ANNEX G:

Sensitive Environmental and Economic Areas

ANNEX G: SENSITIVE ENVIRONMENTAL & ECONOMIC AREAS

1.0 PURPOSE

Response actions require extra care to protect the natural environment and economically important areas in and around the spill location. Different eco-systems have varying levels of resistance and resilience to spill contaminants. There are areas around waterways which contain critical habitats and endangered species which may require more specialized consideration and protection than other areas. For example, deployment of protection devices such as booms and weirs along a river may serve to protect the overall environment but quick and accurate identification of sensitive areas is crucial to reducing the overall impact of the spill.

Contained in this annex is an outline of factors which can be used to identify sensitive environmental and economic areas.

Outlined within this Annex is information which can be utilized to distinguish sensitive areas found throughout the Region. It is not the intent of this annex to provide a complete and total listing of every sensitive area; a thorough listing of all these areas would be to large to be useful. Provided is a list of factors which should be taken into account when assessing potentially sensitive areas. The goal of this annex is to increase awareness of sensitive areas as a whole and to provide the Incident OSC with sufficient information to facilitate the identification process.

There is no way to outline a regimented and systematic approach to protecting all sensitive environmental and economically important areas for every spill. Each spill is unique in the manner and volume of the material spilled as well as its location with respect to an area. These dynamic factors prevent the drafting of a concrete response plan. Rather, the information contained in this Annex should be used to provide insights into the types of environments effected by a spill and what areas warrant greater and or immediate concern. It is an unfortunate fact that ecosystems and economic areas will be impacted by a spill, and that some of the ecosystems and economic areas may have to be sacrificed in the cleanup effort. However, it is the goal of this Annex to provide information which will help the OSC to identify sensitive areas and take the appropriate measures to minimize the impact of the spill.

2.0 RESPONSIBILITIES

The following is a description of the roles and responsibilities of Agency personnel during a spill response.

2.1 OSC

As prescribed in the NCP, the OSC's role is to facilitate cleanup activities and to insure proper measures are taken to remediate the incident. The OSC's function is to work in cooperation with the responsible party and state agencies to provide a quick and effective cleanup. It is preferable for the responsible party and the State to take the lead in a cleanup operation, however the USEPA may have to step to the forefront of a response action to protect threatened habitat or species. The OSC should work with other agencies to ensure that information about the sensitive areas affected by the spill is gathered and distributed. Outlined in this Annex are various sources of information which the OSC may consult to assist in determining and

protecting sensitive areas endangered by the spill.

2.2 STATE AGENCIES

Each state in Region 4 has a department or office charged with protecting the natural resources of that State. Many of these State agencies catalog and monitor sensitive environments and economically important areas. These personnel will have more detailed information about the environments affected by a spill, and are crucial in identifying specific areas and resources.

2.3 NATURAL RESOURCES TRUSTEES:

2.3.1 Department of the Interior (DOI):

DOI is contacted through the Regional Environmental Officer, who is the designated RRT member and the DOI trustee representative. Department land managers have jurisdiction over the National Park system, National Wildlife Refuges and fish hatcheries, public lands, and federal minerals. The bureaus have expertise as follows:

The Fish and Wildlife Service (FWS): Threatened and endangered species and associated habitats, migratory birds, certain marine mammals, certain anadromous fishes; waters and wetlands; and effects on natural resources.

The Bureau of Land Management (BLM): Minerals, soils, vegetation, wildlife, habitat, archeology; and hazardous substances.

The National Park Service (NPS): Biological, natural, and cultural resource managers to evaluate, measure, monitor, and contain threats to park system lands and resources; archaeological and historical expertise in protection, preservation, evaluation, impacts mitigation, and restoration of cultural resources.

The Minerals Management Service (MMS): Oversight of offshore oil and gas exploration and production facilities and association pipelines and pipeline facilities; oil spill response technology research; and oil discharge contingency planning requirements for offshore facilities.

The Bureau of Indian Affairs (BIA): Coordination of activities affecting Indian lands; assistance in identifying Indian tribal government officials.

2.3.2 Department of Commerce - National Oceanic and Atmospheric Administration (NOAA)

NOAA is a resource trustee for waters navigable by deep draft vessels in or under or using tidally influenced waters or waters of the contiguous zone, the exclusive economic zone and the outer continental shelf. NOAA can also provide the Scientific Support Coordinator.

2.4 PRIVATE ORGANIZATIONS

2.4.1 State Natural Heritage Programs

All states in this Region have State Heritage Programs to locate and monitor bio-diversity in their state. These programs have been setup in joint cooperation with The Nature Conservancy and the States of the Region. Individual agreements are being setup between the Agency and the states to provide incident specific information concerning threatened and endangered species in the event of a spill.

2.4.2 Conservation Groups

Many natural areas are monitored by local and national conservation groups, such as local fishing clubs like Trout Unlimited and member organization such as The Nature Conservancy. Local groups can be contacted at the time of the spill to obtain information on waterways they monitor and are potential sources of information on the local natural resources. Many national groups often maintain wilderness preserves.

2.4.3 River Cooperatives

Certain river systems throughout Region 4 have semi-private river organizations that monitor and notify water intakes and other economic users of the river. Where possible the OSC should utilize the services of these cooperatives during a spill or discharge. These organizations can help with notification and may also have information otherwise immediately unavailable.

