Guidance for incorporating human impacts and vulnerabilities in marine oil spill contingency planning

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About this guidance document

This document provides guidance for Area Planning Committees to systematically assess the potential health, social, economic, institutional, and cultural impacts of oil spills – what are often called "human dimensions impacts." This information can inform contingency planning and lead to more successful responses. The approach offered is called a *Human Dimensions Impact and Vulnerability Assessment (HDIVA).*

This document steps through a process that planners and planning committees can use. The process instructs planners how to:

- identify and prioritize human dimensions impacts that must be addressed, including downstream social and economic consequences that can arise from both spills and spill response activities;
- characterize the vulnerabilities of individuals, groups, communities, and economic industries and sectors to impacts; and
- identify effective response actions that can prevent or mitigate impacts and vulnerabilities.
- construct spill scenarios that appropriately test response activities for human dimensions impacts;

The guidance provided here for *Human Dimensions Impact and Vulnerability Assessments (HDIVA)* is based on extensive reviews of oil spill impact assessment tools, literature on vulnerability and risk assessment, and case studies of oil spill response. Additional materials produced as part of this project may be found at: http://seri-us.org/content/human-dimensions-of-oil-spills and http://seri-us.org/content/cordova-case-study

While it is feasible for experienced contingency planners to read through this guidebook and competently incorporate planning for the human dimensions of spills into their Area Contingency Plans, it is more likely that the process will be successful if guided, advised, or managed by an expert in the area of human dimensions. Social scientists have experience thinking systematically about human systems and are accustomed to the conceptual models that form the basis of this approach.

In summary, this guidebook can be thought of as a do-it-yourself instruction manual, but perhaps it will be more useful as a tool to assist you in ensuring the skills required are present on the area committee.

Why assess human dimensions?

The history of oil spills clearly demonstrates that they can have significant impacts to both ecological and social systems. While attention is often focused on the ecological impacts of oil spills, the *Exxon Valdez*, *Prestige, Cosco Busan* spills, and more recently

the *Deepwater Horizon* leak, have made it apparent that there is a wide variety of human dimensions impacts that are also important for planners and spill response activities to address (Dyer 1993; Palinkas et al. 1993; Picou and Gill 1997; Morita et al. 1999; Garcia Perez 2003; Garza-Gil et al. 2006). Impacts to human physical and mental health, social relationships and activities, economic industries and sectors, cultural systems, infrastructure, public and private organizations, governance and political systems are encompassed in this category.

In spite of their widespread and common occurrence, oil spill contingency plans have not traditionally focused on these kinds of impacts. The Marine Transportation System Recovery Unit (MTSRU) focuses on mitigating and managing impacts to transportation infrastructure. In general, contingency plans do an excellent job of preparing to protect threatened ecosystems and the marine transportation system. Protecting these systems is fundamentally important and has implications for some major human dimensions impacts. However, most plans can substantially improve how they characterize, anticipate, or prepare for short or long term human dimensions of spills or the spill response. While state and federal responders foresee and react to human impacts, their knowledge and experience is rarely formalized in contingency plans. Effective spill response can be enhanced by more systematic attention to the range of human dimensions impacts that may arise over the course of a spill event.

Introduction

What are human dimensions impacts of oil spills and spill response activities?

Technological accidents and natural disasters can directly impact both the ecological and human aspects of an affected area. Indirect impacts are also possible. We define *human dimensions impacts* as all impacts that are not ecological. The human dimensions of spills include health, social, economic, use, and cultural impacts to a wide range of entities at multiple scales, including individuals, families, businesses, communities, institutions, and government. Many dimensions of lives and livelihoods can be affected including: mental health, cultural practices, finances and markets, social relationships, and organizational practices. The shorthand term used in the field of social impact assessment is "social impacts." Because the term "social" may reasonably be thought of as excluding things like physical and mental health, emotions, business, markets, politics, beliefs and culture, we use the broader term *human dimensions impacts*.

