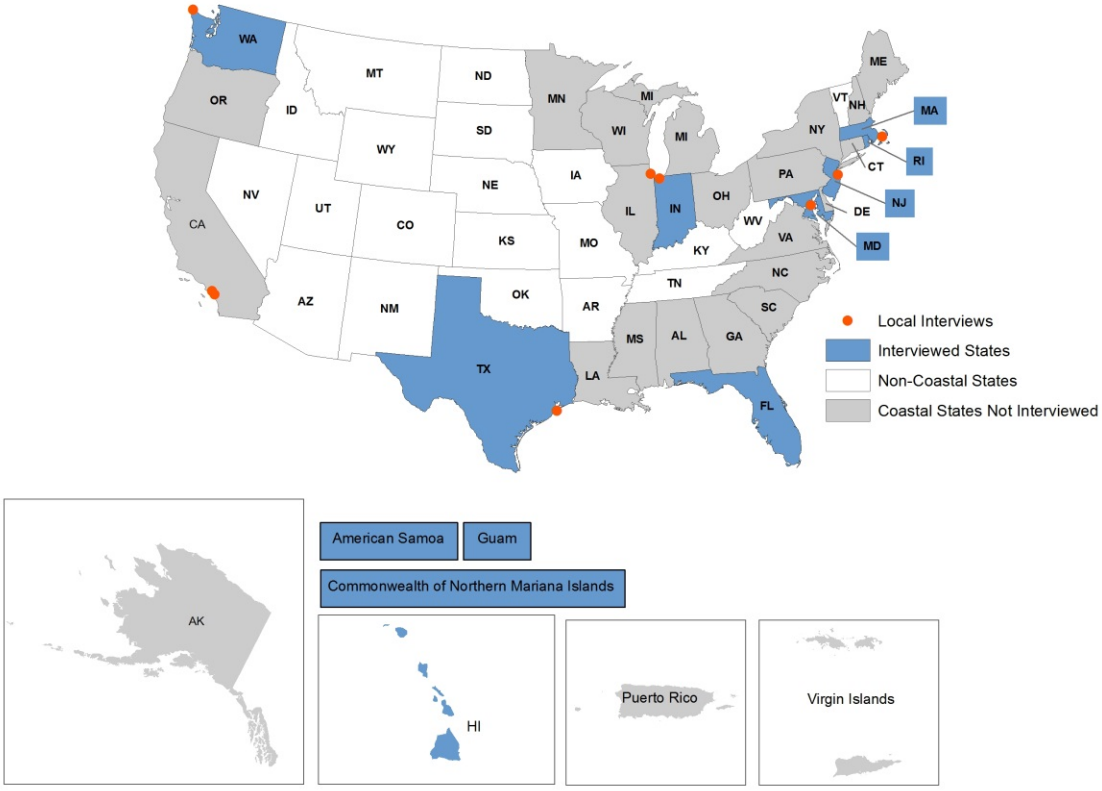
Exhibit 3 provides the list of state, tribal, and local beach programs whose managers we interviewed using the standard interview guides. The map in Exhibit 4 highlights the state, local and tribal programs interviewed for this study.

EXHIBIT 3. OVERVIEW OF STANDARD INTERVIEWS CONDUCTED

INTERVIEWEE CATEGORY	INTERVIEWEES
State contacts	Florida Hawaii Indiana Massachusetts Maryland New Jersey Rhode Island Texas Washington
Local and Tribal contacts	Makah Tribe[7] Orange County, California City of Newport Beach, California Chicago Park District, Illinois Town of Ogden Dunes, Indiana Barnstable County, Massachusetts Anne Arundel County, Maryland Monmouth County, New Jersey Galveston County Health District, Texas

[7] The Makah Tribe is located on the Olympic Peninsula, WA.

EXHIBIT 4. STATE, LOCAL, AND TRIBAL BEACH PROGRAMS INTERVIEWED



Together, the states interviewed for this evaluation monitored 1,697 beaches in 2009, or about 45% of the total number of coastal beaches monitored nationally.

In addition to the interviews described above, which used a standard interview guide, we also contacted other individuals to cover other program-specific questions. In particular, we contacted beach managers in three U.S. territories, individuals from two non-governmental organizations (NGOs), selected stakeholders familiar with beach notification at particular beaches we researched in more detail for case studies (described later), and academic researchers. All of these individuals were identified through our interviews and literature search as having specific knowledge or access to data pertaining to public response to beach notifications (Exhibit 5). We made these contacts primarily through e-mail correspondence, but also through phone conversations.[8] The purpose of these efforts was to gather additional information about program activities, history of beach notification programs in specific locations discussed in the case studies, ongoing or unpublished studies relevant to the evaluation questions, and different perspectives.

[8] These conference calls are distinct from the interviews because they did not follow a structured interview format.

EXHIBIT 5. ADDITIONAL CONTACTS AND CORRESPONDENCE

CATEGORY	ORGANIZATION
U.S. Territory	Guam Commonwealth of the Northern Mariana Islands (CNMI) American Samoa
Non-Governmental Organization (NGO)	Heal the Bay Surfrider-Rhode Island Chapter, South Texas Chapter, and Coastal Bend (Texas) Chapter
Local Stakeholder	Coastal Bend Bays & Estuaries Program, Corpus Christi Texas Corpus Christi Windsurfing Association
Local Government	City of Corpus Christi
Academia	University of Illinois-Chicago

Finally, we discussed preliminary findings from our interviews and additional data collection with EPA regional coordinators to assess the extent to which these preliminary findings fairly represented notification programs within their region.

2.1.2 BEACH USER SURVEYS AND BEACH NOTIFICATION STUDIES

In addition to the interviews and direct contacts described above, the evaluation draws on information collected in existing studies or beach user surveys identified from the literature or provided by the interviewees.

Several pertinent studies conducted by EPA, state agencies, and academic researchers in the last decade have addressed, directly or indirectly, the effectiveness of beach notification and its effects on behavior of the beachgoing public. These studies, which generally use intercept surveys of beach users and/or surveys of the general public as their main data collection technique, aim to understand how beachgoers get their information regarding beach water quality, how they interpret the information, and whether the information influences their behavior. Given that we could not interview individual beachgoers as part of this evaluation, as described earlier, we used existing studies and surveys as an additional source of detailed data necessary to help answer evaluation questions B,C, D, and E.

Existing studies and surveys consider several issues relevant to the evaluation, including:

- **The use of different communication approaches and media and their effectiveness in reaching the public (or certain subset populations).** One study summarized the range of methods used by state beach monitoring programs to inform the public about water quality at beaches (Barker, 2009). The Natural Resources Defense Council issues a report, *Testing the Waters*, that also describes notification methods (NRDC, 2010). These sources are useful in highlighting the frequency with which different methods are used across state programs. They are limited, however, in the insight they offer regarding the reach of different methods and their effectiveness at improving the public's understanding of the risk.

- **How awareness of notifications affect risk perception.** The academic literature provides several studies of risk perception as it applies to beach water quality. These studies are generally based on surveys that: 1) relate the public's awareness of beach notifications (or of local environmental issues in general) to beach visitation/participation, and/or 2) specifically consider how beach users obtain water quality information.
- **How risk perception affects beachgoers' behavior**. Several studies seek to understand what factors affect risk perception and the behavior of beach users. For example, researchers have explored how various factors, e.g., water quality measurements, presence of physical debris, and general messages in the media, affect beachgoer's perception of water quality. Other studies have looked at factors that drive selection of one beach over another, including water quality, water temperature, and recreational amenities. However, we found only two studies that addressed the relationship between perception of beach water quality on a given day and beach attendance or beachgoer behavior (Shaik, 2005 and Turbow et. al., 2004).

2.1.3 NATIONAL AND STATE-LEVEL DATA ON BEACH NOTIFICATIONS AND ATTENDANCE

The most comprehensive source of data on beach notifications is the EPA beach program's PRAWN database (PRogram tracking, beach Advisories, Water quality standards and Nutrients). PRAWN provides data on beach characteristics and on advisories, closures, and other notification events. EPA publishes a summary of these data approximately a year after the end of each summer swimming season. In this evaluation, we used the PRAWN database information to understand the programmatic activities of states interviewed, to develop and focus the interview guides, to help in developing case studies, and to provide additional context to the responses on various evaluation questions.

Several sources provide national- or state-specific data on beach attendance, but only one of these provided sufficient detail to be combined with the PRAWN data to assess the relationship between beach attendance and advisory status (see Case Study C in Chapter 4). In particular, this case study draws on detailed beach attendance data from Newport Beach, California, and provides a regression analysis to assess the relationship between beach attendance, beach advisories, and other factors that may affect beach attendance, such as temperature. Other sources of beach attendance data did not provide sufficient detail for this type of analysis, but instead provided additional context for certain findings, such as to contrast the estimated number of visits to a state's beaches annually to the number of hits to the state's beach notification website. These sources include the National Survey on Recreation and the Environment (Leeworthy and Wiley, 2001) and visitation data for Great Lakes beaches from the literature (e.g., Austin et al., 2007). In addition, EPA provided attendance data for nine beaches around the country from the National Epidemiological and Environmental Assessment of Recreational (NEEAR) Water Study. However, since data were only available for 20 to 30 days for each beach, and these days did not have substantial overlap with days when beach advisories were issued, we were not able to analyze the relationship between beach attendance and beach advisories for these NEEAR study beaches.

2.1.4 RISK PERCEPTION AND COMMUNICATION LITERATURE

In addition to studies that address beach user surveys and beach water quality notifications specifically, the evaluation also considers insights from the general risk communication literature. Risk communication theory offers useful conceptual frameworks for understanding factors that influence individuals' perception of risk and best practices for effective public communication. This general literature, along with selected literature that pertains more specifically to the communication of environmental risk to the public through advisories (i.e., water quality and fish consumption advisories), provide the context for assessing beach notification tools and messages.

2.2 LIMITATIONS

As with any evaluation, the findings of this evaluation are limited by available data, resources and time, as well as by statutory constraints (specifically the Paperwork Reduction Act). These conditions lead to uncertainties, potential errors, and bias, the four most important of which are described below:

- **Uncertainties associated with secondary data.** A survey of beachgoers was outside the scope of this evaluation and we were therefore not able to directly assess beachgoers' awareness of beach notifications or how notifications affect their understanding of health risks or their behavior. Instead, we primarily relied on secondary reports of beachgoers awareness, understanding, and behavior from interviews with several categories of stakeholders, as well as existing studies and survey data. However, interviewees may not have sufficient information to accurately or completely characterize the experiences of beachgoers; and past studies and surveys may not be representative of the experiences of beachgoers in other locales or for current conditions.
- **Sampling error associated with snowball sampling techniques.** Since we relied on certain interviewees (EPA regional beach coordinators) to recommend contacts for other interviewees (state contacts), who in turn recommended local or tribal authorities or beach managers to interview, it was not possible to ensure that the interviewees adequately represent knowledgeable individuals in each group. To partially address this potential sampling error, we sought to ensure that interviewees, particularly at the local level, represent different EPA regions and types of notification methods.
- **Qualitative, non-experimental research design**. The evaluation did not involve a true or quasi-experiment to test the effectiveness of different beach notification methods. Instead, as noted earlier, the evaluation relied on secondary data (i.e., existing research studies) and second-hand reports of the influence of beach notifications on beachgoer behavior. Therefore, the causal impact of beach notifications on beachgoer behavior cannot be determined from this evaluation.
- **Lack of detailed national-level data sets which would allow comprehensive correlation of beach notifications with beach attendance**. Existing data sets (e.g.,

PRAWN and the National Survey on Recreation and the Environment) provide information on beach notifications and beach attendance, but the data are not specific enough to relate notifications to subsequent changes in beach attendance or changes in beachgoer behavior (e.g., whether or not beachgoers swim). While we sought beach attendance records from local beach managers, and we analyze one dataset in Case Study C later in this report, such data are very limited. It is difficult to show a causal relationship between notifications and beachgoer attendance given the myriad other factors that may affect beach attendance (e.g., weather and day of the week). Moreover, beach attendance records may not serve as an accurate behavioral indicator, since beachgoers may visit the beach but still change their behavior in response to advisories by staying out of the water.

CHAPTER 3 | BACKGROUND ON RISK COMMUNICATION

This chapter summarizes relevant background from the literature on risk communication as context for this evaluation. The discussion first provides an overview of the fundamentals of risk communication. We then discuss insight from studies that look at the effectiveness of different communication strategies in the context of environmental risk communication, focusing specifically on studies of water quality and fish consumption advisories. The chapter concludes with suggestions about how this risk literature may inform understanding of the findings of our evaluation, which are presented in Chapter 4.

3.1 FUNDAMENTALS OF RISK COMMUNICATION

The general literature on risk communication offers a useful framework for understanding the process, and also the challenges, of beach notifications. Key steps of risk communication include: 1) creating a risk communication strategy; 2) establishing public trust; 3) crafting specific risk communications; and 4) evaluating outcomes (adapted from Bennett, undated). Each of these steps is considered in more detail below.

Creating a risk communication strategy requires first and foremost establishing the goal of the risk communication. An agency may be seeking either to *influence* or *inform* the public. Influencing the public involves convincing individuals to take (or avoid) certain actions. Alternatively, an agency may simply strive to inform the public; this calls for sharing information so that individuals can make their own judgments and risk management decisions (Ng and Hamby, 1997).

When discussing the intent of public communication on beach water quality, EPA's National Beach Guidance and Required Performance Criteria for Grants (June 2002) stipulates that grantees should use "measures such as beach advisories or closings to *inform* the public of the potential risks associated with water contact activities in waters that exceed applicable state or tribal water quality standards."[9] (emphasis added) The guidance further notes it is up to local beach managers to decide whether to close a beach or issue an advisory, and that advisories are *recommendations* to the public to avoid swimming in water that has exceeded applicable water quality standards. This suggests that the general purpose of the beach notifications is to inform beachgoers so that they can make an educated decision about whether to swim, rather than to ensure that no swimming occurs during an advisory. However, individual states and localities vary in the degree to which they seek to influence the public, and

Plan Carefully and Evaluate Your Efforts:
"Begin with clear, explicit risk communication objectives, such as providing information to the public [or] motivating individuals to act. … Classify and segment the various groups in your audience. Aim your communications at specific subgroups in your audience. … Whenever possible, pretest your messages. Carefully evaluate your efforts and learn from your mistakes."

Source: Seven Cardinal Rules of Risk Communication, US EPA, 1988, OPA-87-020

[9] Section 5.3.2.

some beach managers do seek to keep beachgoers out of water that does not meet water quality standards. Given the implications that the different goals may have on all aspects of the notification program, it is important that beach managers be clear about the goal of their communication strategy.

As part of developing their communication strategy, state and local agencies should also identify different stakeholders and consider how different stakeholders will perceive the beach notification messages. For example, for beach advisories, stakeholders could include local and tourist beachgoers, as well as local business owners and environmental groups. Each of these groups may have different levels of awareness of, and interests in, beach notification, and may require different types and content of communication (e.g., tourists may not read local newspapers, some beachgoers may need to have advisories translated into a language besides English, and some local advocacy groups may be able to communicate beach advisories to their membership).

Regardless of an agency's goal to inform or influence, agencies practicing effective risk communication also work to **establish trust** with key stakeholder groups. Usually risk communication messages are judged first on the basis of whether the source can be trusted, and only secondarily on the basis of the content of the message itself. The extent of trust defines the limits of how effective risk communication can be: "If trust is lacking, no form or process of communication will be satisfactory" (Slovic, 1993) and "Trust is an important pre-requisite for effective orientation and action." (Ng and Hamby, 1997) There are four key factors that determine trust: commitment, competence, caring, and predictability (Kasperson, Golding, and Tuler, 1992). Beach managers charged with communicating risk to the public must therefore strive to demonstrate their trustworthiness to the public, e.g., by providing consistent, accurate information and by showing concern about public welfare. It may also be helpful to partner with parties that already have the public's trust, such as a local television station or neighborhood organizations, in order to get the word out about beach advisories.

In addition to establishing trust, agencies must craft **specific risk communications** that are tuned to the characteristics of both the risk and the target audience. Certain risks are perceived as more worrisome than others. Risk perception can be influenced by the degree of control individuals feel they have over a risk, the immediacy of the risk, and the "catastrophic potential" of situations (Martin and Pendleton, *undated*; Palenchar and Heath, 2002; Slovic, 1987). Exhibit 6 summarizes factors that tend to make a risk more worrying. A number of these factors do not apply to beach advisories, and thus the public may view the risks of contact with contaminated water to be relatively acceptable compared to other risks. Moreover, people tend to be subject to "self-positivity" bias, i.e., an individual's sense that they are personally immune to the consequences of a risk (Menon, 2002). Given this, it may be difficult to get individuals to take seriously the risks of contact with contaminated water, and communications plans should be crafted accordingly.

Risk perception is based not only on factors that pertain directly to the risk, but also a wide variety of characteristics specific to the individual perceiving the risk, such as trust in authority figures, age, gender, disability, language proficiency, literacy, education level, income, religious beliefs, and access to resources (Palenchar and Heath, 2002; Vaughan and

Tinker, 2009). In other words, the public is not a "homogenous mass" but rather individuals who may hold different values and perceptions of risk.

Besides crafting careful notification methods, effective risk communication also requires **evaluation of program outcomes**. In fact, EPA's National Beach Guidance and Required Performance Criteria for Grants (June 2002) requires that BEACH Act grantees evaluate public notification and risk communications programs. Evaluations should address whether the public and agency's objectives have been met, e.g., whether people have sufficient knowledge and understanding to make an informed decision and whether their health was protected. Evaluations of specific beach notification programs should be informed by the program's goals (i.e., whether the intent is to inform or influence the public.) Assessing the beach notification program outcomes and impacts may involve focus groups and surveys, and should include not only program staff but also members of the public.

EXHIBIT 6. RISK-SPECIFIC FACTORS THAT INFLUENCE RISK PERCEPTION, AND RELEVANCE TO BEACH ADVISORIES

RISKS ARE GENERALLY MORE WORRYING (AND LESS ACCEPTABLE) IF PERCEIVED:[10]
• To be involuntary (e.g., exposure to ambient pollution) rather than voluntary (e.g., dangerous sports) • As inequitably distributed (some individuals benefit while others suffer the consequences) • As inescapable by taking personal precautions • To arise from an unfamiliar or novel source • To result from man-made, rather than natural sources • To cause hidden and irreversible damage (e.g., onset of illness many years after exposure) • To pose some particular danger to small children or pregnant women, or more generally to future generations • To threaten a form of death (or illness or injury) arousing particular dread • To damage identifiable, rather than anonymous, victims • To be poorly understood by science • As subject to contradictory statements from responsible sources (or, even worse, from the same source)

3.2 LITERATURE ON RISK COMMUNICATION RELATED TO RECREATION AND WATER POLLUTION

Several studies have found that public perception of beach water pollution is based in large part on direct experience. The public's initial perception of water quality is usually based not on bacteriological data; rather, it is based what they can see or smell in the water (Martin and

[10] Source: Bennett, undated.

Pendleton, undated; Jensen and McClelland, 2010; House, 1996). Researchers have also found that perceptions of water quality are often linked to observable indicators (e.g., physical debris) rather than to water quality monitoring results. Turbow et al. (2004) found that concern over pollution was among the reasons for beachgoers not to swim during their visit, but that temperature and other factors were also at play. Beach managers could use this information in two ways as they strive to craft notification messages. First, they could encourage beachgoers to take note of observable indicators of poor water quality (e.g., discolored water), and to be aware of factors that may lead to water contamination (e.g., recent rain leading to stormwater runoff). Alternatively, beach managers could actively seek to counteract initial impressions, e.g., by conveying the message that even if beachgoers cannot see or smell a problem, the water may still be contaminated. We did not find literature on which of these approaches may be more effective in the context of beach notifications.

Media coverage can also affect public perception. For example, in a survey of beachgoers in Los Angeles County, Pendleton et al. (2001) found that the perception of risk and the resulting behavior related to beach use was influenced by several factors, including general messages communicated by the media about water quality (in addition to specific advisories). Media coverage can influence how individuals interpret their own experience. For example, swimmers in the United Kingdom who had heard reports regarding water quality were almost five times more likely to report skin ailments than swimmers who had not been exposed to any information about water quality (Fleischer and Kay, 2006). These findings may suggest that beach notification programs should include general media outreach as part of their communications strategy, and not rely on individual notification messages in isolation.