3.0 PROCEDURES

3.1 INITIAL PROCEDURES

On arrival at a spill, the OSC must make an initial assessment to determine the material and volume of the spill. As a part of this initial assessment, it is necessary for the OSC to determine the geographical and environmental factors of the area surrounding the spill in order to plan the proper protective and remedial measures. Guidelines for determining whether an environment is sensitive are presented in the next section. The steps for ascertaining the environmental impact of the spill are as follows:

3.1.1 Spill site

Investigate the spill location and the natural areas already impacted to determine the extent of damage. Determine if any immediate actions at the scene can lessen further damage. At the spill site, the OSC should determine the direction and rate of the flow. Immediate steps should be taken to stop the additional release of material and to contain the spill.

3.1.2 Notification

The FOSC must notify the Natural Resource trustees of the spill and information gathered in Section 3.1.1. The FOSC should request, either through the RRT or directly to the Natural Resource Trustee, assistance in identifying sensitive areas. Notification procedures are listed in the Region 4 blue book and Section 4.3 of this Annex.

3.1.3 Areas of immediate danger

Following the assessment of the spill site, the OSC or representative should examine the areas immediately downstream or adjacent to the spill, which although may not have been effected by the spill, are in immediate danger of contact with the spill. *(Immediate danger can be defined as impact occurring in a matter of hours.)* If, based on information from the Natural Resource Trustee, sensitive areas are located, then preemptive measures should be taken to minimize the spill's impact prior to contact. This includes, but not limited to, booms, dams, or other diversion measures to lessen the impact of the spill. Preservation of a sensitive area depends on actions taken prior to spill contact.

3.1.4 Areas of potential danger

While steps are being taken to control the spread of the spill, advance teams should conduct a reconnaissance to determine what other sensitive areas might be impacted if the spill flows further downstream. If sensitive areas are located, provisions shall be made to protect these areas in the event of further release. Preparation should be made for the deployment of additional cleanup teams, in the event of a breakthrough of previously contained material.

3.2 SECONDARY PROCEDURES

Once a sensitive area has been identified and protective measures have been taken, the OSC shall monitor the integrity and effectiveness of these measures. Inspections will be carried out to ensure that the protective measures are holding in place and no additional measures are needed. The OSC will continue to notify the appropriate trustee, to monitor the ecological health of the threatened area.

4.0 DESCRIPTION OF SENSITIVE AREAS

4.1 GENERIC CRITERIA

The following is a partial listing of the area types which might be considered sensitive, either environmentally or economically, within EPA Region 4. This listing should also be considered, in order of appearance, as the general response priority for protection. During a response, the protection priority may be changed by the RRT Chair in consultation with the appropriate Natural Resource Trustees. For a listing of Region 4's sensitive areas, refer to AEPA Region 4 Watershed Vulnerability Assessment@ October 1997.

4.1.1 Sensitive environmental areas

1) Endangered Species. Includes species listed pursuant to the Endangered Species Act (ESA) as threatened or endangered and the ecosystems upon which they depend. Such ecosystems, known as critical habitat, are defined as specific areas on which are found those physical or biological features essential to the conservation of the species and which may require special management considerations or protection.

2) Natural Areas. These are areas which possess value as a whole ecosystem and/or deemed to be of significance to have special designation and protection. They may not contain endangered species, but are representative of the ecosystem in its most natural state. Such areas include units of the National Park System, units of the National Wildlife Refuge System, wilderness areas, state designated wildlife management areas, state parks, water management districts, etc.

Biologically Important Habitat. These areas support communities of animals and plants which although might not come into direct contact with the spill, rely on the area for habitat. These areas also include marshes, swamps, and other areas where water flow is usually slow and has a high occurrence of vegetation and hydric soils. These areas support a large amount of species diversity and can be used by these species for breeding, resting, feeding and cover.

Culturally Important Areas. These areas include Ahistoric properties. The National Historic Preservation Act defines historic property as "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on the National Register"; such term includes artifacts, records, and remains which are related to such district, site, building, structure, or object. 16 U.S.C. Section 470(w)(5). The statutory definition of historic properties and the established criteria determine whether a historic property needs to be considered during emergency response. A historic property need not be formally listed on the National Register to receive NHPA protection, it need only meet the National Register criteria (i.e., be eligible for listing in the National Register).

4.1.2 Sensitive economic areas

Water Intakes: Throughout the Region, rivers and creeks provide primary or secondary water sources to cities and towns. In a discharge or release these intakes may have to be shut down or flow reduced. In the case of primary sources, shut down may deplete a city's water reserve.

Other: There may be other economically sensitive areas potentially impacted by the spill or discharge that may need protection. The OSC and the OSC representative should consult with the state and local responder to identify these potentially sensitive areas.

4.2 CHARACTERISTICS TO DETERMINE AND IDENTIFY SENSITIVITY

The following factors are to be utilized in determining sensitivity of an area. These factors are not the only criteria for determining sensitivity, but are presented here to provide a general formula.

4.2.1 Environmental factors

A. Geography: Examine the position of the river or waterway. River and lake characteristics differ whether they are positioned in the Piedmont or Coastal Zone. Refer to a map of the state to determine in what zone the waterway is located. The Piedmont Zone lies above the fall line, and waterways are distinguished by shallow, fast-flowing rivers which usually have many changes in direction. The forest surrounding a Piedmont Zone river predominately consist of hardwoods and the land slopes sharply to the river. Below the fall line, in the Coastal Zone, the rivers straighten and widen with a steady flow. The land around the river has a more gradual slope.

   Many of the larger lakes in the Region have been developed by the construction of dams along rivers. These areas are widely used by communities for recreation and a spill can impact these activities. Conditions vary whether a water way is a tributary stream or major river. Tributaries are usually not as fast-flowing as major rivers and are often used as breeding grounds for aquatic wildlife. Also, tributaries do not "flush out" as fast as major rivers and spill material may collect in pools or eddies.