Specific examples of human dimensions impacts include:

- physical injuries and acute and chronic health effects from exposure to oil or response countermeasures;
- mental health impacts from uncertainties about the future;
- economic losses due to closed fisheries and beaches;
- loss of trust in responsible parties and government agencies;
- disruption of cultural traditions and subsistence ways of life; and,
- conflict within communities or families.

Human dimensions impacts from oil spills can result from:

- *direct outcomes due to oil in the environment* (e.g., acute health risks from inhalation exposures, economic losses from the oiling of vessels, use-losses from the contamination of beaches),
- *indirect outcomes due to oil in the environment* (e.g., loss of income due to closure of shellfish beds, loss of tourism income because of oil on beaches, loss of income from perceptions of tainted seafood and quality of shoreline, emotional stress from uncertainty about future livelihoods in oiled areas),
- *direct outcomes of the response effort* (e.g., inconvenience from traffic or ferry closures, social conflict from the unequal treatment of people hired for the response, health effects from accidental inhalation of dispersants), and
- *indirect outcomes of the response effort* (e.g., ice manufacturers lose income when fishing is banned, higher housing prices due to large influx of cleanup workers, inability of industry to get supplies and material inputs due to closure of a shipping channel).

This diversity of pathways results in human impacts that arise over the short, medium, and long terms, and result from the spill itself as well as the response and recovery. For example, ongoing litigation is an important factor contributing to psychological and social stress measured in communities long after the *Exxon Valdez* spill (Picou et al. 2004). Impacts affect all scales from individuals, families and households, groups, organizations, communities, economic sectors, and local, tribal, state, federal, and other countries' governments. The stresses on one scale frequently

affect those of other scales. Generally, the severity of human dimensions impacts varies among members whether within a community, an economic sector, or a household (e.g., Palinkas et al. 1993; Surís-Regueiro et al. 2007).

What is a human dimensions impact and vulnerability assessment?

Assessments of human dimensions and vulnerabilities are concerned with answering three basic questions:

1. What are the potential impacts?
2. Which groups or organizations are likely to be affected?
3. What are the vulnerabilities, or differential susceptibility to harm, among those groups and organizations?

Usually when we speak of impacts from oil spills, we are concerned about negative impacts – how individuals, groups, communities, organizations, cultures, etc. may be harmed. However, we should also acknowledge that a spill response can create some benefits. Some businesses will sell more supplies and rent more equipment. There may be temporary jobs available. Some regions will acquire and stage more equipment for spill response. Experience and lessons learned through working on a spill may also contribute to a higher level of training for local responders and improvements to communication protocols among federal, state, and local responders. While we will concentrate on identifying negative impacts, it is important to remember that these potential benefits, if thoughtfully directed, can serve to minimize or offset some other impacts.

There are several components to the *Human Dimensions Impact and Vulnerability Assessment* approach. These components are informed by theories about the sequence of hazard events, how consequences emerge, and the vulnerability of human and ecological systems. The overall approach is informed by two concepts: the causal structure of hazards (Text Box 1) and vulnerability (Text Box 2).

The purpose of using the causal structure of hazards as part of the assessments is to focus people's attention on decision-relevant variables or concepts about which information should be gathered and to provide details about the causal pathways that link an oil spill to specific impacts. In other words, it provides a means for opening up the "black box" to reveal the factors, processes, and responses that determine whether a spill that releases oil into the environment has greater or lesser impacts to people, communities, and organizations. The concept of vulnerability focuses attention on forces that influence how consequences emerge and are differentially experienced. Specifically, vulnerability gives attention to differences in how people are exposed to a threat, the ways in which they are more or less sensitive to that threat, and the ways that they can and do respond to the threat.

Text box 1. The causal structure of hazards and impacts

A causal pathway diagram of hazards documents the process by which a hazard creates a stream of outcomes and consequences (Kates, Hohenemser, and Kasperson 1985, Bowonder, Kasperson, and Kasperson 1985). The stream can be interrupted and blocked at various stages by management activities (see the Figure TB-1). Such diagrams can help focus people's attention on decision-relevant points.

