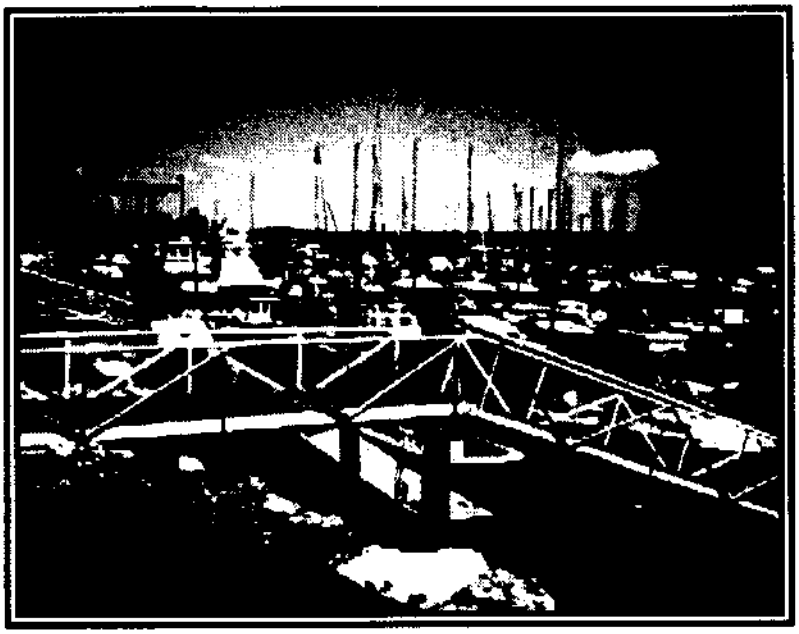
Best Management Practices For Clean Marinas: Lessons Learned



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February 1997

This document is an excerpt from a larger technical report, *Nonpoint Source Pollution Abatement for Recreational Boating Facilities: Applying Innovative Best Management Practices.* Although the appendices referenced within are not available here, they are available in the full technical report.

Additional copies of this publication, as well as copies of the full report, are available from the Rhode Island Sea Grant Communications Office, University of Rhode Island Bay Campus, Narragansett, RI 02882-1197.

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CONTENTS

PROJECT OVERVIEW

Problem/Purpose

In Rhode Island, nonpoint source pollution resulting from the operations of recreational boating facilities has been identified as a problem in the state's Nonpoint Source Management Plan (page 56). Boater discharges have also been identified as a potential problem in the Narragansett Bay Project's Comprehensive Conservation and Management Plan. According to Section 04-01-06 of the plan "given the present level of boating activity in Narragansett Bay, boater wastes may become a significant problem (page 4.102)." EPA/NOAA's "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters" also finds that nonpoint pollution regularly introduces contaminants, such as bacterial concentrations, nutrients and BOD loading, suspended solids, and petroleum products. Studies referenced in the "Guidance" show that these contaminants can have significant effects on water quality relating to fin- and shellfishing and recreational activities, such as boating and swimming. In extreme cases, this pollution can have economic impacts on the tourism, recreational boating, and fishing industries as water quality decreases.

These impacts can be mitigated, however, through the implementation of Best Management Practices (BMPs). Recognizing this, the state of Rhode Island, with the assistance of the Coastal Resources Center (CRC), has recently completed the development of a BMP guidance manual for recreational boating facilities that meets the requirements of the management measures set fourth by the United States Environmental Protection Agency (EPA) and NOAA. With the adoption of this *Environmental Guide for Marinas Controlling Nonpoint Source and Storm Water Pollution in Rhode Island*, implementation of BMPs for controlling nonpoint source pollution will be required for every new and existing marina in state waters by 1999. To facilitate the implementation of this new program, this project was launched to provide technical support and funding for the installation, use, and evaluation of Best Management Practices at five selected marinas in the Greenwich Bay study area.

Activities Undertaken/Project Methodology

Selection of Participating Marinas

The first project task involved soliciting five marinas within the Greenwich Bay area to serve as laboratories for the ground truthing of the state's new policy and for the actual implementation and evaluation of BMPs. The original list of potential participants was generated by the Rhode Island Marine Trades Association and was then condensed to achieve minimal overlap and maximum diversity in facility size, type of ownership, services provided, and perceptions toward nonpoint source pollution control. Seven different marinas were solicited, of which five were selected to participate. A summary of the key characteristics for the final participants is presented in Table 1 (see Appendix A).

Identifying Priority BMPs

Once the participating marinas were selected, the project then identified the priority BMPs for implementation at each of the facilities. Chosen by the process outlined in the state's *Environmental Guide for Marinas*, all BMPs initially selected by the participating marina operators as "planned for implementation" constituted the original list of possible BMPs to be implemented and evaluated at each marina. These were then prioritized according to the needs of the participants and the ability of the project's budget to support their needs. As

depicted in Table 2, the BMPs originally selected for implementation generally fell into three categories.

Table 1. Key Characteristics of Participating Marinas

Marina	Size (# of berths)	Services Provided	Ownership
1. Apponaug	248	2	Private
2. Brewers	256	3	Corporate
3. C-Lark	380	1	Private
4. Ponaug	161	1	Private
5. Wharf	85	2	Private

***Note:** 1 = hauling and storage; 2 = minor mechanical and finishing procedures, along with the activities of category of 1; and 3 = categories 1 and 2 plus major mechanical, finishing, and structural repairs.
Source: Operation and Maintenance Plans as submitted to RI CRMC, 7/96.

Table 2. BMPs Selected for Implementation by Participating Marinas

BMP	Solid Waste Effort	Liquid Waste Effort	Educational Efforts
Vacuum Sander Use	2,4,5		
Recycling-glass, tin & plastic	1,2		
Secondary Containment		1,3,5	
Separate Collection Facilities		1,5	
Liquid Waste Drop-off Booth		2,4	
Spill Response Equipment		4	
Spill Response Plans		2,4	
Workshops			All
Literature Distribution			All
Signs			2,3,4,5

Note: numbers correspond to the marina at which the practice was implemented. See Table 1.