B. Season: Water flow and the dispersion of flora and fauna varies widely with the season.

Steps should be taken to determine what species and habitats are more susceptible at different times of the year. In the winter time, vegetation is dormant and less vulnerable than in the summer growth seasons. The animal communities found in and around a waterway also differ in members and numbers throughout the year.

C. Habitat: The types of habitat that may support endangered species are not uniformly distributed on rivers, even those rivers which are similar. Evaluate the potential for sensitive habitats by the amount of development present on the river, the impact of past spills or whether the location could be considered pristine.

D. Lists/Maps: Examine a listing of protected sections of rivers, public and privately held conservation areas, and State and National Wildlife areas. Also, any listing of endangered species by county for each state in the Region along with a state map. Consult these resources for information on areas immediately effected by a spill and areas which might be impacted as the spill progresses.

E. Local Resources: Determine what local sources of information are available for the area of the spill. Consult State Heritage Programs or local conservation groups for detailed information concerning impacts a spill might have on the areas biologic systems.

F. On-Scene Conditions: OSCs should use their own observations and the information gathered by advance teams to determine the areas likely to be impacted. Reconnaissance of waterways should be done to determine what areas are likely to be sensitive and then verify or deny. All spills have different components, as do all eco-systems and natural habitats. All information gathered should be considered to determine the best strategy for protecting sensitive environments.

4.2.2 Economic factors

A. Drinking Water Intakes: One type of economically sensitive area is the public drinking water intake. These facilities are located on the shores of streams or rivers used as a municipal water source. These intake points can be located by contacting the local agencies concerned with local water supply.

Affected agencies should be notified of the spill as soon as possible and advised to prepare for the protection of the municipal water intakes. Additional protection measures may have to be undertaken to prevent the contamination of the local drinking water supply.

B. Other Sensitive Economic Areas: Other potentially impacted economic areas can be identified by state and local sources at the scene of the incident.

4.3 Notification of Trustees

State State trustee notification requirements are satisfied by OSC contact with the State emergency response contact listed in the State contact section of the Region 4 OSC Blue Book.

Federal The OSC shall ensure that the trustees for natural resources are promptly notified of discharges or releases. The OSC shall coordinate all response activities with the affected natural resource trustees and, for discharges of oil, the OSC shall consult with the affected trustees on the appropriate removal action to be taken.

APPENDIX C-1: RESPONSE STRATEGIE

1.0 PURPOSE and SCOPE

This section outlines strategies for responding to incidents within the Region 4 area. The diversity of spill scenarios makes it impossible to predict specific actions for every release. This appendix will not identify an optimum spill response option, but provide options for selection to satisfy the existing situation. Unexpected factors occur in every response which complicate even the best of strategies. Therefore, it is the responsibility of the OSC to continually assess a spill situation so that the Agency's priorities are met and resources used effectively. The information contained within this Appendix is designed to assist the OSC in making response decisions that are consistent with the following priorities:

RESPONSE PRIORITIES

Priority 1. Protect Human Life and Health

A. Worker/Responder Safety
   * Fire and explosion threat
   * OSHA requirements
   * Boating and water safety

B. Public Safety
   * Protection of drinking water intakes
   * Alternate water supplies
   * Air monitoring, if burning occurs
   * Evacuation

Priority 2. Reduce Overall Impact of Spill

A. Control Spill Source
B. Implement Prevention Measures:
   * Physical containment
   * Burning
   * Dispersants
   * Bioremediation
C. Monitor

Priority 3. Protect Environmentally Sensitive/Critical Habitats

A. Identify Sensitive Areas
B. Develop Protection Strategy
C. Conduct Wildlife Rescue

Priority 4. Protect Economically Sensitive Areas

Priority 5. Cleanup Spilled Material

A. Physical Recovery
B. Shoreline Countermeasures

Priority 6. Restoration

2.0 RESPONSIBILITIES

It is up to the OSC to assess the incident situation and determine what strategy to undertake to comply with the Region's strategies. The OSC must also coordinate all activities to ensure that the priorities are fully understood and are being followed.

3.0 PROCEDURES FOR DEVELOPING A STRATEGY

STEP 1: GATHER INFORMATION

Ask the following types of questions before developing a response strategy.

* What is the exact spill location?
* How much oil was released? What type?
* Where is oil going? How fast?
* What are the dissipation characteristics?
* What is located downstream?
* What resources are at risk?
* What are the on-scene weather conditions?
* What circumstances require special attention?
* Is there a fire or explosion threat?
* What are the public safety hazards?
* Is there adequate access for equipment?
* Where can collected material be stored and disposed?
* How can the available resources be utilized to meet the agency's priorities? What other actions need to be taken immediately?
* What equipment is available?
* How long will it take to get to spill site?
* What approval is needed for a proposed response method?
*What are future weather conditions?
* What actions are being taken so far?

STEP 2: PRE-RESPONSE ASSESSMENT

* Determine the level of response needed.
* Begin filling positions to support the chosen level.
* Form the cleanup and advance teams, and arrange for logistics.
* Deploy the teams to gather information needed to make further decisions.

* Establish the operations centers.
* Contact appropriate persons to arrange for funding of the response.

STEP 3: INITIAL ON-SITE ASSESSMENT

* Determine priorities and specific strategies for each area at risk.
* Coordinate between the Incident Operations Center and the field teams. Communication is vital.
* Determine the Public Health issues.
* Notify the necessary officials of any impact to drinking water or industrial intakes.
* Locate provisions for an alternate water supply.
* Review Response Operations Guidelines in this Annex.

STEP 4: MOBILIZATION LOGISTICS

* Identify sources for additional personnel and equipment. Mobilize to the site as needed.
* Ensure that personnel are properly trained, and health and safety issues are addressed.
* Contact the Natural Resources Trustees.