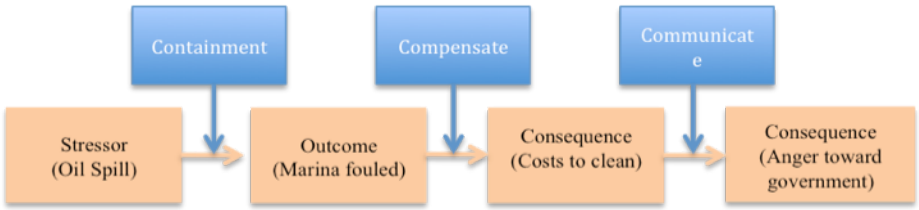


Figure TB-1. Example Causal Chain for Oil Spill

The chain starts with a stressor on the left side. At the end of the diagram, on the far right side, are consequences such as loss of life, economic costs, decline of trust in government, and so on. To avoid unwanted consequences, hazard managers seek to block intermediary steps in the causal chain. These management actions are captured in the boxes along the top of Figure TB-1.

A stressor creates an exposure with potential to harm. For example, an oil spill is a stressor to nearby communities and the ecosystem in which it occurs. Spill response actions can also be stressors. Exposure can be examined at multiple scales, including the individual, household, community, region, nation, or global scales. To understand exposure, it is necessary to define the object or agent at risk. Often we speak about risk to people, but it is also possible to be concerned about risk to species, populations, ecosystems, economic sectors, belief systems, institutions, behavior, and so on. Harm to any of these targets can result from direct exposure to the event/condition or through indirect pathways.

The exposure produces an immediate outcome by affecting an individual, a group, or an activity. Outcomes are changes in an affected party. Outcomes lead to impacts (or consequences), which cascade into secondary and tertiary impacts. Some impacts can be positive, but mainly hazard mangers focus on those to be avoided.

Products of this approach are:

- A list of the potential human dimensions impacts that are of greatest concern in the area under consideration.
- A list of direct and indirect (also called "downstream" or "secondary") consequences and detailed causal chains that document how those consequences emerge.
- A list of individuals, groups, and organizations most vulnerable to the impacts.
- A list of potential ways that spill response can intervene to "break" the causal pathways that link the released oil to specific impacts in order to prevent or mitigate the severity of potential impacts.

Text box 2. Vulnerability

A growing body of theoretical and empirical research on vulnerability has developed over the last quarter century (Dow 1992, Kasperson et al. 2005). Vulnerability studies highlight how hazards arise, how exposures and susceptibility to the threats are differentially distributed, and how people adapt or cope with the threats and their effects.

At its most basic level, vulnerability can be defined as the "differential susceptibility to loss from a given insult" (Kasperson et al. 2001, pg. 24). Increasingly researchers of vulnerability have adopted a definition that is three-dimensional, linking exposure to a hazard, the sensitivity of people to loss from the exposure, and resilience or the ability to resist or cope with the exposure or loss. We use this definition here. A large number of factors – or driving forces – may contribute to the three components of vulnerability.

Integrating the concept of vulnerability into the causal model of hazards framework improves its applicability to area contingency planning in two main ways.

First, it clarifies that differences among people or groups mean that some may face greater harm as a result of equivalent exposures. Thus, the concept of vulnerability implies the need to look beyond patterns of exposure to understand the potential severity of impacts. Sensitivity (sometimes called, susceptibility) to the threats is also important to consider. Obviously, oyster fishermen are less able to move to other areas to fish. Fishermen who participate in Vessel of Opportunity programs may have more experience or training, work on newer, better equipped boats, or work with captains that are more wary of placing crew in harms way. Thus, when considering the vulnerability of individuals, households, communities, or sectors to oil spills it is important to understand both how they are exposed and how sensitive they are to such changes.