Developing BMP Implementation Plans

Once the original list of BMPs was narrowed and finalized, a plan was developed detailing how the BMPs would be implemented and evaluated at each marina. Specifically, these plans described the individual practices; the equipment Ñ costs and suppliers; strategies for implementation and evaluation; and finally, a detailed schedule for completing the process. All BMP Implementation Plans were submitted to and approved by the Narragansett Bay Estuary Program (NBEP) prior to the actual implementation (see Appendix B).

Implementing BMPs

During the actual implementation phase, CRC worked with the participating marina operators and NBEP to purchase the necessary equipment; address operational and regulatory problems; ensure that the equipment was properly installed and operating; and to monitor and evaluate the patterns of BMP use at the five participating marinas. During the implementation of the plans all but one of the BMPs were installed and monitored. The drop-off booths for liquid wastes were not installed because of a lack of marina resources during the commissioning season. The only other modification to the approved

implementation plans (see Appendix B) involved the shift away from conducting boater workshops towards the development and distribution of educational literature and the provision of appropriate signage. This change was made due to poor results because of low attendance associated with conducting boater workshops. Only one such event was held at each of the participating marinas.

Evaluating BMPs

Once the implementation and monitoring of the selected BMPs was complete, the project shifted to focus on the actual evaluation of each practice's cost-effectiveness in reducing nonpoint source pollutants. The criteria used for evaluating these BMPs included their installation cost, use rates, amount of pollutants collected, or measured changes in boater behavior when regarding educational efforts. The primary data used in this evaluation was collected through log books, purchase invoices, and a boater survey. See Appendix C for detailed survey methodologies and the individual case studies for details on the specific evaluation approaches used in each instance.

Document Organization

This document presents the methodologies used and the outputs, impacts, and tools produced by this project. It is divided into two sections. The first section, titled Best Management Practice Case Studies, presents the primary project outputs for each of the practices implemented and evaluated. The second section summarizes other related project outputs and impacts, such as the overall quantity of pollutants collected, number of boaters trained, amounts of educational literature distributed, and positive behavioral changes in boaters.

Appendices referenced in this document may be found in the larger technical report from which this report is excerpted — *Nonpoint Source Pollution Abatement for Recreational Boating Facilities: Applying Innovative Best Management Practices.*

BEST MANAGEMENT PRACTICE CASE STUDIES

Introduction

The following are case studies for each of the individual BMPs addressed (see Table 3 for a complete listing). Categorized by solid waste, liquid waste, and educational efforts, each case study provides: a general description of the practice; a summary of the implementation and evaluation processes used; an explanation of the associated costs, pollutants collected, and overall effectiveness; and concludes with final statements regarding the lessons learned and recommendations for the future use of these individual practices.

Table 3. BMP Case Studies Produced

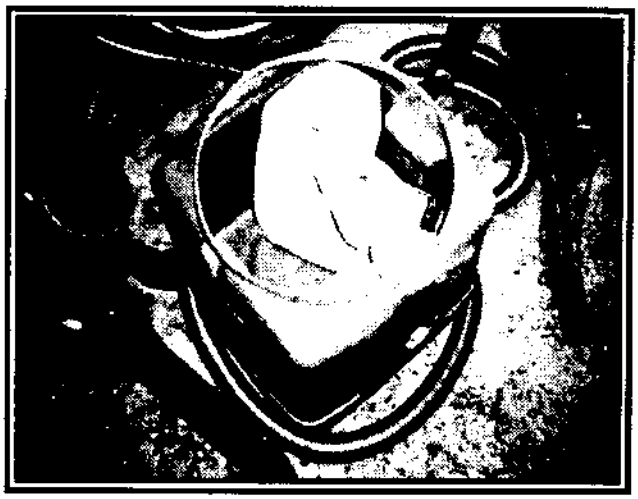
Solid Waste BMPs *(pages 4-7)*	Liquid Waste BMPs *(pages 7-13)*	Educational BMPs *(pages 13-18)*
1. Vacuum Sanders *(page 4)*	3. Separate Collection Facilities *(page 7)*	7. Literature Distribution *(page 13)*
2. Recycling *(page 6)*	4. Secondary Containment *(page 9)*	8. Signs *(page 14)*
	5. Spill Response Equipment *(page 10)*	9. Workshops *(page 15)*
	6. Spill Response Plans *(page 12)*	

Solid Waste Best Management Practices

Using Vacuum Sanders

Description

The dustless vacuum sander targets paint chips and other debris produced through hull maintenance activities, such as bottom sanding. As opposed to traditional equipment, this machine's sanding surface is ventilated to allow the attachment of a vacuum device, which automatically collects debris as it is removed from hull surfaces and before it can reach the open environment.



Implementation

The equipment purchased was the Fein Dust-Free Basic Sanding System. This high quality system included: Msf 636-1 Random Orbit Sander; Low Profile Dust Extractor with Auto Start; 16-foot Hose and Fittings; and a 5-pack of 1 micron filter bags. The equipment came with a full one year warranty and extended support plan that allows the owner to return the equipment to the factory every six months where it is cleaned and overhauled at no charge. For your local Fein distributor call 1-800-441-9878.

The equipment was used by staff and made available for tenant use at no cost. Tenants were notified by word of mouth, the mailing of two informational flyers (see Appendix D), and through the posting of these same flyers within the participating marinas. The equipment was offered on a first-come first-serve basis. Both staff and tenants were instructed on proper operating procedures before using the equipment and asked to fill out a brief questionnaire upon returning it (see Appendix D). The collected information was then compiled with the amount of material collected by the machine to establish a basis for evaluating its effectiveness.

Evaluation

Cost: $1,357 in equipment with an additional $50 in time and printing.