STEP 5: ON-SITE LOGISTICS

* Arrange additional resources as needed. (i.e. food, lodging, additional clothing, transportation, communications, air support).
* Develop and Implement Site Safety Plan.

4.0 GUIDELINES FOR RESPONSE OPERATIONS

GENERAL GUIDELINES

* Obtain all necessary concurrence from RRT and any other relevant agencies before using any treatment/response method.

* Become familiar and comply with approved methods, work plans, advisories and special instructions prior to implementation.

* Minimize the potential to recontaminate areas or attract wildlife by removing oil trapped in booms and trash around site on a daily basis.

* Notify appropriate resource agencies of any reports of dead fish, mammals, and birds found during the response.

* Do not approach, feed or harass any wild animals or birds. Only trained personnel should conduct wildlife rescues. Report all incidents of oiled or stranded birds and animals to the appropriate agencies.

BIOLOGICAL RESOURCES

* Contact Natural Resource Trustees.

* Avoid treatment methods that remove large numbers of indigenous vegetation, invertebrates or microorganisms from shorelines and marshes.

* Boom off sensitive areas (wetlands, marshes, creeks) adjacent to areas where response operations are taking place.

* Remove all signs of human activity when operations are over.

CULTURAL RESOURCES

IMMEDIATELY take the following steps if cultural materials (fossils, archaeological, or historical) are discovered during response operations:

* Do not disturb, remove or alter archaeological or historical sites, facilities or artifacts. Mark off area with flagging tape.

* Stop cleanup activities in the surrounding area.

* Inform the State and appropriate Federal representative to the RRT.

* If a significant site or burial grounds are uncovered, contact the landowner and immediately

notify the state archaeological society representative or state historic preservation officer.

APPENDIX C-2: TYPES OF OIL

There are many complicating factors during an oil response. Oil has different physical properties depending upon where it comes from and whether it has been processed into a useable end product. These physical and chemical differences mean that teams planning for or responding to a release of oil must use the approach that is specifically tailored to the particular properties of the kind of oil released. For example, some types of spilled oil may respond well to the introduction of nutrients to stimulate biodegradation by indigenous microorganisms; other spilled products may require the introduction of new biodegrading species

CRUDE OIL

OIL	CHARACTERISTICS	SPECIAL FEATURES
CLASS A: Light, volatile (highest quality light crudes)	- Highly fluid - Spreads rapidly - Strong odor - High evaporation rate	- FLAMMABLE - Non-adhesive - Flushes with water - Highly toxic
CLASS B: Non-sticky oils (medium fuel oils and paraffin based oils)	- Waxy/oily feel	- Adhesive to surfaces - Removes w/ vigorous flushing - Less toxic than Class A
CLASS C: Heavy, sticky oils (residual fuel oils and medium to heavy crude)	- Viscous, sticky - Brown/black color - Density near water - Sinks as volatizes	- Flushing does not remove - Does not penetrate surfaces - Low toxicity - Can smother/drown wildlife
CLASS D: Non-fluid oils (residual oils, heavy crude oils, paraffin oils, weathered oils)	- Black/dark brown	- Relatively non-toxic - Does not penetrate surfaces - If heated, may melt and coat surface

REFINED OIL PRODUCTS

OIL	CHARACTERISTICS	SPECIAL FEATURES
GASOLINE	- Lightweight, flows easily, may evaporate completely	- FIRE & EXPLOSIVE RISK - Highly volatile - More toxic than crude oil - Amenable to biodegradation
KEROSENE	- Lightweight, flows/spreads rapidly, evaporates quickly	- Easily dispersed - Persistent in the environment
No. 2 FUEL OIL	- Lightweight, flows/spreads rapidly, relatively non-volatile	- Easily dispersed - Non-persistent in environment - Does not form emulsions
No. 4 FUEL OIL	- Medium weight, flows easily	- Easily dispersed w/ prompt treatment - Low volatilization - Moderate flash point - Persist partially in environment
No. 5 FUEL OIL (Bunker B)	- Medium to heavy weight	- Low volatilization - Moderate flash point - Difficult to disperse
No. 6 FUEL OIL (Bunker C)	- Heavy weight,	- Not prone to dissolve - Difficult to pump, requires heat - Difficult to disperse heavier than water - Forms tar balls, lumps, & emulsion - Low volatilization - Low flash point, > 150^{o}F

SPECIAL OILS

GAS OIL: A liquid petroleum distillate derived in the refining process that is composed mainly of volatile hydrocarbons and hydrogen. Gas oils are used as components for domestic heating fuels, are blended with residual fractions to reduce their viscosity to make acceptable heavy fuel oils, and can refined further to make gasoline. Gas oil, which has a viscosity and boiling range between kerosene and lubricating oil, ranges from a light to heavy weight material and may vary in terms of its volatility, flash point, and persistence in the environment.

LUBRICATING OIL: A medium weight material that flows easily and is easily dispersed if treated promptly. It has a low volatility and moderate flash point, but is fairly persistent in the environment.

APPENDIX C-3: TYPES OF ENVIRONMENTS IMPACTED

1.0 Purpose

This appendix describes the different types of environments that may be impacted by a release or discharge of oil or hazardous substances. A description of each area, predicted impacts, and suggested containment and removal strategies are discussed. These are examples only. Reference should also be made to the Shoreline Countermeasures Manual, the Shoreline Assessment Manual and EPAs Oil Spill in Freshwater Environments guide.