Second, vulnerability adds the notion of resilience (also, often referred to as adaptive capacity and coping). In ecology, resilience refers to the ability of a system to return to a reference state after a disturbance, or maintain structure and function after a disturbance. For example, in households dependent on fishing related employment, dual-income households may be better able to withstand temporary loss of income. Conversely, other characteristics may negatively affect the resilience of individuals, households, communities, or sectors. For example, while theoretically fishermen may be able to shift from shellfish to other species in the event of contamination, regulatory constraints and the costs and training required to use advanced and specialized equipment may limit such flexibility. Resilience may be promoted by individual actions or by management responses. Some of that resilient capacity will be directly related to contingency planning efforts, and other elements may come from social networks which offer temporary employment, make no interest loans, and exchange other favors and information during times of need.

Anticipated Benefits

Incorporating the *Human Dimensions Impact and Vulnerability Assessment* into area contingency plans can provide several types of benefits.

First, the approach identifies the important impacts of concern to people, groups, and organizations potentially affected by a spill and spill response. These can include direct impacts resulting from oil and other chemicals in the environment, indirect impacts arising from the way people respond to oils and chemicals in the environment, and impacts from oil spill response itself, including both short-term and long-term recovery efforts.

Second, the approach identifies potential vulnerabilities and disproportionate impacts to sub-groups within an area. People who don't speak or read English will need additional considerations to avoid risks and take advantage of support programming. Subsistence dependence on natural resources may raise issues of food security. It also links these impacts to specific qualities of a spill or spill response, such as the season, the local resources, and uses.

Third, the approach helps to focus attention on resilience, that is, factors that promote mitigation, coping, flexibility, and adaptation. As noted earlier, some response efforts, such as hiring local firms, can build on pre-existing capacity to reduce impacts. The information can also help decision-makers understand how people might respond, either in ways that exacerbate or mitigate impacts. Understanding potential responses can improve communication by providing timely information during spills (e.g., tell people how they can mitigate impacts themselves), where appropriate.

Fourth, the approach produces practical knowledge by involving local stakeholders. By drawing on input from a diverse range of stakeholders and integrating this information in a way that reveals opportunities for spill response actions, the open-ended and qualitative approach helps provide in-depth understandings of social and cultural concerns/conflicts and psychological perceptions. Stakeholders' knowledge and experiences are processed in a way that can reveal important gaps in knowledge, areas of agreement, and critical variables and interactions. The approach can inform future data gathering efforts by focusing attention on key variables and their interactions. Furthermore, it provides a means of highlighting the rationale for believing that disproportionate impacts and vulnerabilities may be related to specific response actions.

Fifth, the approach can inform the selection of performance indicators for assessing spill response by a broad range of potentially affected and interested parties. Performance indicators can be related to pathway variables or to impacts. Getting input can overcome challenges with selecting performance metrics, which include debates about what is important to measure and which of the possible metrics for assessing a particular activity or outcome are most appropriate (Tuler and Webler 2008; Tuler and Webler 2009).

Sixth, it can save money, both in the short-term and in long-term damage assessment.

How to assess human dimensions vulnerabilities and impacts for area contingency planning

The goal of the *Human Dimensions Impacts and Vulnerability Assessment* approach is to identify the important human dimensions impacts that may result from an oil spill and develop spill response plans that will mitigate these impacts. It is helpful to think of the assessment of human dimensions impacts from oil spills as closely allied to the assessment of risk – in this case the risk of human dimensions impacts.

The assessment process involves 10 steps, as shown in Table 1. Loosely speaking, the steps involve understanding three topics: what impacts to plan for, how these impacts come about, and what can be done to prevent or reduce these impacts. The assessment process is designed in a way that facilitates incorporating this information into area contingency plans.

Table 1. Steps of the Human Dimensions Impact and Vulnerability Assessment process

Step	Activity	Who participates
Step 1	Assemble the Core Team	Area Planning Committee
Step 2	Identify potentially impacted parties	Core Team
Step 3	Design draft human dimensions impacts scenarios	Core Team
Step 4	Assemble a Human Dimensions Team (HDT)	Core Team
Step 5	Refine the human dimensions impacts scenarios	Core Team, HDT
Step 6	Identify priority impacts	Core Team, HDT
Step 7	Characterize priority impacts	Core Team, HDT
Step 8	Draw Vulnerability Tree Diagrams	Core Team, HDT
Step 9	Draw Causal Pathway Diagrams	Core Team, HDT
Step 10	Integrate information about human dimensions into Area Contingency Plan	Core Team, APC, HDT