Pollutants Collected: With an estimated collection rate of 98 percent (Grlovich, personal communication), and in using standard 80 grit sand paper, this particular vacuum sander prepped 1,383 feet of vessel bottoms and in the process collected 171 pounds of bottom paint debris. By calculating a ratio, one can see that the machine averaged 1.98 ounces of collected material per foot of boat sanded. Standard ingredients of bottom paint for recreational boats, as exemplified by Interlux Fiberglass Bottomkot, is as follows: 42.75 percent cuprous oxide (of which 37.9 percent is elemental copper) and 57.25 percent inert ingredients.

Cost-effectiveness: With the project survey identifying that only 50 percent of the responding boaters actually sanded their hull this year, consider this: If just 35 percent of the State's 32,052 registered vessels (McGrath, personal communication) had their bottoms sanded with this type of equipment each year, at an average length of 20 feet per boat (McGrath, personal communication), approximately 27,765 pounds of solid waste could potentially be prevented from reaching the open environment annually. When considering the individual installation of these machines, the initial purchase cost appears to present a barrier to such wide spread use, but recent studies have shown that this is not necessarily the case. Ross (1996), points out that in addition to cleaning up the environment, the use of vacuum sanders can dramatically increase the efficiency of sanding operations while also generating significant profits through customer rental.

Lessons Learned/Recommendations

- Thoroughly research the market before purchasing your machine. Compare the overall cost, size of powerheads, quality of vacuum motors and filters, and the specifics of the individual warranties and product support plans.
- Consider developing a rental scheme to compensate for the initial investment. It can either be set up strictly to cover the cost of purchasing and operating the equipment, or it can be structured so as to become a profit center for the marina. Just remember: the lower the cost to the user, the more users you will have and the more pollutants you will capture.
- Publicize, publicize, publicize. If you do not get the word out, the machine will not be used enough to make a return—either in profits or pollutants collected—on the initial investment.
- In addition to the mailing or posting of temporary flyers, consider posting permanent signs in hull maintenance areas to inform tenants that the equipment is available for use.
- Do not forget about the benefits of word of mouth. Inform staff that whenever they see someone sanding with traditional equipment, they should advise them that a

professional vacuum sander is available for their use that is more efficient and will protect their health, as well as that of the environment.

- Always provide users with operating instructions and make sure that they understand them before using the machine. Take any steps necessary to limit liability on the part of the marina.
- Monitor the use and materials collected by the equipment for future reference. Such information could prove invaluable in making decisions regarding the continuation of the vacuum sanding program and/or regulatory compliance.

Recycling Glass, Tin, and Plastics

Description

Like homes, boats, and the marinas at which they are stored, produce many recyclable waste streams. But unlike most municipal neighborhoods, marinas often do not recycle these products because the service is not provided to them by local municipalities. Recognizing this, the aim of this BMP was to properly dispose of these solid wastes by privately providing recycling facilities for tin, glass, and plastics.

Implementation

Standard 96-gallon recycling totes were provided to two of the participating marinas by two different private waste disposal contractors for the collection of tin, glass, and plastics. The two marinas were of similar size (248 and 256 berths). Both marinas placed the totes at the head of their main piers, and adjacent to the dumpsters used for disposing of nonrecyclable solid wastes. All recycling totes were labeled with what they were designed to collect.

To further educate marina tenants on the use of the facilities, the second marina distributed additional educational flyers to each of the tenants (see Appendix E). Evaluation of this BMP was done by monitoring the volume of material collected prior to the weekly emptying of the totes.

Evaluation

Cost: The cost for providing recycling of glass, tin, and plastics averaged $32 per week, per facility.

Pollutants Collected: The two marinas averaged 1.95 full 96-gallon totes per week or the equivalent of 16.25 percent of a standard six yard dumpster's capacity.

Cost-effectiveness: This practice is effective in preventing reusable materials from being permanently discarded in landfills. However, it cost substantially more to recycle the material using a private waste hauler than to simply have disposed of it using the dumpsters that were already available. For example, the average cost to provide and empty a standard 6-cubic-yard dumpster was $36 per week. When you consider that it cost $32 per week to recycle what could have been disposed of in the dumpsters for $5.12 (16 percent of price based on volume of recylables collected), it becomes obvious that although recycling is the environmentally preferred disposal method, it may not be cost-effective in certain installations.

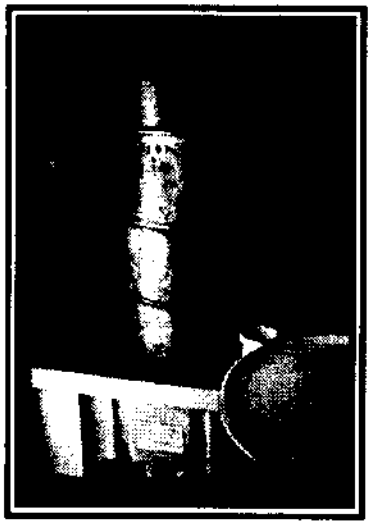
Lessons Learned/Recommendations

- Recycling is the environmentally preferred disposal method for reusable materials.
- Check to see if your municipality will provide the service at no cost or at a reduced fee. If not, try tackling the task in-house.
- Although the practice has proven environmentally effective, due to the fact that private service providers tend to be costly in the provision and emptying of recycling facilities, this method is economically inefficient.
- Recycling of tin, glass, and plastics can be economically efficient if its cost can be made compatible with the fee for standard disposal.
- Sufficient receptacles can be privately purchased and properly labeled for a nominal fee.
- Of the survey respondents not recycling, 50 percent felt that the process took up too much space onboard their vessels and was too time consuming; therefore, try to simplify the procedure by providing commingled collection bins.
- Recyclables can then be disposed of at no charge by either bringing them to municipal collection sites or by encouraging local "scrapers" to collect the metals.