2.0 MARSHES

2.1 DESCRIPTION

$ Marshes characterized by soft-bodied, non-persistent, herbaceous vegetation, such as grasses. Swamps have dense stands of water tolerant shrubs and trees.
$ High degree of species diversity. May harbor sensitive or endangered species.
$ Breeding and nursery areas for many species.
$ Sediments usually consist of organic soils with a soupy consistency.
$ Foot travel very difficult.

2.2 PREDICTED IMPACT

$ Minimal flushing and organic soils allow oil and chemicals to remain in environment.
$ Season is important - dormant vegetation least sensitive; blooming and budding plants most sensitive.
$ High mortality rate - especially for reptiles, amphibians and crustaceans.
$ Trace contamination can impact water supplies.

2.3 SUGGESTED ACTIONS

$ High-priority areas require the use of spill protection devices to minimize impact (i.e. deflection booms, skimmers)
$ Allow lightly affected areas to recover naturally.
$ Avoid activities that mix oil or chemicals into organic soils and sediments.
$ Conduct manual pickup from boats and floating platforms.
$ Use the least intrusive cleanup methods. A no-action alternative may be appropriate to minimize the environmental impact.
$ Quick flushing and removal of oil while still fresh can reduce long-term impacts.

3.0 VEGETATED BANKS

3.1 DESCRIPTION

$ Low banks with grasses or steeper banks with trees.
$ Located in fresh or brackish water.
$ Contain a variety of plant species.

3.2 PREDICTED IMPACT

$ Heavy concentrations penetrate areas and coat plant and ground surfaces. Impact can be severe.
$ Oil and chemicals can persist for months.
$ Water supplies can be impacted through trace contamination.

3.3 SUGGESTED ACTIONS

$ Use caution when cleaning. Supervise and minimize plant cutting, if conducted.
$ A no-action alternative may be appropriate to minimize environmental impact.
$ Cleanup usually unnecessary for light coatings; heavier accumulations may require sediment surface removal to allow new growth.
$ Low-pressure spraying and neutralization solutions may aid removal.

4.0 SAND BEACHES

4.1 DESCRIPTION

$ Fine/coarse sand and gravel beaches. Typically found along coastal areas and along sandbars in inland rivers.
$ Sloping profiles vary from gentle to steep.
$ Species density and diversity low along coarse sand or gravel beaches.

4.2 PREDICTED IMPACT

$ Heavy accumulations of wastes can cover an entire beach surface and subsurface.
$ Wastes liquids and oil can penetrate from 15 cm to 60 cm deep at a minimum.
$ Organisms living along beach killed through smothering or by oil in the water column. Reduces food sources for birds and other animals.
$ Birds and animals may become dangerously contaminated.

4.3 SUGGESTED ACTIONS

$ Fine sand beaches are easier to clean.
$ Remove oil above the swash zone after all oil has come ashore. Soil treatment may be possible for other wastes.
$ Minimize sand removal to prevent erosion. Manual cleanup more efficient. Heavy equipment may remove excess sand.
$ Limit activity around sensitive areas such as dunes.
$ Prevent grinding of oil deeper into beach by limiting activity in heavily contaminated areas.

5.0 RIPRAP STRUCTURES

5.1 DESCRIPTION

$ Cobble to boulder-sized rocks used for shoreline protection.
$ Organisms and plant life can be plentiful and varied.

5.2 PREDICTED IMPACT

$ Deep penetration of wastes between boulders. If left, oil can asphaltize.
$ Fauna and flora may be killed.

5.3 SUGGESTED ACTIONS

$ Remove all contaminated debris.
$ Use sorbents to remove oil in crevices.
$ May remove and replace heavily contaminated riprap to prevent chronic sheening and release.

6.0 BLUFFS

6.1 DESCRIPTION

$ Usually found along eroding river banks.
$ Composed of mixed grain sizes (from silt to gravel).
$ Biological activity usually low.

6.2 PREDICTED IMPACT

$ Oil forms band along top of water line. Contamination can penetrate into sandy sediments.
$ Wave or current action can flush off wastes within days or weeks.

6.3 SUGGESTED ACTIONS

$ Cleanup usually not necessary due to short residence time.
$ Manual labor can be used to scrap oil and wastes from surfaces.
$ Avoid removing sediments where possible.
$ Avoid mechanical cleanup (limited access and steep slopes).

7.0 WALLS, PIERS, and DOCKS

7.1 Description

$ Common in developed areas to protect or facilitate access in residential and industrial locations.
$ Constructed of concrete, stone, wood or metal.
$ Mussels, shellfish, and algae often found attached to structures.

7.2 Predicted Impact

$ Contamination percolates between joints and coats surfaces.

$ Biota damaged or killed under heavy accumulations.

7.3 Suggested Actions

$ High-pressure spraying may remove oil, prepare substrate for recolonization of fauna/flora, minimize aesthetic damage and chronic leaching of oil from structure.

$ Consider concentration of wastes and continual release concentration to make a determination as to whether any action is required to remove contamination from these structures.

APPENDIX C-4: METHODS TO REDUCE OVERALL IMPACT

1.0 PURPOSE

This appendix describes the methods employed by responders to contain and remove spills, releases, and discharges of oil and hazardous substances. The advantages and disadvantages of each are discussed, along with the equipment necessary to implement the various methods listed. Reference should also be made to the Selection Guide for Oil Spill Applied Technologies for determining the appropriate methods.

2.0 PHYSICAL CONTAINMENT

Includes booms, by-pass dams, overflow and underflow dams, diversion berms, permeable barriers

2.1 ADVANTAGES

$ Physically deflects movement of spill; collects slick for recovery/burning.
$ Can be constructed of on-site materials: barriers or berms.
$ Can be used to protect economic or ecologically sensitive areas.
$ Pre-spill booming strategies can be developed, equipment pre-staged.