Studies about the effectiveness of fish advisories also offer potentially useful insights for beach advisories by highlighting how individuals receive and understand environmental risk communication.[11] Several studies have found a relationship between awareness of fish advisories and angler behavior. For example, one study found that anglers who are aware of advisories are 26% less likely to consume listed species than anglers who are not (Jakus et. al., 2002). A study of fish consumption and risk perception of urban fishermen in the New York/New Jersey estuary found that awareness of advisories varied, and that the greater the awareness, the less likely that fishermen would eat their catch (Burger, 1996). These findings suggest that awareness of fish advisories is the foundation for changing behavior; a similar pattern may be true for beach water quality advisories.

Another fish advisory study suggests that general education and outreach may be equally or more important than specific advisories. This study of Wisconsin anglers, especially non-English speaking anglers, found that local newspaper and TV stations were a more common source of information about the risks of eating contaminated fish than fish advisories for particular streams (Knuth, et. al., 2003). Therefore, increasing general public awareness of

[11] We acknowledge important differences between water quality and fish advisories. In particular, water quality advisories are generally episodic, as compared to fish advisories which generally apply over long periods of time. This characteristic of water quality advisories presents challenges for ensuring that the public gets timely information learns how to check information sources regularly for the most up to date information before using the beach.

the risk through outreach may facilitate and reinforce subsequent more specific communication.

The fish advisory literature also offers some potentially relevant perspectives on how to communicate risk to the public. For example, in one study, researchers investigated the relative effectiveness of different formats[12] for fish advisories and the extent to which target audiences understand and respond to risk-related information (Connelly et al, 1998). While there were differences among people with different demographic characteristics, researchers found that the most effective formats combined qualitative and quantitative information using a combination of text and diagrams. In addition, a cajoling rather than commanding tone was found more effective in relaying information to the audience so that they could make their own decisions. These findings highlight the need to tie the format of the message to the intent (i.e., informing vs. influencing behavior), and to consider how the advisory message will be received by the audience.

3.3 IMPLICATIONS OF RISK COMMUNICATION LITERATURE FOR BEACH ADVISORIES

In light of this literature, it seems that individuals may be most likely to take note of beach water contamination when they can directly perceive the contamination (e.g., they observe a change in the appearance or odor of the water) or they have direct experience with the effects of contacting contaminated water. Since not all individuals will have such personal experience, agencies seeking to inform or influence the public should develop a thoughtful risk communication plan. In addition, beach managers that wish to influence the public to avoid contact with contaminated water should develop beach advisories that highlight the aspects of exposure that are most relevant to the public, e.g., consequences of contact with contaminated water, and how to avoid the risk of illness. Since awareness of advisory messages or general outreach seems to precede changes in understanding and behavior, effective beach notification programs may need to communicate information at different levels and using parallel approaches – combining general outreach with multiple methods of communicating specific beach advisories – to ensure that the public is able to make informed decisions. The format of the notification needs to consider both the primary goal (inform or influence) and the characteristics of the target audience. Finally, beach managers should recognize that individuals bring their own values and perceptions about risk and that some individuals will be more likely to heed advisories than others. If it is essential to public health that beachgoers stay out of the water (as currently recommended in the event of a sewage discharge), beach managers may need to go beyond notification to take active steps to close beaches and enforce swim bans.

[12] The advisory formats evaluated by Connelly et al (1998) considered different reading levels; predominance of graphics vs. text; use of a commanding vs. cajoling tone; and use of qualitative vs. quantitative information.

CHAPTER 4 | FINDINGS

The chapter presents findings for each evaluation question, drawing on information collected through interviews, existing surveys and studies pertaining to beach notification. The discussion is organized according to the five primary evaluation questions:

Section 4.1: How are grantees using BEACH Act funding to notify the public of beach conditions?

Section 4.2: Which notification methods are the most effective in terms of reaching the public?

Section 4.3: To what extent do notifications affect the awareness of beachgoers?

Section 4.4: To what extent do notifications affect the understanding of beachgoers?

Section 4.5: To what extent do notifications affect the behavior of beachgoers?

Throughout the chapter, we highlight the observations and findings that apply generally across the data sources we consulted, as well as specific examples that demonstrate a range of experiences. We include in the discussion four case studies that explore in greater detail selected aspects of the findings:[13]

Case Study A: Chicago Park District Uses New Media Tools to Notify Public of Beach Water Quality Conditions

Case Study B: Orange County, California, Pilots Real-Time Beach Notification Using Electronic Signs

Case Study C: Data from Newport Beach, California, Suggest Relationship between Advisories and Beach Attendance

Case Study D: Corpus Christi, Texas, Finds No Major Economic Impacts as a Result of Notification

4.1 HOW GRANTEES ARE USING BEACH ACT FUNDING TO NOTIFY THE PUBLIC OF BEACH CONDITIONS

The nine states we interviewed are all direct recipients of BEACH act funding. In all but one state, the BEACH Act grant is the only source of funds for monitoring coastal beaches and issuing notifications within the state. The one exception is the state of Florida, which contributes about half of the total budget for its program.[14]

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[13] Case studies A and B relate to evaluation questions A and B: How are grantees using BEACH Act funding to notify the public of beach conditions, and which notification methods are the most effective in terms of reaching the public? Case study C relates to evaluation question E: To what extent do notifications affect the behavior of beachgoers? Case study D is not tied specifically to an evaluation question, but explores controversy around instituting beach notifications and the experience of one city in implementing notifications in recent years.

[14] Note that additional funding may be provided at the local level. For example, about half of the funding for Chicago Park District's monitoring and notification program comes from local sources.

Implementing beach advisories involves several responsibilities, including 1) establishing policies and procedures for notification; 2) monitoring water quality; 3) issuing beach notifications; and 4) managing beach operations on site. Section 4.1.1 describes the range of responsibilities that are part of a beach notification program in more detail, and how these responsibilities are coordinated among state, tribal, and local authorities.

Section 4.1.2 describes specific methods used to notify the public regarding beach conditions, and identifies which methods are most and least common. This section also includes a summary of characteristics for beach signs and websites from states and localities we interviewed. Finally, Section 4.1.3 describes our findings about why states, localities, and tribes use the notification methods they do.

PROPOSED 2010 BEACH ACT FUNDING FOR INTERVIEWED STATES

Florida	$531,000
Hawaii	$326,000
Indiana	$207,000
Maryland	$271,000
Massachusetts	$257,000
New Jersey	$280,000
Rhode Island	$215,000
Texas	$386,000
Washington	$270,000

4.1.1 Beach notification responsibilities

State, tribal, and local beach authorities each have a role in carrying out a range of responsibilities related to beach notification, although the allocation and coordination of responsibilities varies from state to state, as described below.

Establishing Policies and Procedures for Notification

All states interviewed for this evaluation establish policies or procedures for notification, including guidance about when advisories should be issued and circumstances when beaches should be closed. Nearly all states recommend that a beach advisory be issued upon receiving fecal indicator bacteria test results above the established standards.[15] New Jersey is an exception, since the state retests the water to verify results before issuing an advisory (except in Monmouth County, where closures are issued without retesting). In some cases, localities make the final determination about whether to issue an advisory based on sampling data. For example, in Indiana, the local health departments or beach managers issue advisories, following policies established by Indiana Department of Environmental Management. The local authorities lift advisories after further testing results indicate that bacteria are below threshold levels.

Most states do not close beaches or prevent access, but instead issue advisories to inform the public of the risk of contact with contaminated water. However, some states (e.g., New Jersey and Rhode Island) do systematically close beaches entirely or ban swimming when test results are above the applicable pathogen criterion. In addition, some localities, e.g.,

[15] *E. coli* (freshwater beaches) or enterococci (in freshwater or marine beaches) are used as indicator organisms of fecal contamination. Advisories are generally issued when single sample maximums exceed the criteria values specified in the standard (EPA, 1986).

Chicago, Illinois, and Newport Beach, California, may close the beach for swimming, depending on the fecal indicator bacteria densities. Both of these localities use lifeguards to enforce swim bans.

In addition to advisories prompted by monitoring results, several states and localities we interviewed, including Rhode Island, New Jersey, Massachusetts, and Orange County California, have established policies to issue preemptive advisories, closures, or swim bans following storms, when stormwater runoff is known to increase fecal indicator bacteria levels. Interviewees noted that several jurisdictions along the Great Lakes are now moving toward using predictive models[16] to estimate fecal indicator bacteria levels and to estimate water quality conditions in "real-time." These methods allow information to be communicated faster than the 18- to 24-hour turnaround of the conventional culture-based testing methods. (Case Study C, later in this chapter, discusses the experience of Orange County, California, in implementing rapid testing methods)

Monitoring Water Quality

Water quality sampling frequencies vary among the states and among beaches within a given state. Beaches are prioritized into tiers based in part on their water quality history and their popularity. Although testing once per week during the swimming season is common, high priority beaches ("Tier 1") may be sampled as frequently as daily.

In some cases states monitor coastal beaches directly, while in others state agencies coordinate the efforts of counties and other local jurisdictions that follow procedures established by the states to implement aspects of the program, such as water quality sampling, testing, and notifications. Seven of the states interviewed redistribute part of their BEACH Act funds to counties, municipalities, private laboratories, or other local organizations that are responsible for implementing the monitoring aspects of the program at some or all of the coastal beaches within the state. Hawaii and Rhode Island are two exceptions, as these states directly monitor all their coastal beaches.

Issuing Notifications

All states interviewed provide a central gateway for compiling and distributing water quality information about all beaches within their jurisdiction. However, many states only post data on their websites, and local beach managers are responsible for putting up signs and taking other steps to notify the public.

Managing Beach Operations on Site

Local governments and municipalities usually take the lead in managing beach operations on site, which may include posting signs, and hiring lifeguards who in some cases may play a role in enforcing swim bans or answering beachgoer questions about beach advisories. States are generally not involved in directly staffing and managing beach operations, except at state

16 The predictive models rely on empirical relationships between pathogen density and climatic or other environmental factors.

parks. Several county departments we interviewed rely on municipal staff to post signs or flags at the beaches and enforce swim bans. For example, Newport Beach, California, lifeguards post and enforce swimming bans when notified by Orange County, California, that water quality sampling revealed problems. Responsibilities are not exclusively assigned to local governments or regular staff. For example, Ogden Dunes, Indiana, relies partly on volunteers who are also involved in outreach to local residents on water quality.

Exhibit 7 summarizes responsibilities of the states we interviewed with regard to aspects of the beach notification program. Exhibit 8 summarizes responsibilities of the localities and tribe we interviewed for selected aspects of the beach program.

EXHIBIT 7. STATE RESPONSIBILITIES FOR BEACH NOTIFICATION

STATE	BEACH PROGRAM RESPONSIBILITIES				
	PROVIDE FUNDING FOR DIRECT PROGRAM IMPLEMENTATION	ESTABLISH POLICIES, STANDARDS, OR PROCEDURES FOR NOTIFICATION	CONDUCT MONITORING/ SAMPLING	NOTIFY THE PUBLIC OF WATER QUALITY CONDITIONS	STAFF THE BEACH AND MANAGE OPERATIONS
Florida	✓	✓		✓	
Hawaii		✓	✓	✓	
Indiana	✓	✓		✓	
Massachusetts	✓	✓	✓	✓	✓[17]
Maryland	✓	✓		✓	
New Jersey	✓	✓		✓	
Rhode Island		✓	✓	✓	✓[18]
Texas	✓	✓	✓[19]	✓	
Washington	✓	✓	✓[20]	✓	

[17] Local officials manage beaches except state park beaches run by the Department of Conservation and Recreation.

[18] Local officials manage beaches except state park beaches run by the Department of Environmental Management.

[19] This function is contracted out.

[20] State will monitor beaches when necessary; however, monitoring is typically performed by the localities.

EXHIBIT 8. LOCAL AND TRIBAL RESPONSIBILITIES FOR BEACH NOTIFICATION

LOCALITY/TRIBE	BEACH PROGRAM RESPONSIBILITIES[21]			
	CONDUCT MONITORING/ SAMPLING	ESTABLISH POLICIES, STANDARDS, OR PROCEDURES FOR NOTIFICATION	NOTIFY THE PUBLIC OF WATER QUALITY CONDITIONS	STAFF THE BEACH AND MANAGE OPERATIONS
Orange County, CA	✓[22]		✓	✓[23]
Newport Beach, CA[24]			✓	✓
Chicago, IL	✓	✓	✓	✓
Ogden Dunes, IN	✓	✓	✓	
Barnstable County, MA	✓			
Anne Arundel County, MD	✓	✓	✓	✓
Monmouth County, NJ	✓	✓	✓	✓[25]
Galveston County Health District, TX	✓		✓	
Makah Tribe	✓	✓	✓	

4.1.2 Methods Used to Notify the Public

This section describes findings for two of the detailed research questions:

A.1 What methods are used by local beach officials to notify the public regarding beach conditions?

A.2 What methods are the most and least common?

According to information compiled by EPA in 2009, of 30 states receiving BEACH Act grants,[26] all posted signage at their beaches and all but one used Internet Web sites to communicate beach water quality to the public. Other methods used by states included, in decreasing order of use: press releases (74%), telephone hotlines (39%), e-mail listservs (32%), beach flags (13%), and other methods such as Really Simple Syndication (RSS) services or social media tools (Barker, 2009). The combination of methods and the content and design of the medium differed among states.

Interviews and other research conducted for this evaluation largely confirm these earlier findings. All of the jurisdictions from which we obtained information for this evaluation use

[21] Local beach managers generally do not redistribute funds to other authorities.

[22] For some locations.

[23] For some locations.

[24] We interviewed the Newport Beach Lifeguard Agency, not the County of Newport Beach (which conducts monitoring and also issues notifications)

[25] For some locations.

[26] Five territories and two tribes also receive BEACH Act grants but were not covered in the study (Barker, 2009).

websites as part of their notification programs,[27] and all but one post notification signs on their beaches. Most signs are similar to traffic signs (i.e., large, physically printed signs that beach managers either post or flip down to indicate the beach status); however in one case (Orange County, California) beach managers used electronic signs to allow for greater flexibility in posting information on beach status.

After websites and signs, e-mail outreach and press releases are the next-most common notification tools. Note that e-mail outreach is more common in the states we interviewed for this evaluation than in the 30 states reviewed in 2009, which may be a result of the composition of states interviewed, increasing use of e-mail outreach over time, or the different data collection method used here as opposed to Barker (2009). Local governments interviewed for this evaluation use social media just as often as press releases. Flags, telephone hotlines, and text messaging are the least common notification methods used among those interviewed.

Exhibit 9 summarizes notification methods used by the states, tribes, territories, and localities interviewed. Note that in some states, different notification methods are used for beaches in state parks or where the state directly manages the beach, and different requirements and notification methods may be in place for semi-public beaches (e.g., beaches at private campgrounds).

Overall, the findings show that the different jurisdictions use similar combinations of methods to notify the public. While it is difficult to generalize the findings given the diversity of specific approaches to each medium, we note that states tend to focus their attention on methods that have a broader and more general appeal such as web sites or use of consistent signage, while local governments are more likely than states to use notification methods that target a local audience (press release, e-mails, and social media tools).

[27] We did not interview the beach program manager for the state of Alaska, the only state mentioned in the Barker (2009) study as not having a website. The website for Alaska's beach program, which is administered by the Department of Environmental Conservation (DEC) provides general information about the program and how local communities can get involved in monitoring their recreational beaches, guidance on how to conduct the monitoring, and other similar information. It also provides links to other resources such as EPA beach program sites. However, it does not provide a link to monitoring results.

EXHIBIT 9. SUMMARY OF NOTIFICATION METHODS USED

LOCATION	WEBSITE	BEACH POSTING: SIGNS	BEACH POSTING: FLAGS	E-MAILS	DEDICATED TELEPHONE HOTLINE	PRESS RELEASES	TEXT MESSAGING	SOCIAL MEDIA (E.G., TWITTER, FACEBOOK)	OTHER/NOTES
States									
FL	✓	✓				✓			Radio notification will generally occur if beach closure is of local interest. State runs general information phone line; the hotline is used for red tides.
HI	✓	✓		✓		✓			Press release if sewage or other spill affects water quality ("brown water" advisory or other severe conditions). Telephone hotline repair/update at the time of the interview.
IN	✓	✓						✓	RSS Feed, Twitter, Facebook
MA	✓	✓							Public outreach: Attend conferences and presentations. Some localities send out press releases.
MD	✓	✓							Signs vary by locality. Press releases are issued in the case of sewage spills. Some counties use Twitter, hotlines, and local websites.
NJ	✓	✓	✓		✓				Signs vary by locality. Press routinely gets data through the state website.
RI	✓	✓		✓	✓	✓			Public outreach, e.g., interviews with media to explain the issues; information distributed during "Bay Day" when beach access is free; other community activities.
TX	✓	✓		✓			✓		RSS Feed; Some localities issue press releases; Pilot project in five counties to report daily beach conditions; Conducted extensive outreach to publicize the Texas Beach Watch website and beach conditions report (e.g., mass mailings, TV and radio ads)
WA	✓	✓		✓		✓		✓	ListServ, Twitter, Facebook, and blog
State Count	**9**	**9**	**1**	**4**	**2**	**4**	**1**	**2**	

LOCATION	WEBSITE	BEACH POSTING: SIGNS	BEACH POSTING: FLAGS	E-MAILS	DEDICATED TELEPHONE HOTLINE	PRESS RELEASES	TEXT MESSAGING	SOCIAL MEDIA (E.G., TWITTER, FACEBOOK)	OTHER/NOTES
Tribe									
Makah Tribe	✓	✓							Also post on local announcement boards and send notification through a community member-only website.
Tribal Count	**1**	**1**							
Localities									
Orange County, CA	✓	✓	✓	✓	✓	✓	✓	✓	Social media tools include iPhone app, Twitter. Recently participated in a pilot project that used electronic signs.
Newport Beach, CA	✓	✓		✓		✓		✓	Social media tools include Twitter; press releases are issued upon high precipitation events.
Chicago, IL	✓	✓	✓	✓	✓	✓	✓	✓	E-mails sent only to internal stakeholders. Social media tools include Facebook and Twitter. Red flag also indicates dangerous weather. Bilingual (Spanish) hotline.
Ogden Dunes, IN	✓	✓						✓	Operate a website subscription service that issues alerts through the police department. Social media tools include a blog.
Barnstable County, MA	✓	✓							One locality sent out e-mails to key stakeholders (e.g., hotels) in 2010.
Anne Arundel, MD	✓	✓		✓	✓	✓		✓	Twitter serves similar purpose as text messaging; have extensive outreach program (fairs, neighborhood canvassing); bilingual (Spanish) website.
Monmouth County, NJ	✓	✓	✓	✓		✓			Issued one press release (2002).
Galveston Island, TX	✓	✓		✓					
Local Count	**8**	**8**	**3**	**6**	**3**	**5**	**2**	**5**	

LOCATION	WEBSITE	BEACH POSTING: SIGNS	BEACH POSTING: FLAGS	E-MAILS	DEDICATED TELEPHONE HOTLINE	PRESS RELEASES	TEXT MESSAGING	SOCIAL MEDIA (E.G., TWITTER, FACEBOOK)	OTHER/NOTES
Territories									
American Samoa	✓			✓		✓			Press releases to radio, television, and newspaper. Beach signs have been designed and will be implemented at Tier 1 beaches in the near future.
CNMI	✓	✓		✓		✓		✓	Social media tools include Facebook.
Guam	✓	✓		✓		✓			Internal agency list and notify beach managers and lifeguards.
Territory Count	**3**	**2**	**0**	**3**	**0**	**3**	**0**	**1**	

Beach Signs

As mentioned above, nearly all state, tribal, and territorial beach authorities interviewed for this evaluation use signs[28] at their beaches to notify the public of water quality. Signs posted at each beach often follow a standard format determined by the state, and in some cases state beach programs provide signs to localities. However, some states, e.g., Maryland and New Jersey, do not require localities to post a standard type of sign. Note that a few localities use the same signs as other programs – namely, the Makah Tribe uses Washington State's signs, and Michigan City and Wisconsin use the same signs as Indiana (although Wisconsin's signs provide the website and phone number for their own monitoring program).

This evaluation reviewed the content and format of a total of 18 signs from five states and two counties. Most the signs reviewed are specific to the current water quality conditions, meaning beach managers will change the sign when bacteria levels change. Thirteen of the signs communicate beach advisories or closures specifically, while the five others indicate good conditions or provide general information. Signs from all but one of the jurisdictions reviewed provide at least some information in more than one language.