Liquid Waste Best Management Practices

Providing Separate Disposal Containers

Description



A major component in minimizing nonpoint source pollution is in providing proper liquid waste collection and disposal facilities. When people cannot easily access such facilities, they tend to dispose of wastes, such as oil, antifreeze, and solvents, in improper ways. In addition to preventing pollutants from being improperly disposed, having separate containers for the collection of differing liquid wastes can save on disposal costs. For example, it can cost anywhere from two to three times the amount to dispose of a 55-gallon drum of oil that has been contaminated with antifreeze ($400-$550) than it would to dispose of an uncontaminated drum ($150) of pure waste oil (Kailer, personal communication).

Implementation

Reconditioned 55-gallon drums with lids were purchased from a local supplier identified through the yellow pages. These drums then served as the primary containers for the separate collection of diesel fuel and antifreeze. In order to ease the collection process, specially designed funnels that screw into the drums and provide sufficient room for the draining of portable containers and oil filters were purchased from the Oil Dri Corporation (for your local distributor call 1-800-Oil-Drip). All of the separate disposal containers were then supplied with labels detailing what they were designed to accept. The labels were produced in 4-inch white vinyl by a local sign maker identified through the yellow pages.

Once acquired, the drums were labeled, affixed with a funnel, and placed atop the two-drum secondary spill containment pallets (see the following case study). Signs were posted at the marinas directing patrons how to properly dispose of harmful materials. Educational fact sheets were also distributed (please see the educational BMP case studies for more detail on these processes). The final step in implementing this practice involved establishing an evaluation scheme. Marina operators decided to simply record the volume (in gallons) of material collected over the course of the boating season.

Evaluation

Cost: Drum-$14.95, funnel-$35, average label-$8, average installation time - four person-hours

Pollutants Collected: Two participating marinas averaged approximately 40 gallons of antifreeze, 350 gallons of diesel plus 17 gallons of gasoline, and 10 gallons of solvents with pre-existing equipment. Two other participating facilities also implemented this practice for diesel and antifreeze but no pollutants were collected. To put this in proper perspective, a few points must be emphasized: First, antifreeze is predominantly produced as a waste product during the early spring when people are de-winterizing or commissioning their vessels for summer use; and second, these facilities were not operational until after this period.

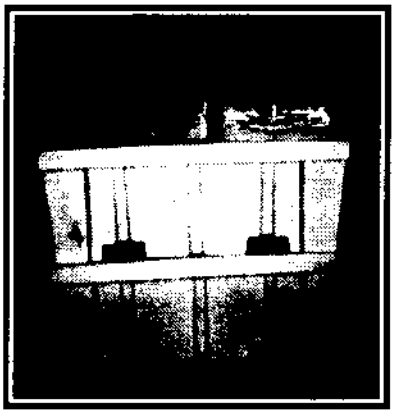
Cost-effectiveness: If one considers the volumes collected at the two participating marinas that had the pre-existing facilities, and the increased cost to dispose of contaminated wastes, one can conclude that a minimal investment in separate collection containers for disposal of liquid wastes can increase the amount of materials properly disposed and decrease the actual disposal cost over the long run.

Lessons Learned/Recommendations

- Carefully assess your needs for separate collection facilities. Full-service marinas will generally produce more waste streams then those who cater primarily to hauling and storage.
- At a minimum consider providing separate facilities for the disposal of waste oil, diesel, gasoline, antifreeze, solvents, and contaminated petroleum products (i.e., oils mixed with such things as antifreeze and/or water).
- Remember, if it costs $60 to install a separate container for the collection and disposal of waste oil that has been contaminated, but it takes two to three years to fill the drum, you still may be achieving a savings in disposal costs of between $200 and $300.
- The cost to provide separate disposal containers can be drastically reduced by reusing drums that you may already have on-site. Labels do not necessarily have to be purchased, they can simply be painted on and although a snug fitting funnel for draining temporary containers is a plus, it is not the only alternative.
- Design collection facilities so that they are easy to access. Over 57 percent of the survey respondents indicated that they did not use the provided facilities because it was easier to dispose of their wastes elsewhere. If possible, try to keep them open throughout the season and always make sure that sufficient capacity exists.
- If it not possible to keep them open or unlocked, consider providing a "drop-off booth" at some convenient point within the marina.

- Publicity, education, and proper instruction is the key. In order to reduce improper disposal practices by your staff and tenants, they must be aware of the facilities available to them and know how to use them correctly. Post signs in the collection area describing disposal methods. Distribute flyers and label containers appropriately. See the educational BMP case studies for additional details.
- Check with local regulatory officials on specific design criteria for hazardous materials storage areas.

Installing Secondary Containment



Description

All containers used to store waste oils and other such potentially harmful liquids should have a form of secondary containment. The primary purpose is to provide additional storage capacity for any materials that may leak due to the failure, overfilling, or improper draining of the primary storage container. Generally speaking, secondary containment should equal 110 percent of the capacity of the primary container and is usually provided by placing a non-leaching berm with an impervious bottom under or around the primary container.

Implementation

In providing secondary containment to the liquid storage facilities at the participating marinas, the decision was made to purchase commercially available products rather then constructing such facilities in-house. In all instances the product purchased was the Oil Dri Corporation of America's two drum spill pallet (product # 90525). Constructed to provide secondary containment for any two standard 55-gallon drums, these units can be easily transported in case of emergency and have been outfitted with spickets so that they may be drained of their contents when necessary. For your local Oil Dri Distributor call 1-800-Oil-Drip.

Implementation of the secondary containment units was accomplished by first placing them in their designated storage locations. The primary containers (55-gallon drums) were then placed on top of the pallets and opened for use. No specific educational activities were undertaken. This BMP was evaluated by checking the amount of liquids that had collected in the bottom of the secondary containment units at the end of the boating season.

Evaluation

Cost: $241 each with minimal time for installation.