2.2 DISADVANTAGES

$ Requires significant time to put in place.
$ There is not one universal boom or barrier (use depends on type of pollutant, wind, current, shore topography).
$ Use limited by availability of deployment/recovery areas and anchoring conditions.
$ Link-up compatibility may be difficult with different types of booms.
$ Currents in excess of 0.7 knots perpendicular to boom will result in entrainment. Effect independent of depth of skirt.
$ Wave height and frequency must be taken into account when selecting boom flexibility. Incorrect matching may result in splash over.
$ Barriers/ dams time consuming to build; equipment dependent.

3.0 PHYSICAL REMOVAL

Skimmers (suction, floating weirs, oleophillic disks, drums or belts, hydrodynamic planes, and vortex or cyclonic skimmers)

3.1 ADVANTAGES

$ Physically removes oil from the environment.
$ Works with all kinds of oil states; even emulsified.
$ Higher recovery rate than sorbents.

3.2 DISADVANTAGES

$ Vortex or cyclonic skimmers and oleophilic disks not effective on highly viscous oil.
$ Works on principle that oil floats on water. High water uptake on very thin oil layers increases volume of waste stream.
$ Loss of efficiency in high tidal or current environments.
$ Limited by storage.
$ High amount of monitoring required during operation.
$ Low tow speeds; effectiveness limited by amount of debris present in water.

3.3 COMMON TYPES OF SKIMMERS

3.3.1 Band (or Rope) Skimmer

Uses oleophilic material such as polypropylene. Oil collected by drawing a continuous rotating band of material through the slick. Adhered oil is wrung from the band by a squeeze roller and collected in an oil sump. High efficiency in calm waters.

3.3.2 Belt Skimmer

Use an oleophilic material belt mounted on the front of a small vessel. The belt pushes the oil below the waterline. Oil carried up the belt is recovered at the top of the system by a squeeze belt or scraper blade and then pumped into a storage container. Not good in shallow waters or tight areas.

4.0 CHEMICAL OIL STABILIZERS

Solid Forming Agent (solidify or gelatinize oil to keep it from spreading or escaping and causing re-oiling elsewhere. Elastol is an example of an oil stabilizing agent.)

4.1 ADVANTAGES

$ Causes oil to change from a liquid state to a "jelly" like substance that does not react with the environment.
$ Lowers explosion vapors.
$ Enhances polymerization of hydrocarbon molecules when applied by liquid spray or sprinkling of dry chemical in the proper dosage.
$ May reduce solubility of the more toxic short chain and cyclic hydrocarbons by locking them into the polymer.
$ May enhance recovery.

4.2 DISADVANTAGES

$ **MAY TAKE TIME TO GET RRT CONCURRENCE PRIOR TO APPLICATION**
$ Reacts with any hydrocarbon; oil, containment boom, weeds, etc.
$ Unknown consequences when in contact with animal oil.
$ Not suitable for vegetated shorelines, seawalls or riprap. Congealed oil sticks to vegetation and remains in crevices making removal extremely difficult.
$ Do not use if marine mammals, birds or other wildlife may come into contact with

congealed oil.
$ Increases smothering of sessile and interstitial organisms.
$ May increase residence time of oil in environment by decreasing evaporation, dissipation and biodegradation rates.

5.0 DE-EMULSIFYING AGENTS

De-watering agent used to break up or prevent water-in-oil emulsions (generally a surfactant)

5.1 ADVANTAGES

$ Separates oil and water from recovered emulsions (50% water to oil)
$ Potential use in field to make emulsions burnable in place

5.2 DISADVANTAGES

$ NONE on NCP Product Schedule.
$ **CANNOT BE USED IN U.S. WATERS**

6.0 DISPERSANTS

Chemical agents that emulsify, disperse or solubilize oil into the water column or promote the surface spreading of oil slick to facilitate dispersal of the oil into the water column and enhance biodegradation. (consult NCP Product Schedule)

6.1 ADVANTAGES

$ Reduces amount of slick able to reach the shoreline.
$ Most effective if applied to slick within first 24 hours after spill.
$ Removal/disposal reduced.
$ Dispersants have been improved to be less toxic than in past.

6.2 DISADVANTAGES

$ **NOT USED IN INLAND WATERS.**
$ **MAY REQUIRE TIME TO GET RRT CONCURRENCE. CONSULT REGION 4 DISPERSANT USE PLAN.**
$ Water column must be at least 30 feet deep.
$ Toxicity problems may result from increasing uptake of oil in biota.
$ Little field data on effectiveness and toxicity impacts.
$ Lots of unknowns.
$ Difficulties tracking the underwater plume.
$ Difficulties obtaining equipment.

7.0 SURFACE COLLECTING AGENTS (or Surface Washing Agents)

Land or shoreline dispersant

7.1 ADVANTAGES

$ Acts as a detergent to reduce adhesion of oil to substrate.
$ Enhances removal of oil.
$ Lowers water temperatures needed for washing.

7.2 DISADVANTAGES

$ Washing agents remove the oil from the surface of shoreline, but allow it to coalesce on the water surface.
$ Method may drive oil into sediment pores.
$ Potential toxicity problems when adding chemicals and making oil more available to the biota (surface weathering may require a "potent" product).

8.0 IN-SITU BURNING

Removal by fire (disposal of oil on the water through ignition)

8.1 ADVANTAGES

$ Works on thin films (down to 2 mm.)
$ On films of 100 mm (4 inches) or more, burning is 98-99% effective.
$ Disposal rates of 100 - 30,000 gals/min (10,000 ft^2 to 1 square mile burn).
$ Easy to ignite if oil is a proper thickness (must be at least 2 mm thick).