As beach authorities consider sign design, they must weigh what information is most important to convey in a small space. EPA's current guidance recommends that beach advisory or closure signs include the terms "Warning," "Advisory," "Beach Closed," or similar language and include the following information:

- Reason for the advisory or closing, and the location affected;
- When samples were taken and information about when the beach will reopen; and
- The responsible agency's name and contact number.[29]

In practice, signs vary in their format and the level of detail they provide. Of the 13 warning or advisory signs reviewed, 12 use images or icons to communicate beach status. All of the signs use color in the sign background or text to convey information about water quality; red, orange, and yellow are the most common colors to convey beach

BEACH SIGNS ALERT BEACHGOERS ABOUT WATER QUALITY CONDITIONS

[28] This section discusses physical beach signs. For a discussion of the one locality interviewed for this evaluation that uses electronic signs, see Case Study B.

[29] U.S. EPA, National Beach Guidance and Required Performance Criteria Chapter 5: Public Notification and Risk Communication.

advisories or closures. Most signs explain the reason for the advisory or the source of contamination, explain the specific activities that may not be safe, mention the agency responsible for issuing the advisory, and provide a website address. While eight signs mention general consequences of contact with contaminated water (i.e., contact could "cause illness") none of the signs describes the type of illness or symptoms that beachgoers might experience. Seven of the 13 signs provided a phone number to call for more information. Only one sign provides information about when the notice was posted and when the beach may reopen.

As was discussed earlier in Chapter 3, the intent of the communication – whether to convince beachgoers to avoid contact with the water, or simply to provide data so they can make an informed decision – should influence sign format and content. This distinction in intent is apparent in the signs we reviewed. Several signs are used specifically to communicate beach closings (e.g., following a sewage discharge) and clearly stress that swimming is forbidden. Others communicate caution by sharing information on bacteria levels. The intent of the sign is also distinguished by use of a cajoling versus commanding tone as indicated by wording (e.g., caution versus warning/stop/closed) or the use of colors (e.g., yellow, orange, red) or shapes (e.g., rectangular versus octagonal signs). Exhibit 10 shows the different features of beach signs reviewed for individual states and local jurisdictions. The text box below summarizes those features that are likely to be relatively effective, based on information we gathered about improvements states have made to their signage over time in response to public feedback, considerations mentioned in the risk literature summarized in Chapter 3, and requirements from the EPA guidance.

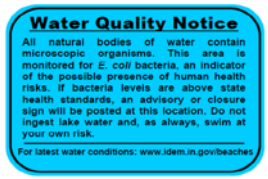
GOOD PRACTICES FOR BEACH SIGNS

Based on available information, findings from this evaluation suggest that beach notification signs with the following features will tend to be more effective than those without these features, all other factors being equal.

- Convey meaning using widely-recognized symbols (e.g., red octagonal shape) and icons, along with simple text.
- Explain the cause of the advisory or closure.
- Highlight consequences of water contact and briefly provide advice on the activities that may be unsafe.
- Use a scale to communicate the severity of the risk (e.g., colors commonly associated with increasing risk levels such as green-yellow- red scale). By reading the sign posted, beachgoers should be able to tell how the current beach status fits on the scale of risk.
- Translate text into relevant languages for residents and visitors.
- Identify the agency responsible for the advisory.
- List other sources where beach users can obtain additional information.

In addition, effective signs should be large, and placed in a prominent location.

EXHIBIT 10. SUMMARY OF BEACH SIGN FEATURES

LOCATION	SIGN	TEXT	LANGUAGE	IMAGES	EXPLAINS REASON FOR CLOSURE OR SOURCE OF CONTAMINATION	EXPLAINS CONSEQUENCES OF EXPOSURE	EXPLAINS SPECIFIC ACTIVITIES THAT MAY NOT BE SAFE	MENTIONS AGENCY RESPONSIBLE	URL	PHONE	NOTES
HI		*WARNING!* *KEEP OUT OF WATER* *No swimming; No fishing; Sewage contaminated water. Exposure to water may cause illness.*	*English*	✓	✓	✓ *(to a limited degree)*	✓				
HI		CAUTION! NO SWIMMING; NO FISHING. Contaminated Water. Exposure to water or eating fish or shellfish may cause illness. Department of Health	English	✓		✓ (to a limited degree)	✓	✓			
IN		Water Quality Notice: All natural bodies of water contain microscopic organisms. This area is monitored for E. coli bacteria, an indicator of the possible presence of human health risks. For latest water conditions <website>	English		N/A		N/A		✓		Provides info about what other signs mean
IN		Water quality today is GOOD, based on recent monitoring for *E. coli* bacteria. For more information <website>	English	✓	N/A		N/A		✓		

LOCATION	SIGN	TEXT	LANGUAGE	IMAGES	EXPLAINS REASON FOR CLOSURE OR SOURCE OF CONTAMINATION	EXPLAINS CONSEQUENCES OF EXPOSURE	EXPLAINS SPECIFIC ACTIVITIES THAT MAY NOT BE SAFE	MENTIONS AGENCY RESPONSIBLE	URL	PHONE	NOTES
IN		CAUTION: Water quality advisory. For your own safety: swim at your own risk, do not ingest lake water, shower after swimming, wash hands before eating, do not swim if you are ill. Increased risk of illness may be present based on recent monitoring for *E. coli* bacteria. For more information <website>	English	✓	✓	✓ (to a limited degree)	✓		✓		Provides detailed advice for staying safe
IN		STOP. CLOSED. Based on recent monitoring for E. coli bacteria serious risk of illness may be present. This area is closed to swimming. For more information <website>	English	✓	✓	✓ (to a limited degree)	✓		✓		Does not say if all water contact should be avoided.
IN		In Spanish: Do not drink the lake water. Swim at your own risk. For more information <website> Green sign: There is no notice posted now. Yellow sign: Precaution. Notice of Water Quality. Increased risk of disease in recent days based on recent analysis of the bacteria E. Coli. Red Sign: Beach Closed. Do not enter the water. High risk of disease likely.	Spanish	✓					✓		Sign does not convey current information on its own, only in conjunction with other signs

LOCATION	SIGN	TEXT	LANGUAGE	IMAGES	EXPLAINS REASON FOR CLOSURE OR SOURCE OF CONTAMINATION	EXPLAINS CONSEQUENCES OF EXPOSURE	EXPLAINS SPECIFIC ACTIVITIES THAT MAY NOT BE SAFE	MENTIONS AGENCY RESPONSIBLE	URL	PHONE	NOTES
RI		Beach Monitoring Program NO SWIMMING (No Se Permite Nadar) Per order of the Rhode Island Dept. of Health, Beach Closure Hotline <phone> <website>	English and Spanish				✓	✓	✓	✓	Does not say if all water contact should be avoided.
TX		TexasBeachWatch.com Check beach conditions online.	English		N/A		N/A	✓	✓		Does not provide information about current conditions
TX		(In English and Spanish) WARNING! Contact with Water may cause Illness. Bacteria levels exceed health standards. Check beach conditions online <website>	English and Spanish	✓	✓	✓ (to a limited degree)			✓		

LOCATION	SIGN	TEXT	LANGUAGE	IMAGES	EXPLAINS REASON FOR CLOSURE OR SOURCE OF CONTAMINATION	EXPLAINS CONSEQUENCES OF EXPOSURE	EXPLAINS SPECIFIC ACTIVITIES THAT MAY NOT BE SAFE	MENTIONS AGENCY RESPONSIBLE	URL	PHONE	NOTES
WA		SWIMMING BEACH WATER QUALITY. This beach is being monitored as part of a state-wide program to ensure conditions meet EPA guidelines for recreational water activities. Changing conditions will be posted here and on the Web. Please refer to this beach area as : _____ <phone> <website>	English	✓	N/A		N/A	✓	✓	✓	Briefly describes program, but does not explicitly say that water quality is currently good. Picture on the bottom takes up space but does not convey information.
WA		CAUTION: No Swimming, no wading. A health advisory has been posted based on monitoring results. The current conditions at this beach are not suitable for recreational water activities. Small children and chronically ill people are at higher risk for increased illness. Please refer to this beach area as : _____ <phone> <website> SHELLFISHING NOT ADVISED	English, Spanish, Vietnamese and a fourth un-identified language	✓	✓	✓ (to a limited degree)	✓	✓	✓	✓	Mentions specific populations at risk. Picture on the bottom takes up space but does not convey information.
WA		CLOSED: No swimming, no wading. Water contaminated! Stay out of the water. Health Officer:_____ Health Jurisdiction: ____ Phone: _____ Shellfishing not advised. Please refer to this beach area as : _____	English, Spanish, Vietnamese and a fourth un-identified language	✓			✓	✓		✓	Picture on the bottom takes up space but does not convey information.

LOCATION	SIGN	TEXT	LANGUAGE	IMAGES	EXPLAINS REASON FOR CLOSURE OR SOURCE OF CONTAMINATION	EXPLAINS CONSEQUENCES OF EXPOSURE	EXPLAINS SPECIFIC ACTIVITIES THAT MAY NOT BE SAFE	MENTIONS AGENCY RESPONSIBLE	URL	PHONE	NOTES
Orange County, CA		(In English and Spanish) WARNING! Runoff/storm drain water may cause illness. Avoid contact with ponded or flowing runoff and the area where runoff enters the ocean. Orange County Environmental Health Division. For more information call <phone> <website>	English and Spanish	✓	✓	✓ (to a limited degree)		✓	✓	✓	
Orange County, CA		(In English and Spanish) WARNING Ocean water contact may cause illness, bacteria levels exceed health standards. Orange County Environmental Health Division. For more information call <phone> <website>	English and Spanish	✓	✓	✓ (to a limited degree)		✓	✓	✓	

LOCATION	SIGN	TEXT	LANGUAGE	IMAGES	EXPLAINS REASON FOR CLOSURE OR SOURCE OF CONTAMINATION	EXPLAINS CONSEQUENCES OF EXPOSURE	EXPLAINS SPECIFIC ACTIVITIES THAT MAY NOT BE SAFE	MENTIONS AGENCY RESPONSIBLE	URL	PHONE	NOTES
Orange County, CA		KEEP OUT Sewage contaminated water. Ocean water may cause illness. By order of the Health Officer, County of Orange. For more information call <phone> <website>	English	✓	✓	✓ (to a limited degree)		✓	✓	✓	Specifies contamination source
Anne Arundel County, MD		CLOSED No swimming due to a sewage spill (Cerrado – No Se Puede Nadar) The Department of Health has ordered an emergency closing and warns against swimming, water skiing, and other direct water contact in the area of: _____ This area will be reopened once water quality conditions are found acceptable. Date posted: ____ For water quality information: <website> <phone> <hotline>	English and Spanish	✓	✓		✓	✓	✓	✓	Provides place to enter specific area affected. Specifies date posted and when area will be reopened.
		COUNT	**12**	**9**	**9**	**9**	**9**	**9**	**7**	**12**	

Several states have changed the size, locations, and design of their signs in an effort to make them more effective. For example, Indiana moved the locations of its signs to more prominent sites at the entrance of the beach rather than placing the signs in general information kiosks, after finding out that beachgoers often did not see the signs at the kiosks. Indiana's new signs also have redesigned content based on the example of signs in Wisconsin, and are intended to provide more information on how to minimize risks. Indiana assessed the effectiveness of the new signs through a pilot test in Ogden Dunes. When asked to comment on new signs being tested, survey respondents suggested using larger signs placed at more prominent locations (64% of respondents); changing the color to a more intuitive green/yellow/red scale (10%); and more clearly distinguishing the reason for the advisory (e.g., riptide vs. fecal contamination) (10%). While respondents preferred signs with shapes or colors and fewer words to communicate the critical information, they also expressed their concern that the public often does not understand the risk and needs to be better informed about how testing is done, what results mean, and the consequences of not heeding the warning. This dichotomy highlights the key challenge faced by beach managers in using signs to communicate risk.

Florida also redesigned its signs, and made them more durable. The old signs Florida used were 8.5"x11" pieces of paper in a plastic protector, and thus were not durable. The signs were not posted in a designated location, and because of their size and location, it was hard for beachgoers to find them. Florida developed its new signs based on EPA guidance and the experience of surrounding states (Georgia and Alabama). The new signs are durable, 36"x16.5" in size, and are posted at the main entry points of beaches.

Hawaii has also changed its beach signs in recent years to make them more durable. Previously, signs were temporary and made of cardboard, but now they are made of metal. The signs are 18" x 24" in size, and are posted near streams and sources of contamination.

Rhode Island replaced the flags that it previously used with signs, after determining that the water quality flags were confusing because they could contradict flags used for other purposes (e.g., surf conditions, rip tides, jellyfish).

In Texas, the Beach Watch program staff felt that the previous signs were not working, since beachgoers were still swimming in the water when the signs were posted. Therefore, the state developed new signs, with different colors, Spanish language translation, and an icon (Exhibit 11). The Beach Watch program says the extent to which the new signs are more effective is unclear. Texas is also working to ensure that signs are not posted once the beach advisory is no longer active, so that the signs provide more timely information than in the past.

EXHIBIT 11. IMPROVEMENTS IN TEXAS BEACH WATCH SIGNS

Previous Advisory Sign

Current Advisory Sign

Websites

All of the states interviewed for this evaluation use websites to convey and explain water quality data to the public. State websites vary in their approaches to providing water quality information and notifications of beach advisories/closures. The information provided ranges from actual water quality testing results to simple updates of beach status (e.g., list of beaches under advisory). Hawaii, Maryland, New Jersey, Rhode Island, and Texas pair notification information with other indicators of beach conditions that are thought to be of interest to beachgoers (e.g., surf conditions and algal blooms). Indiana and Washington have begun implementing ways to reach the public via social networks and mobile applications, and both states provide a link to these media on their program websites. Many of the states interviewed, including Indiana, Massachusetts, Texas and Washington, have set up automated notification procedures, whereby the government or private laboratories that conduct testing enter their results into a system which automatically notifies local contacts and updates the website.[30] Several local beach programs (Chicago, Galveston, Anne Arundel and Barnstable County) maintain their own websites, in addition to receiving or feeding information from and to their respective state beach program's website.

[30] As this was not a specific question in the interview protocol, we do not have data on these types of systems for every state interviewed; however, several interviewees volunteered this information when describing the main features of their beach notification programs.

This evaluation reviewed websites for nine states, seven localities, and three NGOs that provide beach water quality information to identify features of these sites that inform the public. The most common approaches to conveying health risk on websites include: 1) describing the risk qualitatively, 2) categorizing the health risks due to contamination as low, moderate, or high (or some other similar scheme), or 3) comparing the contamination levels to the standard set for bacterial levels. In addition to providing current information on beach advisories and closures, some websites provide information about beach water quality trends and historic data about beach advisories to help the public select suitable beaches.

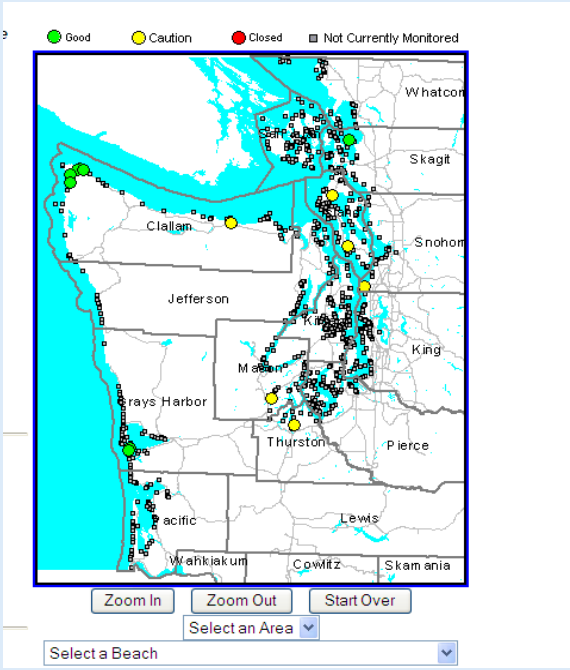
Almost all websites reviewed present the results of their sampling and monitoring efforts, whether as numerical results or as a classification on a scale. The vast majority of sites also list closures and advisories, either as a list of beaches that currently present health risks or as part of the information provided for each individual beach monitored. Many sites use maps to at least indicate the location of the beach itself; some also show the specific sampling locations or store and report water quality data directly on the map.

Some websites contain links to forms or instructions for reporting a beach-related illness. Others provide annual reports so a user can obtain more in-depth information about the beach monitoring program. Many sites also include fact sheets, FAQs, or pages with information and tips about staying healthy and safe at the beach, or provide links to external sites for additional information.

The accessibility of websites through search engines varies. Some, but not all, of the sites reviewed were in the top returns for a Google search on "beach closures" or "beach water quality" and the name of the state.

Appendix E identifies relevant features of the specific state and local websites. The text box below summarizes features that may be relatively effective, based on information we gathered about improvements states have made to their websites, considerations mentioned in the risk literature summarized in Chapter 3, and requirements from the EPA guidance.

MANY BEACH WEBSITES PROVIDE INTERACTIVE MAPPING TOOLS



GOOD PRACTICES FOR BEACH PROGRAM WEB SITES

Based on a review of selected websites, and informed by other information gathered during this evaluation, the following features appear useful.

- Summary information available, on the program home page or through a clearly identifiable link on the home page. Summary information should include the status of each beach (selected from a list or map) or a list of all beaches under advisory.
- Ability to search for current status and history for a particular beach of interest.
- Clear indication of the implication of the testing results (e.g., beach open, closed, or under advisory), ideally communicated through text and color coding
- Information about the day the beach was last sampled and frequency of monitoring.
- An explanation for the cause of any advisories and testing methods.
- Information about health consequences to beach users and advice on the activities that may be unsafe.
- Simple, direct language, translated into languages relevant to key audiences
- Links to other sources where beach users can obtain additional information (phone number, email, fact sheets, EPA web site, etc.)
- Information about beaches other than water quality (e.g., weather and beach amenities) to draw visitors to the beach website

Other Notification Methods

Several states and local beach managers have embraced social media as a means of communicating water quality issues with the beachgoing public and expanding the reach of traditional notification methods. Some beach notification websites reviewed in the previous section include options to sign up for RSS feeds, e-mail alerts, Twitter or other social networking updates, or provide syndication in order to disseminate real time information. For example, the state of Washington uses Facebook and Twitter, building on a broader social media initiative by the Department of Ecology. In Orange County, California, local NGOs Surf Rider and Heal the Bay "retweet" the County health department's tweets on beach advisories, expanding the reach of this information from the 107 groups or individuals who directly follow the health department tweets, to their several thousand followers. The Chicago Park District posts advisories on Facebook and Twitter, and offers a texting service

that allows people to receive messages about the status of a given beach or all beaches (see Case Study A for more detail). In Maryland, Anne Arundel County's notification program features Twitter posts and e-alerts, along with more traditional notification methods.

A number of states issue press releases to local newspapers, television stations, and radio stations that report on beach closures. In some cases this media coverage can inform the public about where to get regular updates on beach advisories, and can lead the public to check state beach websites for beach updates. Several states noted that they include local media outlets (radio stations, newspapers) or local businesses (hotels, Chamber of Commerce) in their notification e-mail list, along with other interested stakeholders. State staff field media requests as needed. The State of Washington includes issuing a press release as part of its standard procedure for notifying the public in the event of an advisory. For other states interviewed, media reports generally occur for selected closures of particular local interest (e.g., closure of a highly frequented beach such as Miami Beach, Florida) or extended duration, when they are picked up by local media.

MEDIA COVERAGE CAN RAISE PUBLIC AWARENESS OF BEACH ADVISORIES AND DRIVE TRAFFIC TO STATE WEBSITES

Example item in local newspaper:

"Fort Adams beach closed to swimmers:
Fort Adams State Park in Newport brings to four the number of areas closed to swimming because of high bacteria counts, the state Department of Health said Wednesday. Bristol Town Beach, Goddard Memorial State Park and Gorton Pond Beach, both in Warwick, have been closed to swimmers since Tuesday. Health officials will continue to monitor water quality and reopen the beaches when they are safe for swimming. Beach closings and advisories are posted on the Health Department Website:
http://www.ribeaches.org/closures.cfm. For recorded information, call (401) 222 – 2751."
The Providence Journal, June 25, 2009, Section B.3

In addition to notifying the public about discrete advisories, several states (e.g., Indiana, Massachusetts, Rhode Island, and Texas) and local beach managers (e.g., Chicago Park District, Ogden Dunes, and Anne Arundel) highlighted their general outreach and education efforts to raise public awareness of water quality issues at beaches and enhance the reach of notifications. For example, Texas invested in a substantial outreach campaign, including developing promotional items (e.g., t-shirts, cups, hats, and bags to hand out at public events), a 60,000-piece mailing to central and coastal counties about the beach watch website and beach conditions report, and purchasing advertisements on television and radio. Rhode Island also emphasizes outreach, e.g., by establishing relationships with the media, sending out targeted press releases to ensure coverage of notifications on local news channels and in newspapers, participating in interviews with local television stations a couple of times each year, and hosting a "Bay Day" where beaches are free and the state provides a booth with educational materials. Anne Arundel County, Maryland, not only issues press releases to local media about specific advisories, but also sponsors general outreach events, and partners with local neighborhood associations to distribute educational materials to residents door-to-door.