Pollutants Collected: One quart of liquid waste was collected by one of the units. In this instance the leak was due to an improper filling of the primary storage container. If not for the presence of secondary containment, this leaked material would have been released directly into the ground.

Cost-effectiveness: These two drum spill pallets represent a very cost-effective means for providing secondary containment. In terms of pollutants collected, although only 1 quart of liquid waste was captured this season, we are confident that these units would be capable of containing a complete failure of the primary storage containers placed upon them. In terms of economics, it is felt that the initial purchase cost for these high-quality units is either equal to, or less than, the cost to produce a similar product in-house. It is also important to recognize several benefits inherent in the spill pallets' design — they are durable, easily transported, and equipped for draining.

Lessons Learned/Recommendations

- Proper secondary containment facilities are effective in controlling both small leaks or spills, as well as larger failures of primary storage containers.
- Secondary containment facilities should be regularly drained of any collected material so that their capacity at any point in time is equal to 110 percent of the primary storage containers.
- When standard 55-gallon drums are used as the primary storage containers, it may be cheaper to purchase commercially available containment units rather than trying to construct such facilities in-house.
- If larger storage containers, such as home heating fuel tanks, are used to store liquid waste, it may become more difficult to provide secondary containment. In these instances, consider removing the larger tanks and replacing them with a series of standard 55-gallon drums and spill pallets.
- As another alternative to replacing large tanks, consider the construction of a central collection site. A particular method worth noting is the use of septic tanks cut in half and enclosed. This approach can provide secondary containment for large quantities of liquid waste. Remember that in many states any storage facility that has the capacity to hold more than 500 gallons of petroleum products must be permitted (check with your department of environmental management).
- When constructing such facilities in-house, be sure to consider design elements such as overall capacity in comparison to the capacity of the primary containers, their permeability, and their ability to be transported and drained.
- Spill pallets capable of holding four 55-gallon drums are commercially available. With the capacity for four drums, these pallets can either be used for different types of liquid waste (i.e. one drum for oil, one for antifreeze, one for solvents, etc.) or to replace a larger container used for a single waste product.

Supplying Emergency Spill Response Equipment

Description

Oil spills resulting from marina-related activities pose a real threat to coastal environments and can impose considerable financial liability on individual marina owners and operators. Recognizing this, the ability to quickly contain and absorb such spills then becomes crucial in mitigating these potential negative impacts. In order to contain and absorb such spills, a certain amount of specialized equipment is recommended to be kept on-site. At a minimum, this equipment should include a sufficient length of boom (approximately 3 feet of boom to every foot of the largest vessel serviced) capable of containing spills and a sufficient quantity of materials capable of absorbing oil in a liquid environment (Amaral, Lee, and Rhodes, 1996).

Implementation

In this instance the spill response equipment decided upon was the Oil Dri 95-Gallon Oil Only Spill Kit (# 90943). Containing 130 feet of boom, 60 smart pads, 10 disposal bags, and an emergency response guidebook, this kit has the ability to absorb 164 gallons of fuel. For your local Oil Dri Distributor call 1-800-Oil-Drip.

Once acquired, the emergency spill response kit was permanently installed at the marina's fuel dock. After consideration, the marina manager decided to leave the storage container unlocked so that the equipment could be accessed at all times by marina tenants. In order to raise awareness of the above equipment, a sign detailing the basics of oil spill response was created and posted at the fuel dock (see Appendix H). Evaluation was accomplished by tracking the number of products actually used. In addition, any used products were to be collected and drained to determine the amount of oil that had been prevented from entering the open environment. In the event that a large spill occurred, the response kit was to be evaluated as to its effectiveness at containing the spill.

Evaluation

<u>*Cost*</u>: $496

<u>*Pollutants Collected*</u>: No instances arose at the participating marina where the deployment of the emergency spill response equipment was warranted. Therefore, no actual volumes could be collected or measured.

<u>*Cost-Effectiveness*</u>: Although the equipment was never actually used by the participating marina, it is felt that this kit is fully capable of absorbing the 164 gallons of oil that the manufacturer claims. Assuming that this is true, when compared with the high costs associated with having a private company respond to a 100-gallon oil spill one can see that the purchase cost of an emergency spill response kit of this caliber is well worth the initial investment.

Lessons Learned/Recommendations

- An ounce of prevention is worth a pound of cure. Look at your marina with a critical eye. Try to identify and correct potential spill sources before they occur.
- If the cost for the purchase of a complete emergency spill response kit seems too high, consider buying booms and absorbents separately and constructing a storage container on your own.
- Equipment does not necessarily have to be purchased all at once. Small sections of boom and bales of absorbents can be purchased individually over time.
- Spill response equipment is not helpful if it is locked up during a spill where people cannot access it. Therefore, before deciding on locking the storage container, experiment with leaving it open so that tenants can access the equipment at any time.
- Consider leaving the storage container unlocked just on weekends and holidays when there is more activity and therefore more potential for spills.

- Both staff and tenants need to be educated on the use and disposal of emergency spill response equipment. Use signs, educational literature, and workshops to instruct them on the proper use of the equipment.
- Develop and maintain a spill response plan.

Developing Spill Response Plans

Description

Simply having the proper equipment available for responding to oil spills is not enough to ensure proper oil spill response and cleanup efforts. An Oil Spill Response Plan clearly identifies the who, what, when, where, and how of spill response for a particular marina. In its most basic sense, the oil spill response plan is simply a proactive safety device which outlines a set of procedures for correctly responding to such an emergency.

Implementation

If proper oil spill response equipment is already available, there is almost no need for additional capital outlays in the development of a spill response plan. We used the *Environmental Guide for Marinas* model oil spill response plan as the reference source in completing the individual spill response plans. Two meetings were held with marina managers to identify potential spill threats, agree on spill response tactics, designate specific personnel with specific roles, and identify contacts for additional spill response equipment (See Appendix F).