8.2 DISADVANTAGES

$ **MAY TAKE TIME TO GET RRT CONCURRENCE, (Consult Region 4 In-Situ Burn Plan)**.
$ Can have a highly negative impact in small rivers and inland lakes.
$ Requires specialized booming.
$ 3M boom ($250 - $300 per foot, good to -40^{o}F to +2,000^{o}F).
$ Smoke plume can be visually disturbing. May create a public outcry.
$ Potential toxicity of plume still being investigated, contains polycyclic aromatic hydrocarbons (PAHs);(A 100,000 gallon spill when burned equals the amount of smoke from 50,000 wood stoves).
$ Air quality permits may be required.
$ Modeling and pre-burn weather data needed.
$ Combustion products may travel great distances before falling to earth.

9.0 BIOREMEDIATION

9.1 NUTRIENT ENHANCEMENT

Enhancement of microbial metabolism of organic contaminants through addition of nutrients and oxygen to the contaminated environment. Results in breakdown and detoxification of contaminants. (Consult NCP Product Schedule) Also, contact RRT to determine if concurrence is necessary before application.

9.1.1 Advantages

$ Does not require addition of non-native microorganisms. Works with natural populations.
$ Works on a wide variety of contaminants.
$ Fertilizers are not typically harmful to nearshore environments.
$ Can be used for both surface oil and subsurface oil spills.

9.1.2 Disadvantages

$ Potential for algae blooms, however little evidence to support this.
$ Soils with low permeability difficult to treat. Increases time for nutrients to reach microorganisms.
$ Contaminant degradation impaired by nutrient overloading, toxicity of nutrients and oxygen depletion.
$ May take weeks or years to completely degrade contaminants.

9.2 BACTERIAL ADDITION

Deliberate introduction of non-indigenous microbiological cultures or enzymes into an oil discharge for the specific purpose of enhancing biodegradation to mitigate the effects of the discharge. (consult NCP Product Schedule)

9.2.1 Advantages

$ Have the potential to begin degrading materials right away without an acclimation time.
$ Can work with natural populations of microorganisms.

9.2.3 Disadvantages

$ **MAY TAKE TIME TO GET RRT CONCURRENCE.**
$ Still highly experimental. No solid evidence to support effectiveness.
$ Carrier may be highly toxic.
$ Granular forms are viewed by some as a problem.
$ Natural species may be just as effective at a much lower cost.

APPENDIX C-5: CLEAN-UP TECHNOLOGIES

The following table presents a number of alternatives for cleaning up oil in the environment, primarily along shorelines. Before undertaking any of the these methods, the OSC should consult with the Region 4 Regional Response Team along with State and Local officials. The information listed was adapted from EPA's Region 3 Shoreline Countermeasures Manual and the American Petroleum Institute's Inland Oil Spill Manual. Reference should also be made to the Selection Guide for Oil Spill Applied Technologies for appropriate technologies.

ACTION	DESCRIPTION	WHEN TO USE	BIOLOGICAL CONSTRAINTS	ENVIRONMENTAL EFFECTS
No Action	No Action is taken.	When shoreline extremely remote, inaccessible, or cleanup will do more damage or an effective method is not available.	Not for areas with high number of mobile animals.	Same impact as oil.
Manual Removal	Remove surface oil by manual means and placed in containers for disposal. No mechanized equipment used.	For areas where oil can be easily removed.	None.	Minimal if surface disturbance and work force movement is limited.
Passive Collection Sorbents	Sorbent material placed on oil surface.	When oil is viscous and thick enough to be absorbed.	None. Method can be slow allowing oil to remain in critical habitats.	No major effects except if soaked sorbent materials are left in environment.
Debris Removal	Manual or mechanical removal of debris, including cutting and removal of oiled logs.	Use on any accessible area. Especially important when contaminated debris could contaminate other organisms.	None.	None.

ACTION	DESCRIPTION	WHEN TO USE	BIOLOGICAL CONSTRAINTS	ENVIRONMENTAL EFFECTS
Trenching	Dig wells or trenches to the depth of oil and pump oil out of well. Best with lighter oils.	Fine grain sand beaches, coarse sand and gravel beaches where oil has seeped in and cannot be removed by manual cleaning.	None.	None.
Sediment Removal	Mechanical or manual removal of sediments. Material disposed of off-site.	Used on sand, pebble and cobble beaches where limited amounts of oiled material have to be removed. Do not use in areas with erosion potential. Do not removal sediments past the depth of oil penetration.	Mechanized equipment should not be used in areas adjacent to endangered or sensitive species.	Maybe detrimental if too much sediment removed without replacement.
Cold Water Flooding	Wash oil from surfaces and crevices to water's edge for collection.	Boulder, cobble, gravel, coarse sand mixed with sediment and rock. Not applicable to mud, vegetated upland or steep rocky shorelines. Frequently used with low or high pressure washing.	Not appropriate at creek mouths.	Habitats may be physically disturbed as sand and gravel are mixed. Organisms may be flushed away.
Cold Water/ Low Pressure Washing	Remove oil that has adhered to rocks or man-made structures. Oil floated to shoreline for pickup by a skimmer.	Boulder, cobble and rock/ seawall shorelines heavily oiled. Not appropriate for sedimentary habitats. Best where adhered oil must be removed to prevent continuous release into environment.	Not appropriate for sand, gravel, mud beaches, marshes or shorelines where destruction of biological communities must be avoided.	May flush contamination into other areas. Increases turbidity in water.
Cold Water/	Better for removing	Riprap, rock and seawalls. Can	Not appropriate for	Removes many