Some states also conduct trainings for local beach managers about monitoring and notification issues. For example, Massachusetts conducts annual trainings, which include information on how to respond if the public asks about water quality. Rhode Island also has meetings with lifeguards, beach owners, and managers at the start of each season to instruct them on how to explain beach advisories to the public when beaches are closed.

CASE STUDY A: CHICAGO PARK DISTRICT USES NEW MEDIA TOOLS TO NOTIFY PUBLIC OF BEACH WATER QUALITY CONDITIONS

The Chicago Park District (CPD) is responsible for managing 31 beaches in the Chicago area, which receive an average of 20 million visitors each summer. The vast majority of these visitors are local (i.e., residents of the City of Chicago or of Cook County) and visit a beach on average once a week; more than half of visitors come to the beach to swim.[31]

Beaches are open for swimming from Memorial Day through Labor Day. Swimming is permitted when lifeguards are on duty, generally from 11AM through 7PM, except when swimming is prohibited due to water conditions. The District uses a two-level notification system whereby it issues an advisory when *E. coli* levels are between 235 and 1,000 cfu per 100 ml, and bans swimming completely when *E. coli* levels exceed 1,000 cfu per 100 ml. [32] Lifeguards strictly enforce swim bans, although beaches remain open to land-based activities.

Notification Methods Used

- Beach flags (green/yellow/red)
- Telephone hotline (English and Spanish)
- Web site
- Facebook
- Twitter
- Texting service
- Park-and-display messages

In 2009, the most recent year for which data were available from EPA, CPD issued contamination advisories on 103 days, and swim bans on 75 additional days. Advisories or swim bans affected 19 of the 31 beaches managed by CPD.

Notification Methods

CPD is somewhat unusual in the broad range of notification methods it uses to alert beachgoers to advisories and swim bans. First, CPD uses colored **flags** to notify the public of water quality and weather-related beach conditions, with green indicating no issue reported, yellow indicating that a swim advisory is in effect (swimming with caution); and red indicating that swimming is prohibited due to severe weather or water conditions that may be hazardous. A sign at the beach explains the

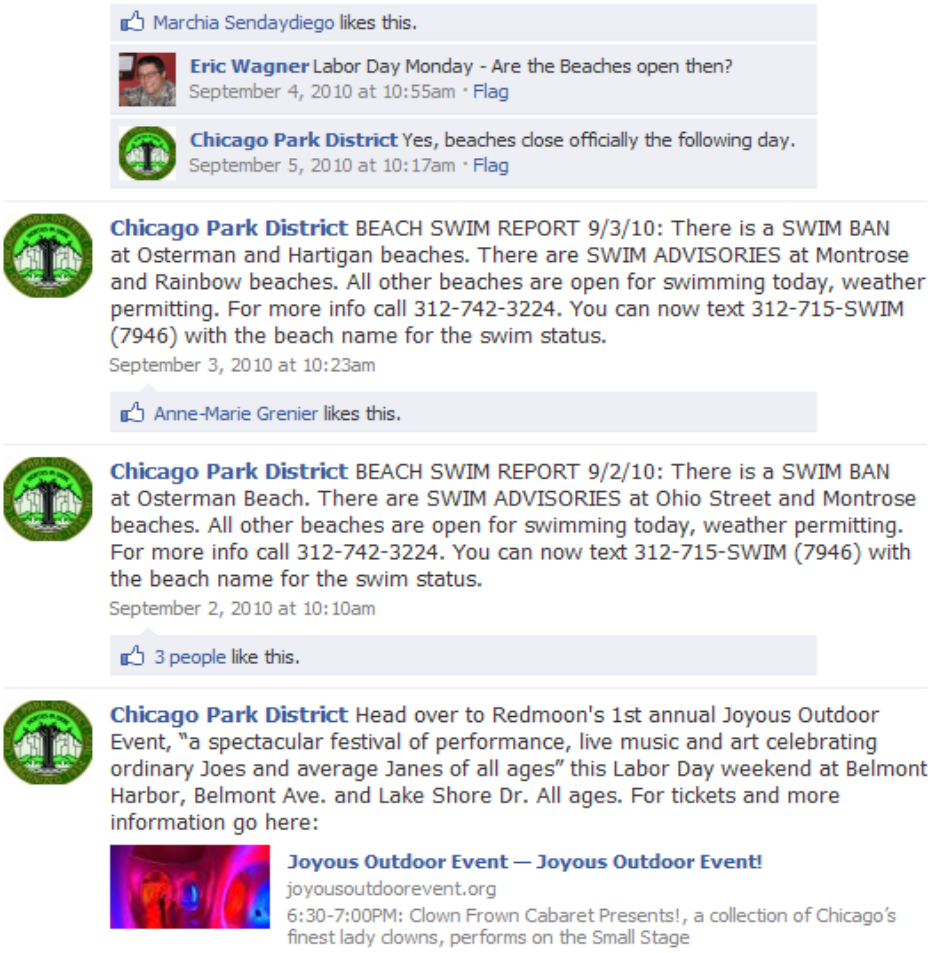
[31] A survey of 1,573 respondents at eight Chicago beaches conducted in 2004 indicated that the vast majority of beachgoers were residents of City of Chicago or of Cook County. Beachgoers generally traveled less than 3 miles to the beach, visited on average once a week, and over half came to the beach to swim (Shaik and Tolley, 2006). The study estimated at $35 (in 2004$) per individual the value of a beach day in Chicago.

[32] The notification protocol changed in 2006 from issuing a closure upon two consecutive days of exceeding the standard, to one day.

meaning of the flag color. The CPD **website** provides general visitor information, current beach status, and more detailed information explaining the flag system and health risks.

In addition, CPD has enhanced its outreach in recent years by implementing new social media tools to publicize beach information. In 2009, the District launched **Facebook and Twitter** pages. Exhibit A-1 shows a sample of Facebook postings for September 2010. The CPD Facebook wall provides daily beach status updates ("Beach Swim Report"), posts announcements for events at beaches, and allows the public to interact with CPD staff by asking questions or communicating their likes and dislikes. The interactive nature of the Facebook site seems to be well received by the public, judging from the amount of back-and-forth displayed on the wall on an ongoing basis.

EXHIBIT A-1: EXCERPT FROM CPD FACEBOOK WALL



In 2010, CPD launched a new **texting service** that allows users to receive beach notification messages (similar to the Beach Swim Report) about one specific beach, or for all 31 beaches managed by the District.

Finally, to reach beach users who may otherwise miss or not have access to the various notification methods, CPD posts also beach status at the entrance to the beach, using **park-and-display service boxes**. While admission to the beaches is free, parking at many beaches is not, and CPD advises beachgoers whether swimming is allowed before they make their parking payment.

Reach and effectiveness

The CPD has received considerable media attention for its use of novel approaches to reach the public. The use of Facebook and Twitter and the more recent launch of the texting service all received wide coverage in Chicago media, with several local and regional newspapers (e.g., Chicago Tribune) and TV stations (e.g., NBC) featuring stories that were later picked up by other media. This media coverage may have helped raise awareness of the program. Another potential factor influencing public interest in the social media tools is the combination of information CPD communicates. For example, the fact that CPD continues to post cultural events of interest to the public on its Facebook page during winter months when beaches are closed may encourage people to continue to receive or sign up for the updates. As of January 2011, the District had over 4,000 Facebook friends and nearly 2,000 Twitter followers. Between the period of June 7, 2010, when the service was launched, and the end of the swimming season in September, about 15,000 text messages had been delivered to beachgoers, upon their request. About as many people (12,000 to 15,000) visit the CPD website on a weekly basis. CPD has not gathered information to assess the effect of these notifications have had on the beachgoing public, and whether the new notification methods have led to a better understanding of beach advisories or changes in behavior based on advisories. (Beachgoers do generally follow swimming bans, since lifeguards strictly enforced them.) However, CPD's combination of notification approaches is among the most comprehensive reviewed in this evaluation.[33]

Future Enhancements to Notification

CPD is planning further enhancements to its notification program, including improvements to the beach flag system to increase public understanding of the risks. This could involve, for example, using multi-lingual signage[34] and emphasizing symbols rather than text. The CPD is currently planning focus groups to assess the effectiveness of different signs. The results of the focus groups will be used to develop new beach advisory signs to be deployed prior to the start of the 2011 swimming season.

CPD is making these efforts to improve the notification aspect of its program in parallel with a push to improve the timeliness of the notifications (e.g., by developing computer models that can predict fecal indicator bacteria density based on weather and other real-time data) and to control sources of pathogen contaminations, such as waterfowl or stormwater runoff.

Sources of information for this case study: Unless otherwise cited, information comes from Cathy Breitenbach, personal communication and Chicago Park District website (http://www.chicagoparkdistrict.com/resources/beaches/).

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33 The only other jurisdiction reviewed in this evaluation that uses as many different types of notification methods as CPD is Orange County, California.

34 CPD's beachgoing population includes not only English and Spanish speakers, but also people whose first language is Chinese or Polish.

4.1.3 Reasons for Selecting Specific Notification Methods

This section describes findings associated with the following research questions:

A.3 What factors influence local officials to choose one method of notification vs. another (e.g., funding, program history)?

States and localities interviewed for this evaluation have gradually refined and improved the notification methods they use, adding new notification methods over time as new technology becomes available. In some cases, changes in notification methods have been prompted by changes in agency or organization communication strategies. For example, Washington State's move to social media (Facebook or Twitter) emerged from a broader strategy by the state government to embrace social media and provide more information to its citizens in real-time. States have also refined their notification methods as grant funding became available (e.g., to purchase new signs), and based on the experience of surrounding states.

Several interviewees specifically mentioned the characteristics of their target audience as factors in selecting notification methods, a key factor in effective risk communication. For example, Ogden Dunes is primarily used by local residents, and therefore local beach managers believe the annual community newsletter is an effective way to remind beachgoers about water quality issues and potential risks. Likewise, the Makah Tribe uses communication methods that members of the local community are already familiar with, e.g., bulletin boards posters, flyers, as well as a community intranet website that links to the State of Washington's website. Beach managers in American Samoa primarily use newspapers and other conventional media to inform the public, noting that the small size of the island makes these methods effective. Several of the local beach managers we interviewed whose beaches are popular with outside visitors and tourists (Galveston County Health District, Barnstable County, Monmouth County, Makah Tribe[35]) noted that their website (or the state's program website) is an important medium to ensure that tourists can get water quality information prior to their visit. The primary language of tourists, as well as residents, can be an important factor in designing beach signs. For example, in Maryland, Anne Arundel County's largest beach frequently attracts a high proportion of tourists who may not read English, and for this reason beach managers use symbol-based signs that visitors can understand regardless of their native language. Some beach managers also consider beachgoer demographics when selecting notification methods. For example, Chicago Park District beach managers sought to reach out to younger beach users by implementing their text message service. Indiana state contacts similarly noted that their interest in texting or SmartPhone applications as a means of better reaching younger beach users.

In some cases, beach managers have wanted to implement certain notification methods, but have lacked technical capacity, staff, or funding. For example, several states expressed interest in exploring mobile applications to reach younger audiences, but doubted that they

[35] Makah Tribe beaches are popular both with tourists as well as tribal community members.

would have the funding to implement the approaches. Other states have set aside plans for website upgrades or telephone hotlines due to lack of funding.

4.2 WHICH NOTIFICATION METHODS ARE MOST EFFECTIVE IN REACHING THE PUBLIC

This section describes findings associated with the following research questions:

B.1 How do beachgoers learn of beach advisories or closings?

B.2 What is the estimated audience reached by each method?

B.3 Do the notification methods differ in terms of the types of audiences they are reaching?

States and localities interviewed had relatively little data on how beachgoers learn of advisories or closures. However, a few beach programs have conducted surveys that touch on this issue. For example, Texas conducted a telephone survey in May 2008 of visitors to the Texas Gulf Coast in order to measure awareness of the Texas General Land Office's Beach Watch Program. The survey was intended as a baseline study, before more recent improvements to the Beach Watch program. When asked how the Texas Beach Watch program can best communicate information about water quality at Texas recreational beaches, television was the most popular response (cited by 36 % of respondents), followed by signs at the beach (21%), or a website (14%) (Penn, Schoen & Berland Associates, 2008). Orange County, California, has conducted two surveys of beachgoers to determine how beachgoers learn of advisories: the first survey, conducted in 2001, was an in-person survey of 372 visitors at local beaches. The survey found that both residents and non-residents were more likely to be aware of beach signs than any other source of water quality information. Fifty-five percent of residents were aware of beach signs, vs. 17 – 31% aware of other sources; 35% of non-residents were aware of beach signs vs. 15-18% aware of other sources. A minority of respondents (15%) had checked the water quality of the beach they were planning to visit before they arrived; of those that did, the most common sources of information for residents were two surfer websites. Forty-one percent of residents went to surfline.com and 32% went to surfider.com. Non-residents were equally likely to check the Environmental Health Hotline (50%) and surfline.com (50%) (Adams and Co., 2001). A more recent survey of beachgoers, designed to assess the extent to which beach users were aware of electronic signs, found that in addition to these electronic signs, between 31 – 41% of beachgoers found out about ocean water quality from the Internet, newspaper, or television (personal communication Orange County Health Care Agency, see Case Study B for more detail). Overall, the data gathered from Texas and Orange County suggest that beach signs, the Internet, and television may be the most common sources beachgoers use to learn of beach advisories or closings.

None of the states interviewed had complete data on the estimated audience reached by each notification method. It is particularly difficult to track awareness of signs and information provided through the general media (e.g., press releases). However, some beach managers

have tracked the number of visitors to state websites and followers on social media sites, as described below:

- **Website traffic:** Texas has records of visitors and hits to their website for the 2009 and 2010 seasons, with 23,401 hits to their website in 2009 and 17,791 in the first eight months of 2010, averaging 84 hits per day. [36] This number is relatively small, when considered in the context that Texas had nearly 50 million swimming visits to coastal beaches in 2009. This translates roughly into one website hit for every 2,100 visitors. Chicago Park District's (CPD's) website receives about 12,000 to 15,000 hits per week (less than 200,000 per season), and the beaches receive 10 to 20 million visitors per season. This translates roughly into one website hit for every 50 to 100 visitors. Even accounting for the fact that visitors traveling together may share the information they sought on the websites, these websites reach only a fraction of beach visitors. Other localities track website traffic, but do not have beach visitation data. For example, Anne Arundel county counted over 7,000 visitors to their homepage, 3,500 visitors to the factsheet subpage, 3,150 visitors to the advisory page, and over 600 visitors to the Spanish-translated homepage.
- **Social media:** Anne Arundel's notification program features Twitter posts with about 2,700 subscribers while the Chicago Park District (CPD)'s Facebook and Twitter pages have over 4,000 and 2,000 friends or followers, respectively. The texting service put in place by CPD responds to an estimated 15,000 text message requests per season. While these numbers are still small as compared to the number of people who visit the websites, and represent only a small fraction of total beach visits, to the extent that they reach different audiences or provide information in a more convenient manner, they still offer a means of increasing the reach of notifications.

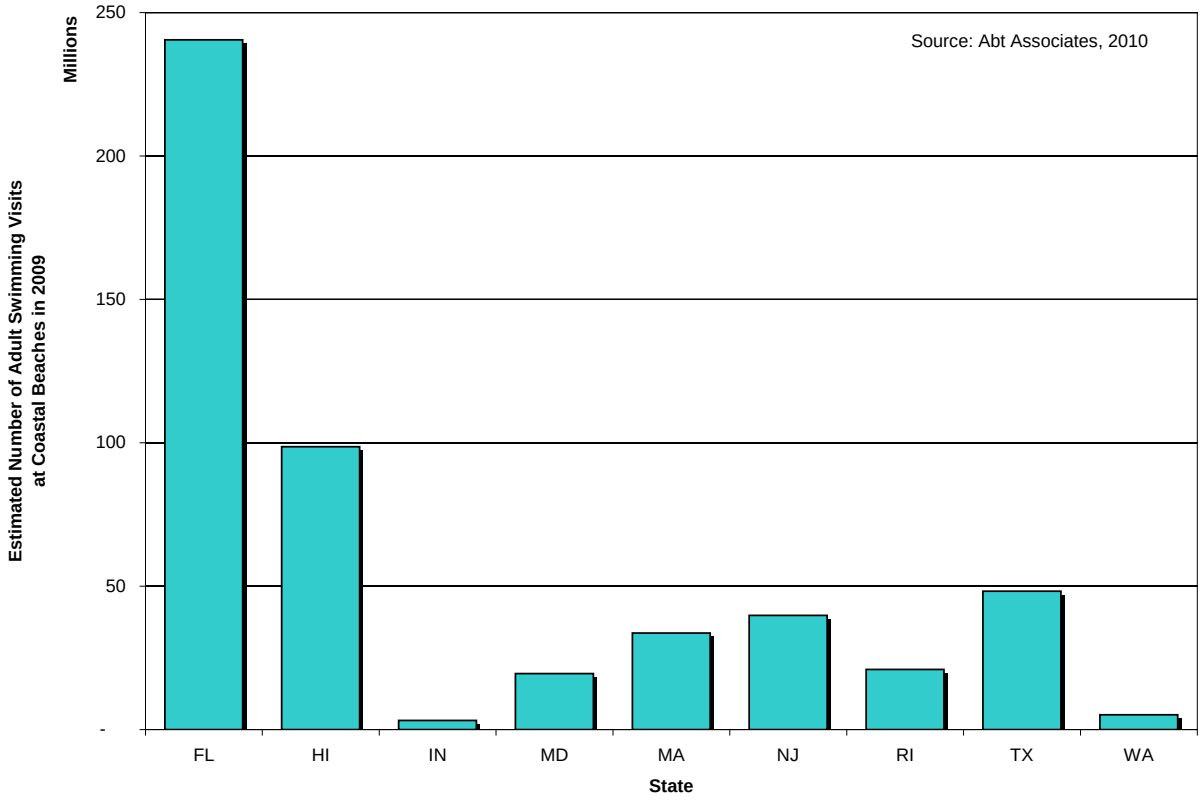
When considering the audience that notification methods reach, it is important to note that the total target audience for beach notifications can be very large. Exhibit 12 presents state-wide statistics of swimming visits by adults to coastal beaches for 2009, as projected based on the 2000 National Survey of Recreation and the Environment (Interagency National Survey Consortium, 2000 – 2002) and Austin et al. (2007). Together, the nine states interviewed for this evaluation received over 500 million visits by adult swimmers in 2009. These statistics represent the estimated number of adult visits to coastal beaches in 2009 by state where the visit occurred.[37] Given the size of the target audience for the communication, and limited resources available for the notification program, states have attempted to make the information as broadly available as possible at minimal cost (e.g., through posting

[36] Statistics are missing for October 2009 and for the last four months of 2010.

[37] Individuals may visit beaches multiple times, however, and therefore the number of individuals who swam at least once in a coastal beach is lower. The relative distribution of individuals to visit beaches by state is similar to the chart in Exhibit 13: Florida has the highest rate of swimming participation with 14.5 million adults. Estimates were derived from data from Leeworthy (2005) for Ocean beaches and CGLI (2007) for Great Lakes beaches, as described in Abt Associates (2010).

information online). At the same time, beach managers interviewed also strive to ensure that beachgoers have access to information at the beach, since many visitors do not check water quality when planning their visits.