Evaluation

Cost: Approximately four person-hours to research and develop the plan with an additional two person-hours for staff review and instruction.

Pollutants Collected: No actual events occurred to allow the spill response plans to be implemented. Therefore, we cannot estimate the amount of pollutants collected, or in this case, prevented from reaching the open environment as a result of having developed a spill response plan.

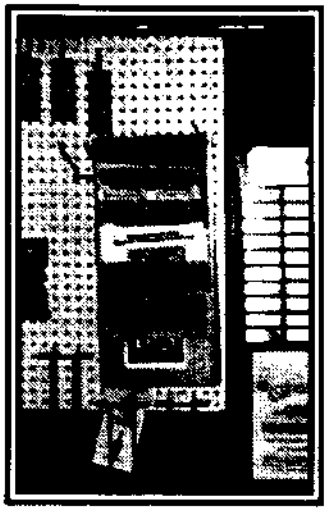
Cost-effectiveness: The implementation cost for this BMP is extremely low, and the development of spill response plans can be very cost-effective. The primary benefit is that the appropriate individuals can then respond to the potential threats identified, become more aware of the procedures to follow in the event of a spill, know where and how to access the necessary response equipment, and better respond to actual emergencies.

Lessons Learned/Recommendations

- The development of spill response plans is straightforward, inexpensive, and can be easily accomplished by marina staff without the assistance of costly private consultants.
- The *Environmental Guide for Marinas* serves as an excellent resource for the development of spill response plans.
- The process of developing the plan with staff is an educational experience, but training in actual spill response is most helpful.
- Properly informed actions on the part of marina representatives in the early phase of spill response has the potential to reduce cleanup costs and marina liabilities.

Educational Best Management Practices

Distributing Literature



Description

Distributing educational literature is often cited as a primary means for informing boaters on nonpoint source pollution controls for marinas. In most instances undertaking this approach depends on three primary factors: what types of literature to use, where to acquire it, and how to distribute it. In regards to the information types, flyers, posters, short booklets, and fact sheets are commonly cited. Although these can be produced in-house on a case-by-case basis, the most likely source of these materials is from governmental and nongovernmental environmental organizations and through industry-related trade associations.

Implementation

The first task was to acquire good source materials that were widely applicable, accurate, appealing, and concise. Once these materials were found, they were adapted to suit particular needs. This was done by CRC/Sea Grant and the NBEP, who then coordinated the production and publication of a Boater Fact Sheet Series that covers the topics of sanding and painting, solid waste disposal, vessel sewage, bilges, fueling, and spill response; vessel cleaning and fish waste; and routine engine maintenance (see Appendix G).

Two different distribution methods were then implemented. The first method used standard literature display racks that were set up at convenient locations within three of the participating marinas. The racks were stocked with materials and monitored as to how many individual fact sheets were taken each month by the marina customers. The second method involved including one of the fact sheets in each of the five marinas' monthly billings over the course of six months. The content of the fact sheets coincided with the activities of boaters during different times of the season. For example, we mailed the sanding and painting fact sheet at the end of April, solid waste disposal in May, vessel sewage in June, and so on. After completing the six-month distribution process, this method was then evaluated through the use of a survey that asked the marina customers if they had been reading the fact sheets, and if they were now using any BMPs that they had learned from reading them.

Evaluation

Cost: The costs associated with the display rack averaged $52.80 per marina ($45 to purchase the rack and $7.80 to stock it with 20 copies of each fact sheet). The cost for the monthly mailings averaged $45.36 per marina ($7.56 for copying per month times six months).

Educational Value: Educational value refers to the ability to persuade the audience to use new BMPs. Through the survey, we identified that distributing literature ranked second among the customers' follow-up choice for best method of informing them. Additionally,

75 percent of those who received the fact sheets actually read them, and of that 75 percent, 91 percent have since begun to use BMPs that they learned by reading the materials.

Cost-effectiveness: Distributing literature has proven very effective in its ability to get boaters to use BMPs. In addition, there was not much difference in cost for the two distribution methods used. The mailing method proved more cost-effective because marinas were able to mail an average of 126 copies per month per marina, whereas the use of the literature display rack averaged only five copies per month per marina.

Lessons Learned/Recommendations

- Distributing literature ranked second among the boaters choices for best method of informing them and had the highest effectiveness rating of the three educational BMPs addressed. The use of this approach is highly recommended.
- Distributing literature through monthly mailings was far more cost-effective in reaching the target audience than simply using display racks, since participating marinas were paying for the postage regardless of the inclusion of individual fact sheets.
- If the use of monthly mailings is not applicable in a specific instance, consider sending mailings with the seasonal contracts or placing copies directly on the individual vessels stored at the marina at different points in the boating season.
- Perhaps the most important lesson learned about this approach was that you cannot expect customers to take information. For this approach to be truly effective, marina operators must put the materials directly in their hands.
- Rhode Island Sea Grant now has a series of six boater fact sheets available that are widely applicable, accurate, appealing, and concise.

Posting Signs

Description

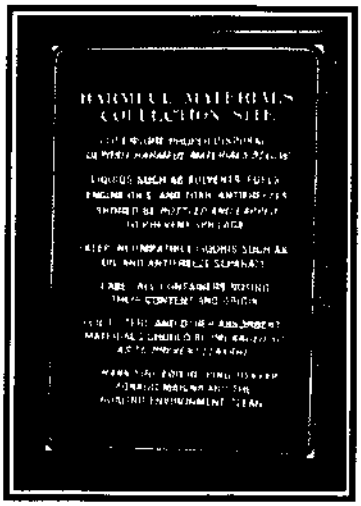
The use of signs has long been recognized as a means for informing people. In this instance they were used to educate boaters on specific BMPs that they can use to help reduce nonpoint sources of pollution from marinas.