ACTION	DESCRIPTION	WHEN TO USE	BIOLOGICAL CONSTRAINTS	ENVIRONMENTAL EFFECTS
High Pressure Washing	adhered oil. Water pressure up to 100 psi.	be used to float oil out of crevices.	sand, gravel, mud beaches, marshes or shorelines where destruction of biological communities must be avoided.	organisms on surface. May drive oil deeper or flush into other environments. Increases turbidity.
Warm Water/ Moderate to High Pressure Washing	Mobilize thick and weathered oil adhered to rock surfaces prior to flushing it down shore for pickup.	Boulder, cobble, and rock/ seawall shorelines that are heavily oiled. Not appropriate for sedimentary habitats. Good for weathered or difficult to remove oil.	Tradeoff between damage to the biological community versus damage from leaving oil in place.	Can kill or remove most organisms. May flush oil into other environments. Increases turbidity.
Hot Water Pressure Washing	Dislodge trapped oil from inaccessible locations and surfaces not amenable to mechanical removal. Requires extensive equipment (water heat - 170^{o}F). Vacuuming necessary to remove oil flowing from rocks and soil.	Not applicable to sandy beaches, marshes or where difficult to place equipment.	Must be careful not to remove all attached organisms from surfaces. Decreases biodegradation potential.	Has a highly negative impact on most environments. Possibility of driving oil further into substrate.
Slurry Sand Blasting	Use sandblasting equipment to remove	Seawalls and riprap. Equipment can be operated from boat or	Not to be used in areas with high biological	Possible destruction or smothering of

ACTION	DESCRIPTION	WHEN TO USE	BIOLOGICAL CONSTRAINTS	ENVIRONMENTAL EFFECTS
	heavy residual oil from solid substrates.	land.	abundance on the shoreline.	organisms.
Vacuum	Use suction head, hose, pump and storage tank to recover free oil from the water surface.	Use for large volumes of free oil. Can be used on any shoreline if accessible.	Do not use in areas where foot traffic and equipment may harm organisms.	Minimal impact if done correctly.
Shoreline Removal, Cleansing and Replacement	Remove and clean oiled substrata before returning it to the excavated area. Cleansing includes hot water wash or physical agitation with a cleansing solution.	Sand, pebble, gravel, etc. Applicable where permanent removal of sediment is undesired. Equipment must be close to excavation area to reduce transport problems. Cleaning solutions must be properly disposed.	Typically unacceptable in spawning areas. Almost all life will be removed from area. Replaced material must be free of oil and toxic substances.	May be detrimental if excessive substrate is not replaced. Very large equipment causes environmental disruption. Could be negative impact if cleaning solution not properly disposed.
Cutting Vegetation	Manual cutting of oiled vegetation using weed eaters and removal of cut material with rakes. Cut vegetation is immediately bagged for disposal.	When risk of oiled vegetation contaminating wildlife is greater than the value of the vegetation that is to be cut, and there isn't a less destructive method.	Prevent forcing of oil into sediments and contaminating the root structures.	Can be a total loss of habitat for some animals. Erosion may occur if vegetation does not grow back.

APPENDIX C-6: NATIONAL PRODUCT SCHEDULE

Section 300.905, Subpart J of the NCP establishes the NCP Product Schedule which contains those dispersants, other chemicals and biological products that may be authorized for use on oil spills. Also, presented in Section 300.905 are the procedures for obtaining authorization for the use of items on the NCP Product Schedule. A copy of the NCP Product Schedule is located in the EPA Region 4 Response Center.

APPENDIX 7: RESOURCES AND CORRESPONDING RESPONSIBLE FEDERAL AGENCIES

The following has been compiled from Appendix D of 40 CFR 112, which is concerned with the *Oil Pollution Act.* The information summarized below covers sensitive environments and critical habitats. For detailed information on this topic refer to the Appendix.

AREAS	RESPONSIBLE AGENCY
WETLANDS, as defined in 40 CFR 230.3	USEPA FWS ACOE
CRITICAL HABITAT for endangered/threatened species	NOAA USFWS
HABITAT used by endangered/threatened species	NOAA USFWS
MARINE SANCTUARIES	NOAA
NATIONAL PARKS	DOI - NPS
FEDERAL WILDERNESS AREAS	USDA DOI
COAST ZONE MANAGEMENT ACT designated areas	NOAA
NATIONAL ESTUARY PROGRAM	NOAA
NEAR COASTAL WATERS PROGRAMS areas	USEPA
CLEAN LAKES PROGRAM critical areas	USEPA
NATIONAL MONUMENTS	USDA DOI
NATIONAL SEASHORES RECREATIONAL AREAS	DOI - NPS
NATIONAL LAKESHORE RECREATIONAL AREAS	DOI
NATIONAL PRESERVES	DOI
NATIONAL WILDLIFE REFUGES	USFWS
COASTAL BARRIER RESOURCES SYSTEM (units, undeveloped, partially developed)	USFWS
NATIONAL RIVER REACH DESIGNATED AS RECREATIONAL	USEPA
FEDERAL OR STATE DESIGNATED SCENIC OR WILD RIVER	DOI
NATIONAL CONSERVATION AREAS	DOI - BLM
HATCHERIES	USFWS
WATERFOWL MANAGEMENT AREAS	USFWS

NOTE:
WHERE USEPA IS DESIGNATED AS THE RESPONSIBLE AGENCY, THE INFORMATION WILL BE PROVIDED BY THE APPROPRIATE REGIONAL OFFICE.

PLEASE CONTACT STATE AND LOCAL AGENCIES FOR INFORMATION ON RESOURCES THEY MANAGE.