EXHIBIT 12. ESTIMATED NUMBER OF SWIMMING VISITS AT COASTAL BEACHES IN 2009, BY STATE



Most state and local representatives interviewed expressed the opinion that a combination of notification approaches is necessary in order to reach beachgoers when they are planning a visit, as well as when they are onsite at the beach. Some notification approaches require visitors to actively seek out information (e.g., website and e-mail alerts), while others (e.g., media reports and signs) do not. These characteristics are summarized in Exhibit 13. Moreover, some notification methods can provide detailed information while others can only summarize the advisory status. For example, websites can complement signs by providing interested members of the public detailed information about advisories and context regarding the risks associated with contaminated waters. Social media can serve as an add-on to the information provided on websites and can provide mobile access to advisory information. Lifeguards can also play a role in ensuring the public is aware of beach advisories and closures (e.g., by enforcing swimming bans or answering questions about what a posting means), but lifeguards' first priority must be public safety.

EXHIBIT 13. BEACH NOTIFICATION CHARACTERISTICS

AVAILABILITY	REACH THE GENERAL PUBLIC	BEACHGOERS NEED TO SEEK OUT/REQUEST INFORMATION OR SPECIFICALLY INDICATE THEIR INTEREST
Available prior to visiting the beach	Media reports (may be prompted by press releases, websites, and ongoing outreach to/education of the media)	Websites E-mails Hotlines Text messages and mobile applications Social networking sites (e.g., Facebook, Twitter)
Available at the beach	Signs or flags Lifeguards Parking notices	Text messages and mobile applications Hotlines

Different notification methods do appear to vary in their ability to reach various subgroups of beachgoers. State beach coordinators interviewed generally thought that media reports are more effective than other methods in reaching older populations, and can be targeted to bilingual and other sub-populations. Several interviewees explained their interest in new media (e.g., texting, Facebook, and Twitter) by noting their popularity with younger adults, in particular. The ability to reach young adults is especially important, since younger adults are more likely to swim than older individuals (Interagency National Survey Consortium, 2000 - 2002).

Overall, states interviewed for this evaluation have divergent perspectives about which notification methods they believe are most effective in reaching beachgoers. Exhibit 14 summarizes the range of interviewee views. States did agree that (1) general outreach in some form is necessary to raise the awareness of beachgoers on water quality issues and about the existence of signs at the beach or of websites; and (2) the various notification methods play a complementary role with one method reinforcing – or raising awareness of – another. For example, Indiana noticed increased traffic on their website after the replacement of beach signs with larger, more visible signs that included a link to their website. The new signs also prompted greater interest in the beach monitoring program overall during public outreach events such as Earth Day.

EXHIBIT 14. NOTIFICATION METHODS STATES PERCEIVED TO BE MOST EFFECTIVE IN REACHING BEACHGOERS.

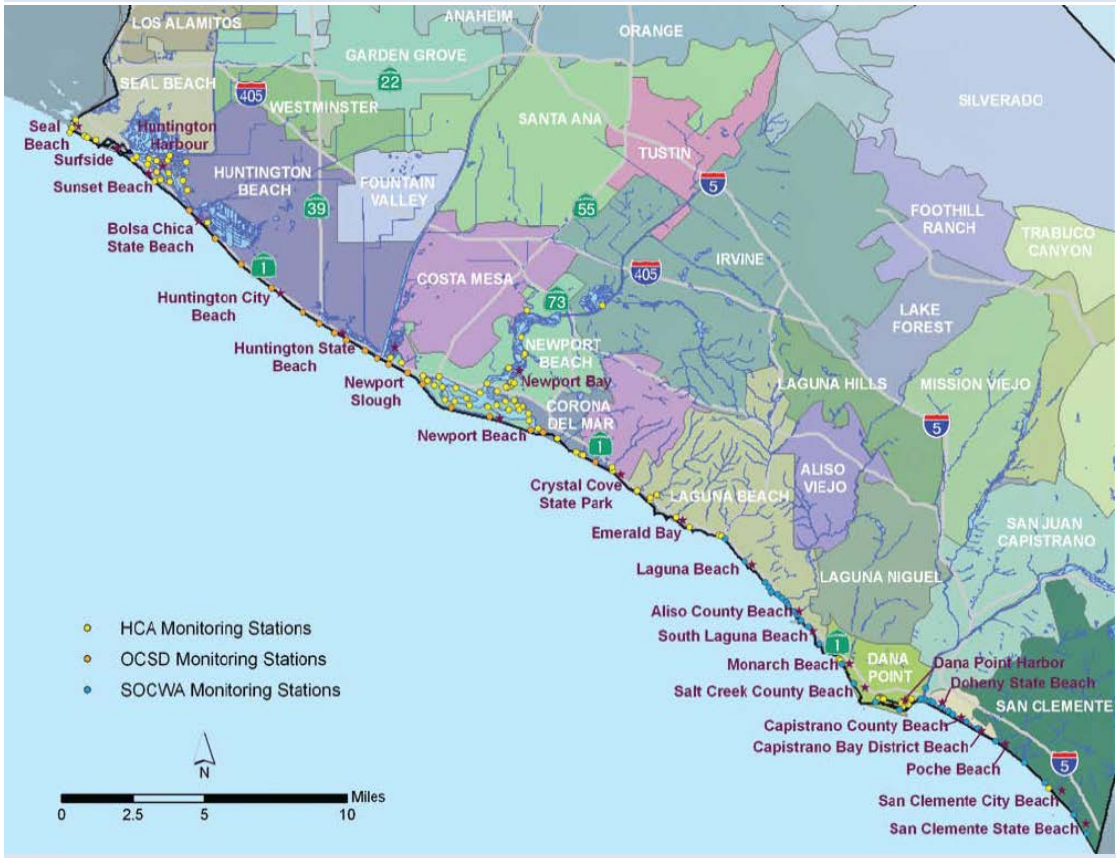
STATE	METHOD(S)
FL	Website, new signs
HI	E-mail is fastest and easiest way, followed by website High-profile Waikiki spill prompted heavy media publicity and raised awareness
IN	Website, new signs
MA	Need broad variety of notification methods (media/TV reports, website, trained lifeguards and signs at the beach)
MD	Signs
NJ	Not sure about the most effective method
RI	Press releases
TX	E-mail
WA	Combination of all methods. Can use social media (e.g., listserv, Facebook) to leverage exposure in traditional media outlets.

CASE STUDY B: ORANGE COUNTY, CALIFORNIA, PILOTS SAME DAY BEACH NOTIFICATION

The County of Orange Health Care Agency (HCA) partners with two wastewater districts (Orange County Sanitation District, OCSD, and South Orange County Wastewater Authority, SOCWA) to monitor the county's 42 miles of open coastline and 70 miles of harbor and bay frontage. The agencies test water samples for bacterial contamination at approximately 150 ocean, harbor and bay monitoring locations. Beaches are sampled at least once per week during the swimming season (April 1 – October 31). Some locations monitored by the wastewater districts are monitored two or five times a week.

When water quality does not meet standards, beach managers may post either warning or closure signs, depending on the extent of water contamination. In the case of a beach closure (e.g., when there has been a sewage leak), visitors may use the beach but are not allowed in the water, and lifeguards enforce this restriction. In the case of a warning, beach managers will post signs that recommend staying out of the water, but visitors are allowed in the water at their own discretion. In addition to warnings and closures, HCA issues beach "advisories" that recommend staying out of the water for three days after rain storms. Such beach advisories are not posted on signs, but are included in the HCA's other notification methods, which include press releases, a telephone hotline, website updates, an e-mail list, and Twitter updates.

EXHIBIT B-1: ORANGE COUNTY BEACH MONITORING STATIONS



Source: 2009 Annual Ocean, Harbor & Bay Water Quality Report County of Orange, California, Health Care Agency, August 2010.

In addition to these ongoing notification methods, HCA has participated in a recent pilot project to test real-time testing and notification methods. Standard water quality monitoring methods require a 24-hour period to culture the bacteria, and therefore typical beach notification methods are at least one day out of date, and can often be up to a week out of date, depending on the frequency of monitoring. In 2010, a collaborative group headed by the Southern California Coastal Water Research Project piloted a demonstration project to test rapid water quality testing methods that could produce results within four hours (by noon on the day that samples were taken). The non-profit foundation MiOcean[38] installed electronic LCD screens at six[39] locations across Orange County. MiOcean allowed Orange County HCA to update the signs remotely based on the rapid testing responses. Each electronic sign had a banner that showed red, yellow, or green to indicate that the beach was closed, there was a warning, or the beach was open. The electronic signs also showed a

[38] http://www.miocean.org/bim.html

[39] Four new signs were installed: two at Newport city beach, one at Huntington state beach, and one at Doheny state beach. In addition, the city of Newport already had two electronic signs prior to the rapid testing pilot project, at Newport Pier and "Big" Corona del Mar beach, which had been installed in late 2009. The signs had previously displayed information on beach "grades" provided by Heal the Bay, another non-governmental advocacy group. These grades were based on beach conditions over the last 30 days, and did not provide "real time" data on beach water quality.

map, indicating the current location and the status of all beaches monitored, as well as weather and surf information, and tips on preventing beach pollution The signs were located at the kiosks where visitors pay parking fees. Parking attendants handed out fliers to explain signs to visitors. The project ran for two months (July and August) in 2010.

EXHIBIT B-2: ELECTRONIC SIGN DISPLAYING REAL-TIME INFORMATION

(Inset shows part of sample display)[40]

Toward the end of the demonstration project, Orange County HCA conducted a survey of beachgoers at Doheny and Huntington beaches, where electronic signs with same day testing information was posted. Over half (54%) of respondents said they noticed the electronic sign regarding the water quality when they entered the beach parking lot. Over half of those who noticed the sign (63%) found the information displayed on the electronic sign helpful and easy to understand. In addition to the electronic signs, survey respondents also reported finding out about conditions of ocean water quality via Internet (41%), newspaper (32%), television (31%), a hotline (14 %), radio (12%), other signs (12%), or the Heal the Bay website (3%). Ten respondents wrote in additional comments indicating that the signs were too small, difficult to read, or poorly placed. For example, one respondent said, "Electronic sign is too small (too much info) to see and understand when driving in." Another respondent commented, "Found it by accident on the bathroom building. Writing was overlapping (difficult to read), also the date wasn't current. Signs are a waste of money. A flag similar to surf reports would be more visible and less costly." While these comments provide important perspectives, they should not overshadow the fact that the majority of respondents did notice the signs, and most of those who did found them helpful.

The pilot project has now concluded, and same day notification is unlikely to continue due to funding limitations. MiOcean continues to use the electronic signs and has resumed providing beach grades provided by Heal the Bay, which provide a summary of beach water quality over the past 30 days.[41]

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[40] http://www.miocean.org/bim.html

[41] For example beach report cards, see http://brc.healthebay.org/?st=CA&f=1

No surveys have assessed the degree to which beachgoers valued having same day beach water quality information, or if members of the public understand the time lags associated with standard beach monitoring. Further research on the value for this notification approach, as well as the costs to implement it, may be warranted.

Sources of information for this case study: Unless otherwise cited, information comes from personal communication with Larry Honeybourne, Orange County HCA. For more information about Orange County's monitoring and notification program, see http://www.ocbeachinfo.com.

4.3 EFFECT OF NOTIFICATIONS ON THE AWARENESS OF BEACHGOERS

This section describes findings associated with the following research question:

> C.1 Does awareness of poor water quality, presence of notifications, or potential health impacts vary by notification method?

While few studies have formally assessed the public's awareness of beach notifications, some states and localities have conducted surveys to assess the effectiveness of their notification methods in raising overall awareness of water quality issues and health risks on the part of beachgoers. These studies vary in their design and the format of the questions, but a number of surveys have found that awareness of beach notifications is generally low (less than half of beachgoers surveyed). In some cases these studies prompted beach managers to improve their notification methods, which resulted in greater public awareness of advisories. Each of the relevant studies is summarized below.

Findings from a survey administered by the Texas General Land Office (TGLO) in 2008, prior to TGLO's targeted campaign to raise awareness of their program, suggest that relatively few respondents (33%) were aware of warning signs placed at the beach and even fewer (24%) were aware of the Texas Beach Watch Program. Of those that were aware of the program, only 6% had ever used the Texas Beach Watch website to check water quality conditions. The majority of respondents (78%) considered themselves to be "concerned" about water quality from a health perspective; however, only 20% actually checked water quality reports before going to the beach. Of those that did check water quality reports, about a third primarily used the Internet, 14% mentioned newspapers, and 14% used the television as their primary information source. Furthermore, coastal residents were more likely to have seen or heard water quality advisories than tourists (Penn, Schoen and Berland Associates, 2008)[42]. TGLO has not conducted a follow-up survey since conducting its outreach campaign to raise awareness of the Texas Beach Watch program, but the state thinks that public awareness has increased in recent years.

Prior to making changes to its beach signage, the Indiana Department of Environmental Protection conducted a survey to determine the awareness of beachgoers to signs in Lake and

[42] The sample of this survey totaled 325 individuals.

Porter County beaches and to flags in La Porte County beaches. Very few respondents (2-8%) were aware of signs, and only slightly more (22%) were aware of the flags. Additionally, very few respondents (3-10%) obtained water quality information before arriving at the beach. When asked whether they preferred flags or signs, the respondents generally preferred the method not used at the beach they frequented; this may follow from the low awareness of the existing method and a belief that the alternative method would fare better. Potentially also for this reason, over 60% of the 350 respondents indicated their preference for a combined warning sign/flag to "cover all the bases." (Environmental Law and Economics Institute (ELEI), 2007).[43] Our interview with Indiana state staff provided some more insight on the potential reasons for the lack of awareness of the old signs – they tended to be small (8 ½" x 11") and posted in locations where they could easily be missed (e.g., often shared a message board or kiosk with other general information about the beach). In 2009, Indiana addressed these problems by adopting new signs, which are now much larger (18" x 24"), use a simple color system, and are located in highly-visible spots at the entrance of each beach. A follow-up online survey administered to Ogden Dunes beachgoers in 2009 to assess the redesigned Indiana sign suggests that the new signs were more successful. The survey revealed that 47% of respondents were highly aware of the blue signs (indicating acceptable water quality for swimming), 39% were aware of the yellow signs (indicating an advisory and potentially unsafe water quality), and 50% were aware of the red sign (indicating a beach closure)[44].

Surveys in Orange County, California, have assessed awareness of water quality information sources. A 2001 survey of 372 beachgoers found that 65% of residents and 45% of non-residents were aware of at least one source of information on water quality, and that the best known source of information was beach signs. This study also found that a minority of respondents (15%) had checked the water quality of the beach they were planning to visit before they arrived (Adams and Co., 2001). This survey also considered use of water quality information (as distinguished from awareness of the information); section 4.5 of this report describes this data. A more recent survey in Orange County found that the majority of respondents (88%) were aware of water quality monitoring efforts at the beach and over half (54%) noticed an electronic sign. As noted in Case Study B, aside from electronic signs, survey respondents also reported finding out about water quality conditions from the Internet (41%), newspaper (32%), television (31%), a hotline (14 %), radio (12%), other signs (12%), or the Heal the Bay website (3%). [45]

Pendleton et al. (2001) found that residents in Los Angeles did have a considerable degree of awareness of beach notifications. Over half[46] of residents surveyed were aware of the

[43] The sample of the survey totaled 172 beachgoers at Lake and Porter County beaches and 178 beachgoers at the La Porte County beach.

[44] The total sample size of this survey was about 50 people and varied depending on the question as some respondents did not answer each question.

[45] The total sample size was not given in this particular survey.

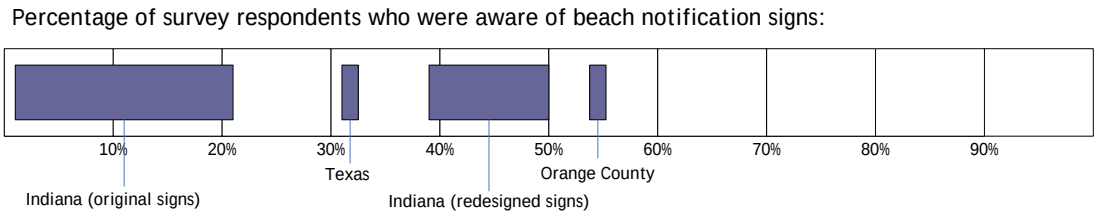
[46] The study authors do not provide an exact percentage.

warning signs about stormwater pollution, 68% had heard of a beach closure within the past year, and 74% had seen or heard a news story about beach water quality concerns, most commonly on the television.

An intercept survey administered to 1,007 beachgoers at the Santa Monica Pier, California, found that only 23% were aware of general water quality issues at the pier and only 5% of residents were aware of Heal the Bay's Beach Report Card, a rating system based on bacteriological data (Heal the Bay, 2008).

Exhibit 15 and Exhibit 16 summarize the survey results described above regarding beachgoer awareness of signs, extent to which beachgoers check water quality information before going to a beach, and the most common sources of beach advisory information, aside from signs.

EXHIBIT 15. SUMMARY OF BEACHGOER AWARENESS OF NOTIFICATIONS



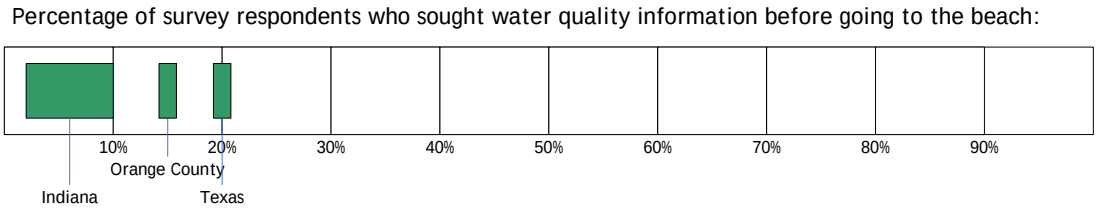
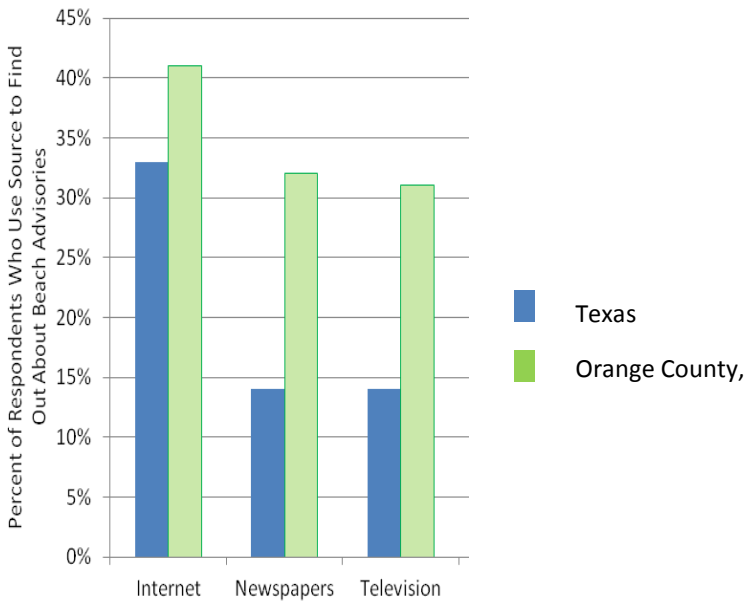


EXHIBIT 16. SOURCES OF BEACH NOTIFICATION INFORMATION, ASIDE FROM SIGNS



Several states interviewed remarked that public awareness of beach advisories has improved over time, due to repeated exposure to media coverage of beach closures or related stories, notifications, and various outreach efforts. Florida, Hawaii, and Indiana observed that beachgoers are asking more detailed questions and displaying a higher base of knowledge about monitoring efforts and risks, highlighting the success that beach monitoring has had in raising overall awareness. These states based their feedback on direct interaction with the public during outreach events. Public feedback on the suite of notification methods is usually "positive."

The sentiment shared by several beach managers interviewed is that beachgoers most aware of beach issues tend to be local residents; more specifically, residents that raise questions and attend outreach events and those that have gotten sick after swimming or know someone who has (Martin and Pendleton, *undated*; Elin Jones, personal communication). Local beach managers and state program contacts mentioned that local residents can often anticipate when water quality is more likely to be good or poor; for example following heavy rainfall, based on their experience with past notifications. In the case of Newport Beach, California, the interviewee noted that local surfers tend to be one of the most aware groups. Several surveys and studies confirm that, compared to visitors, residents have a greater awareness of notification programs and beach water quality concerns. For example, the 2001 Orange County survey found that residents were more aware of beach signs, hotline and webpage, and used these informational sources more frequently than visitors (Adams & Co., 2001). In Texas, coastal residents were more likely to have seen or heard advisories compared to tourists (70% of residents compared to 49% of tourists) (Penn, Schoen and Berland, 2008).