Implementation

The first task involved categorizing and compiling materials into logical topics that would be appropriate for posting at different locations within the facility. We identified several consistent priority topics for signs, including solid waste disposal tips, harmful materials, or liquid disposal tips, and instructions for responding to spills and the operation of pumpout stations.

With the topics decided, the specific language was developed (see Appendix H) and the production of the signs was contracted out to a local sign maker. Constructed of steel with vinyl backgrounds and lettering, the 36-by-24-inch signs were then posted in appropriate places. For example, solid waste disposal signs were placed near facility dumpsters, and spill response instructions were placed next to facility spill response equipment.

After completing the installation of the signs, this approach was then evaluated through a survey that asked the marina customers whether they had learned new waste disposal BMPs through reading the signs, and whether they were now using the practices that they had learned.



Evaluation

Cost: $105 per sign, with minimal installation time.

Educational Value:. Through the survey, we identified that the posting of signs ranked first among the customers' choice for best method of informing them. Additionally, 72 percent of those who read the signs learned new practices, and of that 72 percent, 79 percent have since begun to use the BMPs that they learned.

Cost-effectiveness: The cost of the signs initially appears high when compared to the costs associated with distributing literature. However, when one recognizes that the literature distributed will usually only serve a one-time benefit, whereas the signs will continue to spread the word to people over the course of years, one can see that posting signs can be quite cost-effective, especially if the signs can be produced in-house or at a cheaper rate.

Lessons Learned/Recommendations

- Posting signs was ranked first by boaters as the best method for informing them. It ranked second in terms of its effectiveness in getting boaters to use BMPs.
- Priority topics for the posting of educational signs include solid waste disposal, liquid waste disposal, pumpout station operation, and spill response instructions.
- Developing the specific language for educational signs does not have to be difficult (see Appendix H).
- Although signs need to be durable, legible, and eye-catching, they do not necessarily have to cost a lot. In many instances, they can be made inexpensively with some wood and a little paint.
- In order to be effective, signs need to be visible, even if that means making several copies of the same sign and posting them in different locations.
- Make sure signs are of an appropriate size and post them in suitable locations.

Conducting Workshops

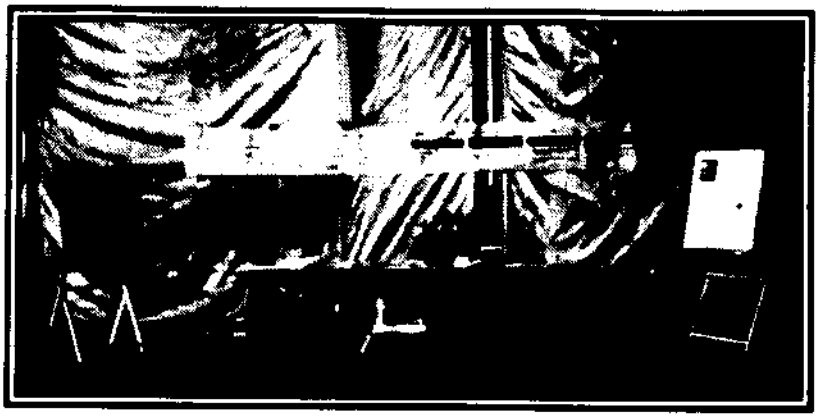
Description

The *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* (EPA, 1993) states that "meetings/presentations at local marinas or other locations are a good way to discuss [nonpoint source pollution issues] with boaters." To this end, we conducted several such events/workshops and assessed their value.

Implementation

Preparation involved cataloging and categorizing the materials to be presented. Once this task was complete, three different formats were selected for use. The question-and-answer forum, slide show presentation, and facility walking tour (see Appendix I). In addition to using three different formats, several different venues were selected: the facility walking tour was conducted at the marinas. The question-and-answer forums also took place at the

marinas, although one event was incorporated into an existing function traditionally well-attended by marina customers. The first slide show presentation was scheduled for a large local boating supply store, and the second was held at an adjoining restaurant, with appetizers and refreshments provided by the marina operator.



With the actual content, organization, and location of the events finalized, the planning then shifted to publicizing the various events. Although the approaches used varied slightly among marinas, publicity flyers (see Appendix I) were the primary advertising vehicle. They were posted throughout the participating facilities and mailed, on two occasions, to marina tenants. The one exception was the slide show presentation held at the local boating supply store. For this event, an additional 200 flyers were given to the store to be handed out over the two-week period preceding the event.

Once preparations were completed, the actual events were conducted in accordance with the individual session plans. Events/workshops were evaluated through a survey that asked marina tenants the following questions: 1) Were you aware of the workshops? 2) Did you attend? 3) If you did attend, are now using the BMPs discussed? 4) If you did not attend, what would have encouraged your participation?

Evaluation

Cost: With the exception of publicity efforts (which averaged $16 per facility) and the slide show presentation conducted at the restaurant, there were no large costs associated with purchasing needed equipment or materials for the individual workshops. On the other hand, one must recognize that it takes a *considerable investment of time* to plan and conduct a successful formal workshop. On average, 10 hours were needed to plan and publicize the events, two hours to gather any needed materials, three hours to advise any additional speakers, two hours to do a preliminary dry run, and an additional three hours to set up, conduct, and clean up after the actual event.

Educational Value: Conducting workshops ranked last among customers' choice for best method of informing them. Additionally, of the 26 percent who were aware of the workshops, only 9 percent chose to attend. It is important to note that the low percentage of survey respondents aware of the workshops might not be representative, as the events were conducted one year prior to the administration of the survey, and therefore, respondents could have forgotten of their notification. Of those who were clearly aware of the events and attended, only 31 percent have started to use BMPs learned at the events.

Cost-effectiveness: When comparing the average investment of time and resources for preparing and conducting formal workshops with the 9 percent attendance rate observed and the associated 31 percent effectiveness at getting participants to use BMPs, the cost-effectiveness is very low compared to the other educational approaches presented.