4.4 EFFECT OF NOTIFICATIONS ON THE UNDERSTANDING OF BEACHGOERS

This section describes findings associated with the following research question:

> D.1 Does the public understanding of why to modify behavior and what behaviors are safe vary by notification method?

State beach program coordinators have different opinions about the degree to which the public understands the risks of contact with contaminated water. For example, Rhode Island's perception is that the public generally knows which beaches present a higher risk, while Massachusetts is concerned that there has not been a lot of public education and the public does not understand that health impacts (e.g., stomach aches) may be caused by exposure to contaminated beach water. Similar concerns were expressed by local beach managers regarding the public's understanding of the health risks of exposure to contaminated water. According to local beach coordinators, public understanding of beach water quality issues has improved in recent years as a result of outreach, improved communication (both state and county websites and signs) and media attention on specific high visibility events. This is based on the types of questions that come up during outreach events or when talking to beach users directly (e.g., outreach done by the lifeguards).

None of the states interviewed had direct information to compare differences in public understanding of risk based on different notification methods. However, there are a few recent surveys that have assessed public understanding of beach advisory signs. For example, in 2008 Indiana surveyed a small number of residents in Ogden Dunes and found that most respondents understood the content and message of the color-coded signs.[47] The greatest percentage of respondents found the blue and red signs to be "very understandable" (87% and 84% respectively), while nearly as many respondents (72%) said the yellow sign is "very understandable." (see

Exhibit 17 for a snapshot of each of these signs). Features of these signs that may make them easy to understand include use of a clear red/yellow/green color scale, explanatory text (on the blue sign) that accompanies the indication of current water quality statistics (on the green, yellow, or red signs), simple graphics, and a link to a website for more information. Note the color scale posted with the signs in Spanish (Exhibit 18); this graphic along with the blue water quality notice sign may provide context for the other signs.

47 The online survey of 130 residents of Ogden Dunes had a response rate of 37%. Thus the percentages presented here are based on the opinions of slightly less than 50 people.

EXHIBIT 17. OGDEN DUNES SIGNS

EXHIBIT 18. COMBINATION OF SIGNS IN OGDEN DUNES MAY PROVIDE CONTEXT FOR ADVISORY INFORMATION

As noted in Case Study B, Orange County also evaluated the respondents' comprehension of the electronic signs and found that of the 54% who were aware of the signs, 63% believed the sign was helpful and easy to understand.[48] A study at Santa Monica Pier found that 55% of respondents did not understand the permanent signs containing information on water quality, and 21% of beachgoers did not understand the beach closure signs. To increase understanding, those beachgoers recommended enlarging the signs, including several languages, and making them more visible by increasing the number, improving the placement, and using brighter colors (Heal the Bay, 2008).[49]

4.5 EFFECT OF NOTIFICATIONS ON THE BEHAVIOR OF BEACHGOERS

This section describes findings associated with the following four research questions:

E.1 Are there observable changes (e.g., since 2000) in the number of beach visits or activities beachgoers engage in for beaches subject to advisories or closures?

E.2 How do beachgoers change their behavior when their preferred beach is under an advisory or closure (e.g., by not visiting the beach, visiting a different beach, or avoiding contact with the water)?

E.3 Does beachgoer behavior vary by notification type?

E.4 What other factors, aside from notification methods, may influence public behavior (e.g., beach management characteristics, such as presence of lifeguards or another "official" presence on the beach; beach location characteristics such as number of access points to the beach).

There are limited sources of data that directly address the degree to which beach notifications affect beachgoer behavior. One beachgoer intercept study was conducted in Indiana in conjunction with the Environmental Law and Economics Institute in 2007, *prior to* the design and installation of the state's current signs, shown in Exhibit 17. This study found that very few survey respondents (2-8%) were aware of the beach advisory signs the state used at that time, however, of the beachgoers that were aware of the signs, over half (56%) indicated that the sign did influence their behavior, with about 43% of these respondents deciding not to get in contact with water. A second survey at a different Indiana beach, where flags were posted, found that 23% of respondents indicated that the flag changed their decision of whether to get in contact with water (ELEI, 2007). These findings suggest that flags may not be as effective as signs in influencing behavior. After redesigning its signs, Indiana carried out another survey in 2008 in Ogden Dunes. As noted in Section 4.4 of this report, most respondents understood the redesigned signs, and in addition, the majority of respondents said that the new signage would have an impact on their decision to go swimming. Specifically, 79% of respondents said the blue signs would have a "great impact" on the person's decision to go

48 The sample size for this survey is unknown.

[49] The total sample size of this survey was 1,007 individuals.

swimming at the beach, 78% said the red signs would have a "great impact," and 64% said that the yellow signs would have a "great impact."[50]

As noted in Section 4.3, a survey of 372 beachgoers in Orange County, California, conducted in 2001, found that respondents were most aware of beach signs, compared to other notification methods. This survey also asked about beachgoers' "use" of water quality information. (The term "use" was not defined, however it seems to refer to beachgoers using the information to inform themselves about beach conditions, which may in some cases translate into changes in behavior.) The survey found that the most used source of information on ocean water quality was beach signs, used by 39% of respondent respondents and 20% of non-resident respondents. The least used source of information was the telephone hotline, used by 8% of resident respondents and 5% of non-resident respondents (Adams and Co., 2001).

Aside from conducting surveys of beachgoers, another approach to assess changes in beachgoer behavior in response to beach notifications is to assess changes in beach attendance on days when beach advisories are posted, vs. days when no advisories are posted. Unfortunately, most beach managers interviewed for this evaluation did not have access to beach attendance data. However, the City of Newport Beach, California was able to provide such data, although beach managers cautioned that many factors (e.g., weather, season, and day of the week) affect beach attendance. An analysis of the data suggests a relationship between the water quality status and number of visitors to a beach, controlling for other factors that influence beach visitation. Results of a preliminary analysis using data for one beach over a three-year period are discussed in Case Study C, below. EPA's National Epidemiological and Environmental Assessment of Recreational (NEEAR) Water Study has also collected data on beach attendance, however, the number of observations of beach attendance on days when there were beach advisories was not sufficient to enable the type of analysis presented in Case Study C for other locations around the country.

CASE STUDY C: DATA FROM NEWPORT BEACH, CALIFORNIA, SUGGEST RELATIONSHIP BETWEEN ADVISORIES AND BEACH ATTENDANCE

Lifeguards at Newport Beach, California, are responsible for posting advisories or closures at the beach, using information received from the Orange County Health department, and for enforcing swim bans when a closure is posted. In addition, lifeguards record beach attendance daily.

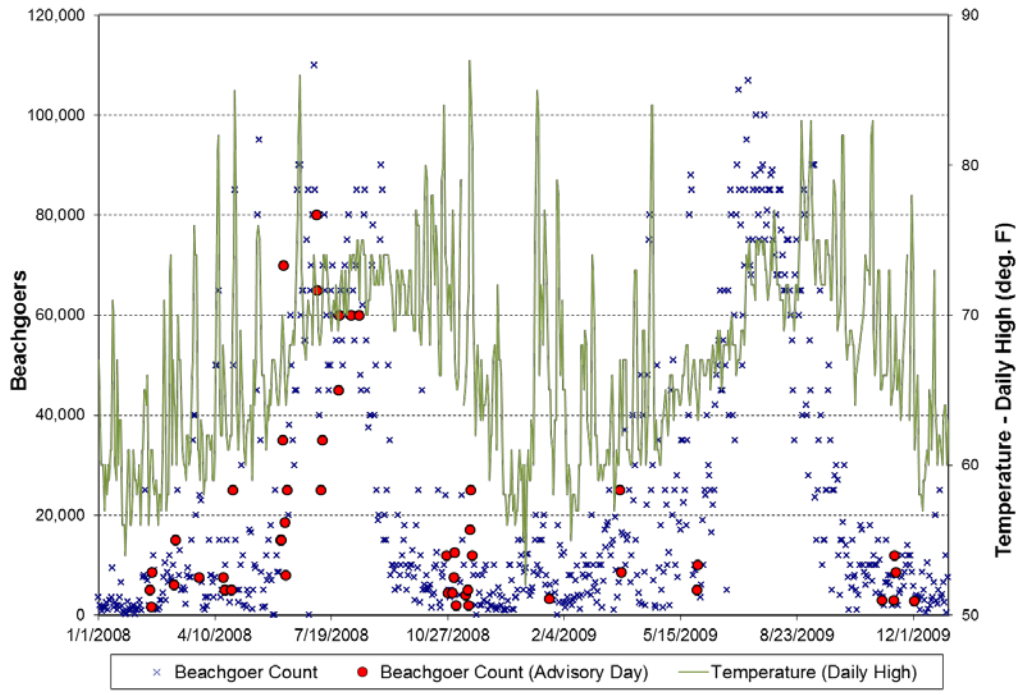
To test the hypothesis that advisories influence the behavior of beachgoers, we analyzed daily attendance records for Newport Beach for 2008 and 2009 to look at whether there was a statistically significant relationship between the number of beach visitors on any given day and the beach status, all else being equal.[51] To do this analysis, we first augmented the attendance data with daily weather

50 As noted above, the survey size for this web-based survey was small, slightly less than 50 residents of Ogden Dunes.

[51] While attendance records were also available for January through October 2010, these data were not included in the analysis as advisory data summaries were not yet available from EPA for 2010.

data obtained from the National Weather Service and advisory data obtained from EPA's PRAWN. Weather (temperature and precipitation), season, and day of the week, were all mentioned by the Newport Beach interviewees as key determinants of beach attendance, along with other less easily quantifiable factors such as sport events or holidays. Exhibit C-1 shows time series of beachgoer counts and maximum daily temperature for the two-year period. Beachgoer counts on days when an advisory was in place are marked using red circles. Beach attendance varies throughout the year following temperature and seasons with summer months showing a greater number of beachgoers, on average, than the winter months. A closer look at the raw data also confirms that attendance depends on precipitation and day of the week, with sunny days and weekend days both generally showing a higher number of visitors.

EXHIBIT C-1: RECORDED TEMPERATURE DAILY HIGH AND NUMBER OF BEACHGOERS ON DAYS WITH AND WITHOUT ADVISORY AT NEWPORT BEACH, CA IN 2008 AND 2009.



To verify these tendencies, we ran a statistical regression on the Newport Beach, California, data. The purpose of the analysis was to determine whether advisories affect recorded attendance, controlling for the multitude of factors that may influence beach visitation rates. The linear regression model relates the daily number of visitors at the beach (*Attendance*) to a set of explanatory variables that includes advisory status (*Advisory*, true/false), the maximum daily temperature (*Temperature*), a precipitation indicator (*Rain*, true/ false), a weekday indicator (*Weekend*, true vs. false), a season indicator (*Summer*, true/false), and several interaction variables

that account for correlation among the explanatory variables.[52] The resulting regression is expressed as follows:

Results show that the model explains 67% of the variation in daily attendance and that the equation is internally valid.[53] All regression coefficients have the expected directional impact on beach attendance and are significant at the 5% confidence level, except for rain which is significant at the 15% level.

The estimated regression confirms that beach attendance increases during summer months (June, July, and August), on weekends, and with higher air temperature. Attendance is approximately 40,200 visits higher during the summer as compared to other months and increases by about 800 visits for each degree increase in the temperature. Further, attendance is on average 11,200 higher on weekends as compared to weekdays. The significant interaction between weekends and season suggests that the difference in attendance between weekends and weekdays is larger during the summer. During summer months, attendance is approximately 20,000 greater on weekends compared to weekdays, while attendance is only 11,000 greater on weekends compared to weekdays during other months.

Of particular interest for this evaluation, the estimated regression suggests that **advisories are associated with significant declines in beach attendance: 5,900 fewer people visit the beach during advisories posted during off-peak months, and 11,000 fewer people visit if the advisory instead occurs during the summer.**

These limited results suggest that a statistically significant relationship may exist between advisories and daily beach attendance when controlling for other factors. It is unknown whether the results for Newport Beach, California, would hold for other beaches that implement their beach notification programs differently. For example, the presence of lifeguards at the beach could reinforce the effect of beach advisories on visitation rates. Moreover, when looking at beach attendance more generally, it is important to keep in mind that changes in beach attendance are not a necessary indicator of adherence to beach advisories.[54] Since individuals may visit the beach and still avoid contact with the water, indication that an advisory did not significantly decrease beach attendance would not necessarily mean that the advisory was not effective; this could be considered to be a positive outcome since it would suggest that advisories result in a smaller reduction in the recreational benefits of beach use, while providing human health benefits to beachgoers.

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[52] Interaction variables include: Summer-Rain; Advisory-Summer; Weekend-Rain; and Weekend-Summer.

[53] The regression was run on a subsample (75%) of the dataset and used to predict the other 25% of observations. Calculated predicted values and actual values had a correlation of approximately .80

[54] This distinction is not as important for Newport Beach since lifeguards enforce swim bans.

Studies from the literature suggest that water quality has an influence on beachgoers' behavior, but that weather and water temperature seem to be more important determinants for many individuals. For example, a survey conducted at Chicago beaches during the summer of 2004 revealed that a large fraction (80%) of the nearly 2,000 respondents were aware of past swimming bans (Shaikh, 2005, unpublished). When the researchers focused on reasons why people decided not to swim at the surveyed beaches, most non-swimmers identified either water temperature or weather as the main driver for their decision to avoid the water (61%). However, a significant subset of respondents (36%) listed concerns over water quality as a factor in their decision.

A 2004 study conducted in Huntington Beach, California 24 hours after a beach closure revealed that a large majority of respondents (83%) was aware of the recent closure, and the same fraction indicated that water quality was an important or very important issue in deciding to come to the beach. Despite this, more than half of respondents felt the water was either safe or very safe to swim in, and 35% thought the risk of becoming ill from swimming was low (the beach closure posting had been lifted at the time the survey was conducted). Furthermore, 84% planned on swimming. Of those that decided not to swim, 41% cited the cold temperature of the water as the main reason not to swim. However, 64% of respondents with children or grandchildren would not allow their children or grandchildren to swim (Turbow et al., 2004).[55] The study authors attributed the public's willingness to swim soon after a beach closure to a high level of public trust in health agency officials to properly decide when beaches should be open or closed. The authors further noted that "beach visitors may equate open beaches with safe swimming water. Alternatively, beach visitors who swam immediately following closures may have been well aware of the risks but not concerned with becoming ill."

An older survey administered in Ohio Lake Erie beaches in 1999 found similar results: beachgoers continued to visit beaches even though there was some awareness of poor water quality or an advisory or closure. In this study, over 70% beachgoers indicated that they have never cancelled a trip because of a beach closure (Murray, 1999).[56] These results suggest that episodic beach advisories and closures may not adversely influence visitation trends or affect beachgoers' decision on whether to swim at a beach in the longer term, once the advisory or closure has been lifted.

Comments about beachgoer behavior from state and local beach managers interviewed for this evaluation were generally consistent with information from existing surveys and literature. Anecdotally, state and local contacts noted that while most beachgoers do abide by the advisories, not all beachgoers adhere to advisories or closures, unless beaches are either physically closed or lifeguards prevent beachgoers from entering the water. The local beach managers we interviewed mentioned that while people are generally better informed about risks now, compared to a few years ago, translating this understanding into behavior changes

[55] The sample size of this survey totaled 204 individuals.

[56] The sample size of this survey totaled 1,587 individuals.

is proving to be a significant challenge. As discussed in Chapter 3, research on how different people respond to risk messages suggests regardless of the risk communication approach, not *all* beachgoers will heed advisories. Since a stated objective of the beach notification program is to inform the public so they can make appropriate and knowledgeable decisions, this outcome in itself does not represent a shortcoming of the notification program.

State and local beach managers generally did not have sufficient data from which to estimate the fraction of beachgoers who abide by, or ignore, advisories. The interviewees noted that they believe that fewer beachgoers use the beach and even fewer go swimming during an advisory, but aside from the small survey conducted in Ogden Dunes, Indiana (described earlier in this section), beach managers did not have specific data to support their observation.

At the same time, the interviews suggest that the presence of lifeguards can strongly influence behavior during an advisory if the advisory is accompanied by a swimming ban. Beaches in Monmouth County, Barnstable County, and Newport Beach, for example, are staffed with lifeguards who will strictly enforce a swimming ban.

When asked why some beachgoers who are otherwise aware of the advisory may still decide to go swimming, the interviews and the existing literature offered some potential reasons. The state and local beach managers we interviewed speculated that some beachgoers who are aware of advisories may enter the water anyway for a variety of reasons: they may not understand the significance of the advisory, may care more about surf conditions or other factors, may believe that *they* would not get sick (i.e., self-positivity bias), or may think they can control exposure by not swallowing water.

In addition, an individual's access to alternative recreation may influence their decision. For example, the beach manager for the state of Indiana interviewed for this evaluation noted that the fraction of beachgoers who may disregard an advisory may be relatively higher in lower-income urban areas where impaired beaches are close to home, free, and where there may not be a readily accessible alternate site.

Furthermore, the fact that it takes 24 hours to get water quality monitoring results[57] may lead beachgoers to discount beach advisories, in the believe that they do not reflect current conditions. Several interviewees mentioned the delay between testing and water quality notification – which typically ranges between 24 to 48 hours – as a potentially significant factor that can lead local residents not only to discount beach advisories, but also question the credibility of agencies issuing the advisories. Local beach managers (Chicago, Newport Beach) note their strong interest in implementing more timely notifications. Orange County has tested a rapid testing method that can provide water quality information within a few hours of testing (see Case Study C earlier in this chapter).

[57] Culture-based methods used to measure fecal indicator bacteria density have a turnaround of about 24 hours, meaning that even in cases where beaches are sampled daily, the water quality status posted on any given day actually reflects conditions for samples collected the prior day.

CASE STUDY D: CORPUS CHRISTI, TEXAS, FINDS NO MAJOR ECONOMIC IMPACTS AS A RESULT OF NOTIFICATION

The city of Corpus Christi in Nueces County, Texas, began implementing beach notification as part of the Texas Beach Watch program in early 2008. Prior to that time, the city Health Department, the Coastal Bend Bays & Estuaries Program, and the University of Texas at Corpus Christi were all active in water sampling, however results were not disseminated to the public. For example, the Health Department sampled all receiving waters to test water quality, the estuaries program was studying the types of contamination from storm drains, and the University of Texas was studying the sources of contamination. However, the only signs posted at the beach were general warnings (e.g., warning visitors of glass on the beach). There were a few reasons why the city did not provide beach notifications. First, the city perceived that businesses and local residents were concerned that notifications would lead to a negative image of the city, which could hurt the local economy that depended on tourists. Moreover, the city's Environmental Director was concerned that since samples were only taken once a week in the summer, and once every two weeks in the winter, providing notifications based on these potentially out-of-date sampling results could give the public a false sense of security (i.e., that beaches were safe if there was no notification, which might not be the case). Therefore, the city's Environmental Director felt that it was most important to provide general education to the public not to swim in receiving waters after a rain event. Indeed, the Commodore of the local windsurfing association reported that prior to the city issuing notifications, many local windsurfers knew through their own experience that they should not enter beach water for two days after a rainfall.

View from a Local Windsurfer

"I live right next to an outflow …Water will flow out of it darkish brown or black [after a rainfall event]. You can see a mass of polluted water around the Bay …Normally the water is turquoise or greenish, but it turns brown or black after a rain, [even if the rain is three or four miles inland]. It takes the currents a couple of days to dissipate [the polluted water].

I think the Texas Beach Watch program is great, and feel the signs are a good educational tool to inform Bay users of the potential hazards in the water."

However, after the Texas Beach Watch program was launched at the state level, and based on input from the Surfrider Foundation, the city began issuing notifications about beach water quality by posting Beach Watch signs. Notifications are also provided by the state through the Beach Watch website, an e-mail list, and a RSS feed.

Texas Beach Watch Sign

Photo Credit: Rob Nixon, Chairman Surfrider Foundation South Texas Chapter

Perspectives on the impacts of the notifications vary. The city's Environmental Director feels that the general population does not notice the Beach Watch signs and beachgoers have not changed their behavior, although there has been more media attention about the notifications. The Executive Director for the Coastal Bend Bays & Estuaries Program (hereafter, the Estuary Program) believes that the Texas Beach Watch program has raised public awareness and knowledge about bacterial contamination at the beaches. While there are no data on changes in beachgoer behavior, the Executive Director believes it is likely that visitors are

paying attention to the signs and staying out of the water when there is an advisory. The Program Manager for the Estuary Program notes that there is a distinction between beaches on Corpus Christi Bay, versus those on the Gulf of Mexico. Gulf beaches are less likely to have notifications, but when they do beachgoers seem to take note and "second guess" getting in the water. The Program Manager did not have any anecdotal information about whether visitor behavior had changed at Bay beaches. Overall, the Program Manager believes that notification signs are a useful communication tool for people visiting the beach, alerting them not only to the most current information available on water quality, but also where to get more information (i.e., the website). The Commodore from the local windsurfer association believes that local windsurfers and kite surfers were generally aware of water conditions even prior to the notifications, based on word of mouth and personal experience. However, visiting windsurfers and kite surfers may not be aware of water quality issues in the Bay, and therefore the signs are useful for informing them. In addition, members of the windsurfing club do check the Texas Beach Watch website regularly, and the club has put a link on its website to the state's Beach Watch website, where visitors can find information on bacteria counts at local beaches and other possible surfing sites.

Cole Park, Corpus Christi

Photo Credit: City of Corpus Christi

All of those interviewed for this case study agreed that the notifications have not resulted in a noticeable negative impact for the city's economy. As the Executive Director of the Estuary Program stated, "The truth is now that the signs are up it has been practically painless for the city. There has been no mass movement or public outpouring of demand to deal with the problem." The city's Environmental Director observed that there may not be any negative economic impacts of the notifications in part because tourists who notice the signs and opt not to use the beach patronize local businesses instead. Or it may be that the beaches where notifications are most likely to occur (Cole and Ropes Park) are not frequented by tourists, since they are not sandy beaches.

Aside from any influence on beachgoers, the beach monitoring data has informed other initiatives regarding water quality. For example, the city Health Department formed a task force to help address water quality issues, and two locations in the city were placed on EPA's 303d list of impaired waters. Including the city's beaches on the 303d list seems to have prompted the most concern from the city as well as the Texas Commission on Environmental Quality.[58] Currently, two locations in Corpus Christi Bay are included on the 303d list: Cole and Ropes Park.[59]

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[58] Documentation of EPA's response to the Texas Commission on Environmental Quality's concerns about the 303d listing is available at http://www.epa.gov/region6/water/npdes/tmdl/303d/tx/follow_up%20letter%20to%20tceq_ccbay.pdf <last accessed February 8, 2011)

[59] DRAFT 2010 Texas 303(d) List (February 5, 2010), available online http://www.tceq.texas.gov/assets/public/compliance/monops/water/10twqi/2010_303d.pdf <last accessed February 8, 2011)

Sources: Unless otherwise cited, information from this case study is drawn from interviews or personal communication with Peggy Sumner, Environmental Director for the City of Corpus Christi; Ray Allen, Executive Director Coastal Bend Bays & Estuaries Program; Jace Tunnell, Project Manager at the Coastal Bend Bays & Estuaries Program; and Chip Ducrest, Commodore of the Corpus Christi Windsurfing Association.

CHAPTER 5 | CONCLUSIONS

This evaluation explores the types of beach notification methods used to inform the public about water quality concerns, and the effectiveness of these notifications. This chapter highlights conclusions drawn from the research.

5.1 BEACH NOTIFICATION PROGRAMS USE A COMPLEMENTARY SUITE OF NOTIFICATION MESSAGES

The states and localities interviewed for this evaluation tend to use, on average, more than four different notification methods. Some of these methods (e.g., signs) are targeted to beachgoers at the beach, and others (e.g., websites) are targeted to potential visitors before they travel to the beach.

Evidence from existing surveys suggests that beach signs, as well as press releases to television and radio stations, are essential, since only a minority of beachgoers seeks out water quality information before they visit the beach. However, aside from signs, the Internet is the most common source of information about beach water quality and the primary mode by which state and local beach managers provide detailed water quality information to the public. Beach program managers report that the different notification methods reinforce each other (e.g., coverage in the media or signs at the beach drives traffic to the website). Moreover, general public education and outreach are necessary to build a common understanding of beach water quality issues, risks of contaminated water, and steps that beachgoers can take to stay safe while still enjoying the beach. Educated members of the public will be more likely to be aware of, seek out, and abide by beach water quality notification messages.

5.2 THE CONTENT AND FORMAT OF BEACH NOTIFICATION MESSAGES VARIES, EXAMPLES DRAWN FROM STATES AND LOCALITIES SUGGEST GOOD PRACTICES

The review of signs and websites in Chapter 4 suggests that there is no standard format for beach notification messages at beaches across the country, and that the content and wording of messages, as well as the level of detail and contextual information provided, varies widely. Part of the reason for this range of approaches may be that beach programs may tailor the content and format of their communications based on their target audiences (e.g., residents vs. tourists), and based on the goal of the communications (e.g., to inform vs. to influence beachgoer behavior). While directly contrasting the effectiveness of one approach versus another is not possible, there are features of signs and websites that are likely to be relatively effective in informing and influencing behavior, based on comments from interviewees and the literature.

Large durable signs, placed in a prominent location, that convey meaning using widely-recognized symbols and icons, along with simple text to explain the cause of the advisory or closure, are likely to be relatively effective. In addition, signs that use a familiar color scale (e.g., red, yellow, green) to indicate risk levels should help beachgoers understand the risk. Signs can briefly highlight consequences of water contact and tips on staying safe (although such explanations will necessarily be very short). Signs should identify the agency responsible for the advisory, as well as a source for more information (e.g., a phone number or website). Where visitors are likely to speak languages other than English, signs should be translated.

Websites can provide considerably more information than signs, and yet it is still important to design websites so that the most relevant information is summarized briefly on the beach program's home page (or on a clear link to the home page), so that beachgoers can quickly find it. A review of websites suggests that it is helpful if websites prominently display a summary of the status of each beach, or a list of all beaches under advisory. In addition, some websites include useful features such as allowing users to search for current status and history for a particular beach of interest. Several websites reviewed provide detailed testing information (e.g. bacterial levels) and this information is likely useful to researchers and experts. However, beachgoers may be more likely to be able to understand simple summaries of testing results (e.g., beach open, closed, or under advisory) communicated through text and/or color coding. In order to help interested beachgoers understand the basis for the beach status, websites can provide information about the day the beach was last sampled, the frequency of monitoring, and an explanation for the cause of any advisories and testing methods. Websites can also provide detailed information about health consequences of contact with contaminated water, and advice on the activities that may be unsafe. Finally, beach websites may provide information about beaches other than water quality (e.g., weather and beach amenities) to draw visitors to the beach website.

5.3 NOTIFICATION MESSAGES REACH ONLY A FRACTION OF BEACHGOERS, BUT SOCIAL NETWORKING TOOLS, AS WELL AS TRADITIONAL MEDIA, CAN EXPAND REACH

Although limited in number, the available studies suggest that beach signs, the Internet, and television may be the most common sources beachgoers use to learn of beach advisories or closings. However, the total target audience for beach notifications can be very large, and therefore it can be difficult to reach the majority of beachgoers. For example, the state of Texas conducted a major outreach campaign as part of its Beach Watch program, which did increase visitors to the website, but the total number of website hits (roughly 23,400 in 2009) was still a small fraction of the number of swimming visits to Texas beaches that year (nearly 50 million).

Beach managers are increasingly using social networking tools (e.g., Facebook and Twitter) to expand the reach of their beach notification messages. In some cases, beach managers partner with local stakeholders (e.g., NGOs) to reach a broader audience. For example, in

Orange County, California, local NGOs "retweet" the County health department's beach advisories, expanding the reach of this information by at least a factor of ten. However, social networking tools typically only reach subscribers. Traditional media approaches (e.g., press releases to local television stations and newspapers) can expand the reach of notification messages to the general public (both residents and tourists). Some states have found cultivating relationships with local media en effective way to ensure that newspapers and television stations routinely publicize beach status updates.

5.4 PUBLIC AWARENESS OF BEACH ADVISORIES VARIES; BEACHGOERS WHO ARE AWARE OF SIGNS OFTEN FIND THEM HELPFUL

While research on beachgoer awareness is limited, the few studies that do exist vary in the percentage of beachgoers that are aware of notifications. For example, awareness of beach signs has varied from 2% to 54%, depending on the survey. Awareness of *any* notification method tends to be higher, for example, one survey in Orange County, California found that 65% of residents and 45% of non-residents were aware of at least one source of information on water quality. However, a smaller percentage of beachgoers checks for information about water quality before visiting a beach (approximately 20% of survey respondents or less). This suggests that simply making sure beachgoers see signs, and hear about other notification methods prior to visiting a beach, may be the greatest challenge for beach managers.

The few studies that tested beachgoer understanding of beach signs suggest that they can communicate effectively to the public, depending on their design, content, and placement. For example, between 72% and 87% of respondents in one small survey in Indiana found redesigned signs to be very understandable, while 63% of survey respondents who were aware of electronic signs in Orange County, California, found they were helpful and easy to understand.

5.5 BEACH ADVISORIES APPEAR TO HAVE SOME EFFECT ON BEHAVIOR, BUT OTHER FACTORS MAY PREDOMINATE

Studies that consider factors influencing beachgoer behavior suggest that beach advisories influence some members of the public, but that weather and water temperature seem to be stronger factors in many individuals' decisions not to swim. Beach attendance data do suggest a relationship between number of visitors and advisory status, but weather also exerts a strong influence on beach attendance. An unknown proportion of individuals choose to visit the beach and enter the water even when advisories are in place. There may be many reasons that individuals choose to contact the water when an advisory is in place, including being unaware of the advisory, not having alternate recreation opportunities, or believing that they will not get sick.

5.6 BEACH NOTIFICATION PROGRAMS HAVE EVOLVED BASED ON EXPERIENCE, BUT LITTLE SYSTEMATIC EVALUATION OF PROGRAM EFFECTIVENESS HAS BEEN COMPLETED

The states and localities interviewed generally developed their notification programs based on their own experience. Beach notification managers have adapted their programs over time to add new technologies as they have become available (e.g., social media tools) and to improve notification methods that seemed not to be effective (e.g., flags or small signs).

While states and localities do appear to take note of feedback they receive from beachgoers, only a few noted specifically learning from the experience of their peers (e.g., other states) when adjusting the design of their notification programs. It seems likely that beach program managers may not be fully aware of techniques their peers are using, and therefore may not be in a position to adopt best practices.

While a few programs have conducted targeted studies to identify areas to improve, most programs have not conducted such research, and no programs have conducted a series of studies over time to assess changes in behavior as the beach notification programs evolved. The scarcity of data on effects of beach notification (e.g., large scale surveys of beachgoers and data on beach attendance) substantially limits an evaluation of the outcomes of effectiveness of beach notification programs. While EPA guidance calls for BEACH Act grantees to evaluate their programs, it is not clear whether individual grant agreements include evaluation as part of their scope. Interviews with states and localities suggest that funding is a limiting factor for beach programs, and therefore the paucity of primary research may be due to lack of resources to conduct gather data. Additional research in the form of surveys of beachgoers and tracking attendance records would help assess program effectiveness. Such surveys could be carried out by EPA, states, localities, universities, or NGOs, and ideally coordinated by a central agency (e.g., EPA).

APPENDIX A: INTERVIEW CONTACTS

We would like to thank the individuals who provided information for this evaluation.

STATE/LOCALITY/ORGANIZATION CONTACTED	INDIVIDUAL INTERVIEWED OR CONTACTED
Florida	David Polk, Florida Department of Health
Hawaii	Dale Mikami and Watson Okubo, Hawaii Department of Health
Indiana	Michelle Caldwell, Beach Grant Program Coordinator, and Danielle Barnett; Indiana Department of Environmental Management
Makah Tribe	Andrew Winck, Emergency Management Coordinator, Makah Tribe
Massachusetts	Chris Huskey, Massachusetts Department of Public Health
Maryland	Heather Morehead, Kathy Bromont, and Tom Nscuta, Beaches Division/Shellfish Division, Maryland Department of Environment, Technical & Regulatory Services
New Jersey	Virginia Loftin, NJDEP Bureau of Marine Water Monitoring, Cooperative Coastal Monitoring Program, Clean Shores Program
Rhode Island	Amie Parris, Beach Coordinator, Rhode Island Department of Health
Texas	Craig Davis, Texas Beach Watch Coordinator, and Landon Camp and Melissa Porter; Coastal Resources Division, Texas General Land Office
Washington	Jessica Archer, BEACH Program Manager, Washington Department of Health; and Jessica Bennett, Washington Department of Ecology
Anne Arundel County, Maryland	Elin Jones, Public Information Officer, Public Information Office, Anne Arundel County Department of Health
Orange County, California	Larry Honeybourne, Orange County Health Care Agency
City of Newport Beach, California	Jim Turner, Lifeguard Battalion Chief, Newport Beach Lifeguard Agency
Chicago Park District, Illinois	Cathy Breitenbach, Chicago Park District
Town of Ogden Dunes, Indiana	Sue MiHalo, Chair of Ogden Dunes Environmental Advisory Board
Barnstable County, Massachusetts	Bethany Sadlowski, Beach Sampling Program Coordinator, Barnstable County Health and Environment
Monmouth County, New Jersey	Anne Marie Fournier, Cooperative Coastal Monitoring Program Coordinator, Monmouth County Health Department
Galveston County Health District, Texas	Ronnie Schultz, Director of Galveston County Environmental Health Program

STATE/LOCALITY/ORGANIZATION CONTACTED	INDIVIDUAL INTERVIEWED OR CONTACTED
Guam	Annie Leon Guerrero, Guam EPA
Commonwealth of the Northern Mariana Islands (CNMI)	Clarissa T. Bearden, Lead State Contact, CNMI Division of Environmental Quality
American Samoa	Christianera Tuitele (Water Program Manager) and Josephine Regis, American Samoa EPA
Surfrider-Rhode Island Chapter	Dave Prescott, Executive Director
City of Corpus Christi	Peggy Sumner, Environmental Director
Coastal Bend Bays & Estuaries Program, Corpus Christi Texas	Ray Allen, Executive Director, and Jace Tunnell, Project Manager, Coastal Bend Bays & Estuaries Program
Corpus Christi Windsurfing Association	Chip Ducrest, Commodore
Surfrider Foundation – Coastal Bend Chapter, Texas	John S. Adams, Chair - Coastal Bend Chapter
Surfrider Foundation – South Texas Chapter	Rob Nixon, Chairman, South Texas Chapter
University of Illinois-Chicago	Sabina Shaikh, Lecturer, Public Policy Studies and Environmental Studies

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APPENDIX C: STATE INTERVIEW GUIDE

CONTACT INFORMATION

Name: _____

Title: _____

Organization: _____

Email: _____

Phone number: _____

INTRODUCTION

Thank you for agreeing to speak with us today. As you may know, we are contractors assisting the U.S. EPA in conducting an evaluation of the notification component of the Beaches Environmental Assessment and Coastal Health (BEACH) Act. As we're sure you're aware, the Act provides funding to state and local health and environmental protection agencies to monitor bacteria levels in water, and when levels exceed standards, notify the public by posting warnings or advisories, or closing a beach. Through this evaluation, EPA is seeking to understand:

1. How grantees are using their BEACH Act funding to notify the public about local beach conditions;
2. Which notification methods are the most effective in reaching the public; and
3. How beachgoers' awareness of beach advisories and closures, understanding of water quality risks, and beach visitation behavior has changed in response to notifications since the BEACH Act was enacted.

EPA intends to share the results of this evaluation at the 4th National Beach Conference in 2011.

In this interview, we are hoping to learn from your experience about effective approaches to notifying the public about beach conditions, so that EPA can share this information with other states and local governments. **Please note that we are not auditing or evaluating your program.** Rather, we are trying to understand the successes and challenges you and other states have encountered, so that EPA can learn from this experience and improve its guidance and assistance to other BEACH Act grantees. We appreciate your involvement and feedback.

In this interview, we will start with general questions to understand the beach monitoring and notification program in your state. These questions are meant to verify our current understanding of your program, based on our research to date. We will then ask you more detailed questions about notification methods used in your state to alert the public to beach conditions, and the extent to which these notification methods reach beachgoers. Finally, we will ask about your experience with how these methods affect beachgoer awareness and

behavior, and any insights you can share on how states could improve their notification programs. We are aware of research done by University of Illinois Chicago (UIC) about some of these same topics and we are hoping to complement the information you may have provided to UIC researchers earlier.

For purposes of this interview, we are only interested in coastal and Great Lakes beaches subject to the BEACH Act; if you have experience with other beaches (e.g., beaches located inland) please let us know, but note that our questions are primarily focused on your activities related to coastal and Great Lakes beaches.

During this interview we may ask you questions that you cannot answer because you do not have the requested information readily available. Whenever that is the case, just let us know. We do not expect you to conduct a file review to answer any question. Some of the information we are looking for may not be collected by your state, but we are asking to make sure that we do not miss any information that is relevant to our evaluation.

In addition to speaking with you, we are conducting interviews with several other state beach officials, and we also plan to interview several local beach managers to understand their perspectives about beach notification. We will ask for your recommendations on potential local beach managers to interview toward the end of our conversation.

Do you have any questions before we begin?

INTERVIEW QUESTIONS

GENERAL QUESTIONS ABOUT PROGRAM AND ROLES

1. We understand your state has the following responsibilities with regard to implementing the BEACH Act notification program: [Fill in appropriate responsibilities depending on specific state and information based on state website. If information is unclear, ask about roles directly]

    - ☐ Provide funding and guidance to municipalities, counties, local beach managers, or others involved in direct program implementation
    - ☐ Conduct monitoring/sampling of water quality at public beaches
    - ☐ Establish policies, standards, and /or procedures for notification at public beaches
    - ☐ Notify the public of water quality conditions
    - ☐ Staff the beach and manage operations

2. In addition to your particular department or agency, are other organizations (e.g., municipalities, counties, universities, etc.) substantively involved in implementing your notification program?

    - What monitoring and notification activities do these organizations conduct?

- What fraction of your state's coastal beaches do these organizations monitor and provide notification for?

NOTIFICATION METHODS

3. When water quality monitoring shows a beach's waters do not meet standards, is there a standard notification process? Is this standard formalized (e.g., in a policy or requirement for all organizations involved in beach notification)?

   - If there is a formalized standard, what does it require? Does it address process, timing, medium, format, and/or content of notifications?

4. *[If state is responsible for notification at some or all beaches]* We understand that all coastal and Great Lakes states post beach notifications on their websites and in signs at the beach; is this accurate for your state?

   - What type of notice do you post at the beach, e.g., flag, permanent placard, other notice?
   - Does your state use any other notification method(s) to inform the public about water quality conditions at beaches? (Indicate all method(s) you are currently using)

     ☐ Press release (specify media: television, radio, newspapers)

     ☐ Telephone hotline

     ☐ Email list

     ☐ Text messaging

     ☐ Outreach through mobile devices or using "social media" tools (e.g., iPhone application, Facebook, Twitter)

     ☐ Other (specify)

   - What factors led your state to choose the notification methods it uses?
   - Has your state considered other notification methods? Which ones? Do you expect your state will implement these other methods? If so, why? If not, why not?
   - Has your state used any notification methods in the past that have now been discontinued? Which ones? Why were they discontinued?
   - [*For each method currently used*] What type of information do you include in the notification message? (e.g., binary status such as beach open/closed, actual water quality results, detailed information on the health risks of exposure.) *[If the information is not on your state's website, can you send us a sample notification?]*

- Has your state tried including other types of information in the notification messages, or wording the messages in a different way? What did you learn from this experience?

5. *[If other organizations are involved in notification]* Do you know what notification method(s) the beach managers from other organizations in your state use to inform the public about water quality conditions at beaches in your state? *(Indicate all method(s) you are aware of)*

    - ☐ Posting a notice at the beach (*specify type*: flag, permanent placard, other)
    - ☐ Website (*specify website/organization*, if known)
    - ☐ Press release (*specify media*: television, radio, newspapers)
    - ☐ Telephone hotline
    - ☐ Email list
    - ☐ Text messaging
    - ☐ Outreach through mobile devices or using "social media" tools (e.g., iPhone application, Facebook, Twitter)
    - ☐ Other (*specify*)

    - Do you have any information on how these other organizations chose the notification methods they are using, or whether they have used or considered other methods in the past?

REACH OF NOTIFICATION METHODS

6. Have you estimated the number of beachgoers that receive advisories?

    - How did you develop this estimate (e.g., through statistics on web site visits or survey methods)?

7. Have you found that some notification methods are more effective than others in reaching beachgoers?

    - How do you know? Do you have any quantitative data regarding this (e.g., beach attendance figures, beachgoer surveys), or is it more a qualitative judgment?

8. What factors do you think are most important in affecting the degree to which a beach notification reaches beachgoers?