Lessons Learned/Recommendations

- Conducting workshops ranked last among methods to inform boaters and had the worst effectiveness rating of the three educational approaches tested.
- If conducting workshops is the chosen approach, focus on traditional publicity methods, such as word of mouth and the posting and mailing of flyers, and more importantly, try to schedule the event into an existing marina function that is traditionally well-attended by tenants. This will give you a large audience with minimal effort.
- To increase attendance, try offering incentives, such as door prizes, discounts, free product samples, or even a small social event following the workshop.
- In terms of workshop formats, the facility walking tour appeared to be the best method, as it allowed participants to gain hands-on experience in the benefits and use of BMPs through actual on-site demonstration of products and procedures.
- The slide show presentation appeared less effective than the walking tour, but more effective then the question-and-answer forum, in that it engaged the participants and allowed the opportunity for the presentation and discussion of appropriate BMPs.
- The question-and-answer format proved least effective in that it was difficult to engage the tenants.
- Finally, the conducting of successful formal workshops requires a considerable investment of time and resources. If sufficient time and resources are not available, it is better to reconsider that approach, rather than conduct an event that may set negative tones for future BMP implementation, evaluation, and education efforts.

SUMMARY OF OTHER PROJECT OUTPUTS AND IMPACTS

This section highlights associated project impacts that are not directly referenced in the preceding BMP case studies. These include pollutants collected, amounts of educational literature distributed, positive behavioral changes measured, and tools developed for marina operators.

Pollutants Captured

Although the total ramifications of this project in terms of pollutants prevented from reaching the open environment cannot be reasonably estimated, the collection and proper disposal of 171 pounds of bottom paint debris, 22.12 cubic yards of recyclables, and 1 quart of waste oil can be directly attributed to this project.

Educational Literature Distributed

A total of 85,204 (see Table 4) individual pieces of educational literature were distributed to boaters and marina operators over the course of this project. This number is bolstered by the fact that four of the six Boater Fact Sheets used in the second season (see Appendix J) were published by *Rhode Island Boating Magazine* (see Appendix G), which, as quoted by its publisher, has a monthly circulation of approximately 20,000 copies (Miner, personal communication).

Several major events were also attended by CRC/NBEP representatives for the purpose of disseminating this information. These events included the 1996 Greenwich Bay Day Celebration, The Watershed '96 video downlink held in the city of Warwick, and the 1996 Rhode Island Department of Environmental Management (RIDEM) Pollution Prevention Conference held at the Rhode Island Convention Center. An additional 1,200 copies of the Boater Fact Sheet series have been set aside for distribution at the upcoming 1997 Rhode Island Indoor Boat Show. These are not accounted for in Table 4.

Table 4. Educational Literature Distributed by Method

Material	Boater Workshops	Mailings & Distribution Racks	Public Events & Magazines	Total
First Season				
Project Description	122	15	38	175
Boaters Guide	120			120
MARPOL Placard	128		17	145
Cleaning Article	119			119
Pumpout Map	121	5	35	161
Coastal Features	114			114
Second Season				
EQ/IQ		4	49	53
Fact Sheet 1		635	20,043	20,678
Fact Sheet 2		900	20,039	20,939
Fact Sheet 3		637	24	661
Fact Sheet 4		644	24	668
Fact Sheet 5		642	20,044	20,686
Fact Sheet 6		641	20,044	20,685
Total	724	4123	80,357	**85,204**

Positive Behavioral Changes Measured

According to the survey conducted, an average of 73.5 percent of the boaters from the participating marinas noticed, received, and/or read the educational fact sheets distributed and signs posted. Of those who learned new practices from these approaches, an average of 85 percent of them are now using BMPs. Using these figures, we can then estimate that 706 individuals have made some type of positive change toward reducing nonpoint source pollution in their boating behaviors. Additionally, 31 percent of the 38 individuals who attended the educational workshops have made an effort to control nonpoint source pollution in their boating behaviors. If we apply the same statistics as used above to the Boater Fact Sheets distributed via *Rhode Island Boating Magazine*, we can assume that an additional 13,650 individuals have made some type of positive change. Overall it is estimated that as a direct result of this project, a total of 14,368 individuals have made positive changes regarding nonpoint source pollution reduction in their boating behaviors.

Tools Developed for Marina Operators

Through this project, a group of previously unavailable tools have been developed for marina operators. These include educational materials, such as detailed instructions for conducting boater workshops, sample language for the posting of educational signs, and a Boater Fact Sheet series widely suitable for distribution across this state and perhaps beyond. In addition to these educational materials, elements such as rental agreements and operating instructions for the use of vacuum sanders, have also been made available, along with a demographic and social profile of the Rhode Island marina customer base (see Appendix C).

Transferring the Experience

These final outputs, impacts, and lessons learned must now be transferred to coastal regulators and marina operators within this and other coastal states. To accomplish this, several efforts have and will be undertaken. First, the case studies included in this document will be formatted into one-page documents and posted on the MarinaNet World Wide Web site. At the present time, CRC Sea Grant and the NBEP are trying to locate additional funding for the professional publication of a "glossy" document that would highlight the lessons learned and experiences gained through this project.

Outside of the written realm, CRC Sea Grant will continue to actively transfer the experiences gained via formal and informal public speaking/technical assistance events. CRC/Sea Grant representatives recently unveiled the project's preliminary findings to Rhode Island's marina operators and coastal regulators at the R.I. DEM 1997 Pollution Prevention Conference. In addition, two project-related abstracts have been submitted for the International Marina Institute's Fourth National Marine Research Conference to be held in Dallas-Fort Worth on March 8, 1997.

LITERATURE CITED

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APPENDICES

Appendices referenced in this document may be found in the larger technical report from which this report is excerpted — *Nonpoint Source Pollution Abatement for Recreational Boating Facilities: Applying Innovative Best Management Practices.*