9. In your opinion, what is the public's preferred method for getting information about water quality conditions at your state's beaches?

EFFECTIVENESS OF NOTIFICATION MESSAGE

In our study, we are distinguishing between beachgoer awareness and understanding of beach advisories (i.e., noticing the advisories and being able to interpret what they mean), and beachgoer behavior (i.e., what the beachgoers decide to do based on the information they have). We ask about both types of responses below.

Awareness and Understanding

10. Do you know how advisories have affected beachgoer awareness or understanding of risks associated with contacting the water?
11. Have you found that some notification methods or messages are more effective than others in affecting beachgoer awareness or understanding? Why do you think this is?

Behavior

12. In your experience, have advisories or other notifications had an impact on the number of visitors to the beach or on the behavior of beachgoers?
13. Have you found that some notification methods or messages are more effective than others in affecting beachgoer behavior? Why do you think this is?
14. Are there improvements that you would like to make to the way your notification program is currently implemented that you think would improve the effectiveness of the program?

ADDITIONAL DATA

15. Are you aware of any studies, or do you have data or further information, that you think would inform our study and that you would be willing to share?
16. Are there other individuals that we should talk to in other organizations in order to better understand beach notification in your state?

LOCAL BEACH MANAGERS

17. In addition to our interviews with state program staff, we are seeking to interview a handful of local beach managers that are involved in implementing the beach notification program. Specifically, we are looking for beach managers that are more engaged and active on issues pertaining to beach notifications, have conducted relevant studies, and/or are implementing innovative notification methods. Can you suggest two or three local beach managers that you think would be willing to participate in an interview with us?

APPENDIX D: LOCAL INTERVIEW GUIDE

CONTACT INFORMATION

Name: _____

Title: _____

Organization: _____

Type of Organization: ☐ County government ☐ Town/City government

☐ Other (specify)

Email: _____

Phone number: _____

INTRODUCTION

Thank you for agreeing to speak with us today. As you may know, we are contractors assisting the U.S. EPA in conducting an evaluation of the notification component of the Beaches Environmental Assessment and Coastal Health (BEACH) Act. As we're sure you're aware, the Act provides funding to state and local health and environmental protection agencies to monitor bacteria levels in water, and when levels exceed standards, notify the public by posting warnings or advisories, or closing a beach. Through this evaluation, EPA is seeking to understand:

1. How grantees are using their BEACH Act funding to notify the public about local beach conditions;
4. Which notification methods are the most effective in reaching the public; and
5. How beachgoers' awareness of beach advisories and closures, understanding of water quality risks, and beach visitation behavior has changed in response to notifications since the BEACH Act was enacted.

EPA intends to share the results of this evaluation at the 4th National Beach Conference in 2011.

In this interview, we are hoping to learn from your experience about effective approaches to notifying the public about beach conditions, so that EPA can share this information with other states and local governments. **Please note that we are not auditing or evaluating your program.** Rather, we are trying to understand the successes and challenges you and other beach managers have encountered, so that EPA can learn from this experience and improve its guidance and assistance to other BEACH Act grantees. We appreciate your involvement and feedback.

In this interview, we will start with general questions to understand your particular beach monitoring and notification program. These questions are meant to verify our current understanding of your program, based on our research to date. We will then ask you more detailed questions about what notification methods you use to alert the public to beach conditions, and the extent to which these notification methods reach beachgoers. Finally, we

will ask about your experience with how these methods affect beachgoer awareness and behavior, and any insights you can share on how states could improve their notification programs. We are aware of research done by University of Illinois Chicago (UIC) about some of these same topics and we are hoping to complement the information you may have provided to UIC researchers earlier.

For purposes of this interview, we are only interested in coastal and Great Lakes beaches subject to the BEACH Act; if you have experience with other beaches (e.g., beaches located inland) please let us know, but note that our questions are primarily focused on your activities related to coastal and Great Lakes beaches.

During this interview we may ask you questions that you cannot answer because you do not have the requested information readily available. Whenever that is the case, just let us know. We do not expect you to conduct a file review to answer any question. Some of the information we are looking for may not be information you collect, but we are asking to make sure that we do not miss any information that is relevant to our evaluation.

In addition to speaking with you, we are conducting interviews with several other local beach managers. We are also interviewing a small set of state beach program managers and non-governmental organizations to understand the beach notification program from their perspective.

Do you have any questions before we begin?

INTERVIEW QUESTIONS

GENERAL QUESTIONS ABOUT PROGRAM AND ROLES

1. How many beaches is your organization responsible for?
   - If more than one beach, are all these beaches coastal/Great Lakes beaches? For purposes of this interview, we are only concerned with beaches subject to the BEACH Act.
2. What are the primary responsibilities of your locality with respect to implementing the beach notification program? (*identify all that apply*)
   - ☐ Conduct monitoring/sampling of water quality
   - ☐ Establish policies, standards, and/or procedures for notification at public beaches? *(specify and describe)*
   - ☐ Notify the public of water quality conditions
   - ☐ Staff the beach and manage operations (*specify*: collect fee, provide lifeguards and ensure security, clean and maintain facilities, enforce beach closures) (Note, we recognize these activities are not directly part of the notification program, but we are asking about them to understand the context of the notification program.)
3. When water quality exceeds the state standards, do you:
   - ☐ Issue an advisory/warning only
   - ☐ Close the beach

NOTIFICATION METHODS

4. What notification method(s) are you currently using to inform the public about water quality conditions at beaches? *(indicate all method(s) you are currently using)*

   - ☐ Posting a notice at the beach (*specify type*: flag, permanent placard, other)
   - ☐ Press release (*specify media*: radio, newspapers)
   - ☐ Telephone hotline
   - ☐ Website
   - ☐ Email list
   - ☐ Text messaging
   - ☐ Outreach through mobile devices or using "social media" tools (e.g., iPhone application, Twitter)
   - ☐ Other (*specify*)

5. Are the same notification methods always used, or does it depend on the circumstances?
6. What factors led you to choose these notification methods?
7. Have you considered other notification methods? Which ones?
   - Do you expect to implement these other methods in the future? If so, why? If not, why not?
8. Have you used any notification methods in the past that have now been discontinued? Which ones? Why were they discontinued?
9. [For each method currently used] What type of information do you include in the notification message? (e.g., binary status such as beach open/closed, actual water quality results, detailed information on the health risks of exposure.) [If the information is not on your program's website, can you send a sample notification?]
10. How long does it take to post notifications after receiving water quality results back from the laboratory?
    - If multiple notification methods are used, are all methods updated with the same frequency?

REACH OF NOTIFICATION METHODS

11. Do beachgoers in your area tend to be local (e.g., from nearby towns), from other parts of your state, or from outside your state?
    - Has this affected your choice of notification method(s)?
12. Do you have estimates of the number of beachgoers that use your beach(es) annually?
    - What is the maximum number of people that use your beach(es) during a typical hot weekend day?

13. Do you have an estimate the number (or fraction) of beachgoers that typically receive advisories?
    - What information is your estimate based on? (e.g., through statistics on web site visits or survey)
14. *[If multiple notification methods are (or have been) used]* Have you found that some notification methods are more effective than others in reaching beachgoers?
    - How do you know? Do you have any quantitative data regarding this (e.g., beach attendance figures, beachgoer surveys), or is it more a qualitative judgment?
15. In your opinion, what method(s) appear to be most effective in reaching the largest number of beachgoers?
    - Are some methods more effective than others in reaching specific subsets of the population (e.g., different age groups, or local vs. out of state beachgoers, or different user groups, such as surfers and fishermen)?

EFFECTIVENESS OF NOTIFICATION MESSAGE

16. Do you have any information about how beachgoers respond to advisories or other notifications at your beach(es)?

In our study, we are distinguishing between beachgoer awareness and understanding of beach advisories (i.e., noticing the advisories and being able to interpret what they mean), and beachgoer behavior (i.e., what the beachgoers decide to do based on the information they have). We ask about both types of responses below.

Awareness and Understanding

17. In your experience, do beachgoers understand the meaning and potential health implications of advisories?
18. What other factors, aside from notification methods or messages, do you think might influence beachgoer awareness or understanding of risks associated with coming into contact with water (e.g., newspaper stories; word-of-mouth)?
19. Have you found that some notification methods or messages are more effective than others in affecting beachgoer awareness or understanding?

Behavior

20. Have you or your staff personally observed any changes in beachgoer behavior, attendance or adherence following a notification? (e.g., by not visiting the affected beach, visiting a different beach, or avoiding contact with the water while at the affected beach)? (specify and describe)
21. Aside from personal observation, do you have any information on behavior changes in response to notifications? (e.g., beach attendance data or reduced parking revenues on days during which an advisory was in effect as compared to similar days) If you did not observe changes in behavior, why do you think this is?

22. What other factors, aside from notification methods or messages, do you think might influence beachgoer behavior?
23. Have you found that some notification methods or messages are more effective than others in affecting beachgoer behavior?
24. Are there improvements that you would like to make to the way your program is currently implemented (focusing on notifications) that, in your view, would improve the effectiveness of the notification?
    - What constraints, if any, have you faced in making these improvements?

ADDITIONAL DATA

25. Are there other topics that you feel we should have covered to understand how you implement the beach notification program in your locality?
26. Are you aware of any studies, or do you have data or further information, that you think would inform our study and that you would be willing to share?
27. Are there other individuals that you think we should talk with in order to better understand how your program has affected beachgoer awareness, understanding, and/or behavior?

APPENDIX E: SUMMARY OF BEACH NOTIFICATION WEBSITE FEATURES

ENTITY AND WEBSITE	HOW RISK IS COMMUNICATED	HISTORY OF WATER QUALITY SAMPLE RESULTS	OTHER BEACH CONDITIONS	MAPS OF BEACHES WITH ADVISORIES	SYNDICATION/NEWSFEED/ ALERTS	OTHER FEATURES	CONTACT INFORMATION EASILY FOUND	IN FIRST PAGE OF GOOGLE RESULTS?	STRENGTHS	LIMITATIONS
States										
Florida http://esetappsdoh.doh.state.fl.us/irm00beachwater/default.aspx	Map provides list of counties, and within each county a map of sampling sites is provided. For each sampling site, Water quality is described as good, moderate, or poor.	✓	Link to oil contamination	✓			✓	✓	Main page includes map where user can browse beaches by county	Cannot search by beach or town name. Website does not provide a list of all beaches that currently have advisories on one page.
Hawaii http://emdweb.doh.hawaii.gov/cwb/wqd/viewer/Home.aspx?AspxAutoDetectCookieSupport=1	Water quality levels identified but no information about risk associated	✓	Weather, surf, salinity, pH, dissolved oxygen	✓	✓ RSS feed	Links to other resources		✓	All advisories listed on main page through the "Show all Postings" feature. Detailed information about cause and status of contamination provided.	It can be difficult to find advisories through the mapping feature. Map color key and colors shown on map appear different. Map does not display all sample points (only those with advisories).
Indiana https://extranet.idem.in.gov/beachguard/	Water quality levels identified and compared to threshold, but relationship to risk level not explained	✓		✓	✓ RSS feed		Phone numbers available, but contact for beach program not prominent	✓	Closures/ advisories prominently listed on front page; Monitoring frequency and agency responsible identified.	Interactive map available but not prominently displayed

ENTITY AND WEBSITE	HOW RISK IS COMMUNICATED	HISTORY OF WATER QUALITY SAMPLE RESULTS	OTHER BEACH CONDITIONS	MAPS OF BEACHES WITH ADVISORIES	SYNDICATION/NEWSFEED/ ALERTS	OTHER FEATURES	CONTACT INFORMATION EASILY FOUND	IN FIRST PAGE OF GOOGLE RESULTS?	STRENGTHS	LIMITATIONS
Massachusetts http://mass.digitalhealthdepartment.com/public_21/	Beach status (e.g., open) displayed, and detailed sampling results provided, but relationship to risk level not explained	✓	Recent storm event	Shows beach locations only		Annual Reports			Provides monitoring frequency and detailed historical data. Find beach by clicking on map or selecting from list (by town or beach name).	Information about the program and standards are not on the homepage or in a direct link. Website does not provide a list of all beaches that currently have advisories on one page. Site provides such detailed information that it may be difficult for the public to interpret it.
Maryland http://www.marylandhealthybeaches.org/current_conditions.html	General description on FAQ page that bacteria increase risk of illness		Algal blooms, link to rainfall	✓		Links to other resources including "healthy beach habits"	✓	✓	Site provides a survey for feedback on Google Earth tool. Provides step-by-step instructions for using Google Earth tool. Site provides tips for helping to prevent water contamination.	Website does not provide a list of all beaches that currently have advisories on one page. Site requires users to download Google Earth, and then download the update file to get current beach information status.
New Jersey http://www.njbeaches.org/	Water quality levels identified and compared to threshold, but not correlated to risk level	✓	Link to algal bloom data	Linked		Links to other resources Annual Reports	✓	✓ top hit	Recent updates located at top of home page – list closures in monitoring season. Phone number provided in prominent location. Utilizes graphs for historical information.	User must infer individual beach status by the sampling levels.
Rhode Island http://www.ribeaches.org/	Water quality levels identified and compared to threshold. No correlation to specific risk level, states that beaches that have been posted result in a "greater risk" of the swimmer getting sick.	✓		Shows beach locations only	✓ Press releases through RSS feed	Links to other resources (e.g., fact sheets); Annual Reports; Illness complaint form	✓	✓ top hit	Link for recent closures in a prominent location on home page. Includes resources for beachgoers and managers. Phone number and email for state Beach Coordinator provided.	Standards are not listed near water quality data.

ENTITY AND WEBSITE	HOW RISK IS COMMUNICATED	HISTORY OF WATER QUALITY SAMPLE RESULTS	OTHER BEACH CONDITIONS	MAPS OF BEACHES WITH ADVISORIES	SYNDICATION/NEWSFEED/ ALERTS	OTHER FEATURES	CONTACT INFORMATION EASILY FOUND	IN FIRST PAGE OF GOOGLE RESULTS?	STRENGTHS	LIMITATIONS
Texas http://www.texasbeachwatch.com/	Water quality levels categorized as high, medium, low; link to description of health risks.		For some beaches, information provided on wind conditions, surf height, etc.	✓	For some beaches - other conditions	Links to other resources	✓	✓	Home page displays map with beach locations. The user can also search or browse for beach name.	Map does not indicate exact sample level or sampling time or frequency (although date of last update is provided)
Washington http://www.ecy.wa.gov/programs/eap/beach/ http://www.doh.wa.gov/ehp/ts/WaterRec/beach/default.htm	Water quality levels categorized as good, caution, closed, or not monitored. EPA standard is referenced.		Shellfish and parks and recreation data	✓	✓	Links to other resources; Illness complaint form	✓	✓	Advisories and sample data are available from home page. Advisory definitions and classifications are available from link underneath results. User can find data from two different urls. User can import sampling data to spreadsheet	Closures and data results are on different pages.
Localities and Tribal Governments										
Orange County, CA http://www.ocbeachinfo.com/	Warnings that levels of bacteria can rise significantly after rainstorms. Beaches with closures, warnings, and advisories are listed on the main page.	✓ In text file format; designed to be imported into a spreadsheet, rather than viewed on screen	Amenities and current weather at each beach	Maps of all beaches are provided	Twitter	Phone number to call to report an illness Annual reports	✓	✓	Closures and advisories are listed in prominent location on main page. Phone number for advisories also provided.	Sample data are available but must expand "downloads" option in left menu bar to find it, and it is not easy to tell by looking at the sampling results whether a particular sample exceeded standards
Barnstable County, MA Health Department http://www.barnstablecountyhealth.org/beachsampling.htm	Use a red-green color coding system to show if water quality levels are above or below the standard	✓		Just to identify town		FAQs explain the program and proposed changes to the state beach regulations		✓	Color coding in sample results provides strong visual information about beach water quality status; it is easy to determine history for multiple beaches in a town at one glance.	Reports a "pass" or "fail" but standard for pass/fail not indicated on sample results page.

ENTITY AND WEBSITE	HOW RISK IS COMMUNICATED	HISTORY OF WATER QUALITY SAMPLE RESULTS	OTHER BEACH CONDITIONS	MAPS OF BEACHES WITH ADVISORIES	SYNDICATION/NEWSFEED/ ALERTS	OTHER FEATURES	CONTACT INFORMATION EASILY FOUND	IN FIRST PAGE OF GOOGLE RESULTS?	STRENGTHS	LIMITATIONS
Galveston County, TX http://www.gchd.org/pollution/BeachAdvisory.htm	Site lists if there are current advisories			Link to state tool				✓	Scrolling text at top of page indicates if there are advisories.	No sample data available directly on site; must visit state beach watch site.
Makah Tribe http://www.makah.com/beachmonitoring.html	Site informs user if each beach is open or closed due to health risks							✓	Beach status and last testing date for beaches prominently listed on front page.	Site does not provide sample data, maps, or other information about program.
Monmouth County, NJ http://www.visitmonmouth.com/page.aspx?ID=2031	Links to state site.	✓ In spread-sheet format.						✓	Historical data are available to download. Enterococci standard is provided.	No real-time data or advisories directly on page; links to state monitoring site. Historical data do not explain whether a particular sample exceeded standards
Michigan City (Washington Park), IN http://www.emichigancity.com/cityhall/departments/parks/beach.htm	Risk conveyed through colored signs and flags correlated to particular levels of bacteria						✓	✓	Phone number provided for water quality information. Levels for advisories and closures are stated, and delay between testing and notification clearly stated. Sign locations provided.	Actual current conditions are not posted on site - must call phone number or visit beach to view sign.
Anne Arundel County, MD http://www.aahealth.org/programs/env-hlth/rec-water	Sample results compared directly to acceptable level.	✓		Beach locations only	✓	Links to other resources	✓	✓	General advisory against swimming after rainfall is prominent on home page. Dates for advisories are given. Sample results compared directly to acceptable level.	Current status is not given for each beach - advisories and closures are listed from home page.

ENTITY AND WEBSITE	HOW RISK IS COMMUNICATED	HISTORY OF WATER QUALITY SAMPLE RESULTS	OTHER BEACH CONDITIONS	MAPS OF BEACHES WITH ADVISORIES	SYNDICATION/NEWSFEED/ ALERTS	OTHER FEATURES	CONTACT INFORMATION EASILY FOUND	IN FIRST PAGE OF GOOGLE RESULTS?	STRENGTHS	LIMITATIONS
Territories										
Commonwealth of the Northern Mariana Islands http://www.cnmicoralreef.net/wq/beachclose.htm						Previous years' data available		✓	Information about what causes beach closures provided.	Violations are identified on map, under page title of "beach closures", but no bacteria levels or standards are given. Most recent violations are in February 2010. Current status is not given for each beach - advisories and closures are listed from home page.
Non-Governmental Organizations										
Heal the Bay http://brc.healthebay.org/	Beaches are given letter grades based on sample results; grades for both wet and dry. Uses color coding and graphics. Grades are updated weekly.	No raw data	✓ Weather	✓	✓	Links to other resources Annual reports		✓	Link for alerts in obvious spot on top right of home page. Alternatively, search for particular beach by state. Closed beaches are clearly noted. Uses color coding and graphics on report card. Sample date provided.	Standards for letter grades and terminology are not immediately available on home page or report card – must go to documents section.
Save the Harbor, Save the Bay http://www.savetheharbor.org/index.php/beach-water-quality	Using colored flags (blue or red)					Link to Facebook page		✓	Describes flag color meanings.	No actual sampling data or statuses for specific beaches other than Fort Point Channel.

ENTITY AND WEBSITE	HOW RISK IS COMMUNICATED	HISTORY OF WATER QUALITY SAMPLE RESULTS	OTHER BEACH CONDITIONS	MAPS OF BEACHES WITH ADVISORIES	SYNDICATION/NEWSFEED/ ALERTS	OTHER FEATURES	CONTACT INFORMATION EASILY FOUND	IN FIRST PAGE OF GOOGLE RESULTS?	STRENGTHS	LIMITATIONS
Surfrider Foundation http://www.surfrider.org/waterquality.asp; http://www.surfrider.org/stateoftheb each/home.asp	Sample results are reported both in numerical value and with corresponding classification (very low to very high)	✓				Links to other resources Illness compliant form; Links to regulations and standards available on sample results page		✓	Blue Water Task Force provides water quality sampling results performed by Surfrider. State of the Beach also compiles and analyses water quality data from states. Testing date provided.	Limited number of beaches available. Samples collected by volunteers.