HDT = Human Dimensions Team; APC = Area Planning Committee

To complete the assessment, spill response planners will need to gather and analyze information to inform their thinking. They will also need to engage with other potentially impacted individuals and groups to discuss the implications of the information, identify concerns, and incorporate details on local conditions. It is very important to realize that who participates, and which information is used, will depend on the goals of each step of the process. For example, more inclusive participation from a broad range of people is important to identifying the full range of human dimensions impacts that worry people. Participation from disciplinary experts such as economists, sociologists, and public health practitioners, will be important to understanding the ways those impacts may arise in an oil spill. In the following discussion, we provide additional information about strategies

and considerations for each step in developing information about human dimensions impacts and designing contingency plans.

The Step-Wise Process

Step 1. Assemble a Core Team of 3-7 individuals

As with other aspects of Area Planning, this component will benefit from the consistent involvement of a core team of planners who oversee the process and assure consistency and coherence from step to step. We envision that the core team members will also participate in the Human Dimensions Team, which will be discussed in more detail later.

In order to assure successful integration, particularly if this area is less developed, the core team will also benefit from the experience and authority of the head planner, an assistant planner, and at least one other person from the Area Planning Committee. For this third person, we recommend identifying someone who has familiarity and experience doing collaborative planning with communities and planning for human dimensions impacts. Text Box 3 (on the following page) discusses how planning for human dimensions impacts differs from planning for ecological impacts.

The responsibilities of the core team are to draft preliminary documents and facilitate the process of document review and revision. Specifically, the Core Team should

- identify the parties at risk;
- design the HD spill scenarios;
- establish the Human Dimensions Team;
- characterize impacts and vulnerabilities;
- obtain review and coordination from potentially affected parties; and,
- run the process for integrating the results into the contingency plan.

We next elaborate on a systematic approach to achieving these tasks.

Step 2. Identify Potentially Impacted Parties

Begin by identifying *who or what is at risk*. There is a wide variety of people, groups, institutions, and such that may be affected by a spill or spill response. We recommend referring to them using the general term, *potentially impacted party (PIP)*. A PIP is any identifiable type of group or institution that could experience loss or gain as a consequence of a spill. A review of the literature on human impacts of spills revealed the following general categories of PIPs:

- *Individuals*, such as clean-up workers, residents, the general "public" (local or not local), and commercial fishermen
- *Social groups*, such as households, families, ethnic groups, subsistence hunters and fishers, formal associations, and tribal communities
- *Economic organizations*, such as associations representing the tourism industry, commercial fishing industry, retail businesses, oil sector (including responsible party)
- *Non-governmental organizations (NGOs),* such as environmental NGOs and social service NGOs
- *Governments* including local, county, state, federal and tribal governments and agencies

Text Box 3: Consider how human impacts differ from ecological impacts

In some respects human and ecological systems are similar – they are complex and involve multiple feedbacks at various time and spatial scales. However, there are important differences. Being aware of the special challenges and complexities involved with characterizing human dimensions impacts can aid in their assessment.

First, human impacts will not all occur in the place exposed to the oil spill. Ecological impacts involve a physical exposure pathway to, for example, juvenile life forms, migratory species, or ecological resources. We can map these pathways and the ecological components affected and, for the most part, they don't move far. Some human impacts are like this too. For example, a marina exists in a certain location. However, other human impacts cannot be easily mapped. The signals spreading human impacts can be indirect based on economic ties among places, media reporting of impacts on a vaguely defined region, or family ties that span states. For instance, the people who experience a loss because they could not enjoy a beach vacation are difficult to locate. Consider the individuals who cancelled their vacations to the Gulf Coast during the summer of 2010. They may have lived anywhere from Sarasota to Seattle. Economic linkages can cause impacts to ripple from direct resource-based industries to supporting processing, distribution, and sales. Consider a shore-based business that supports the fishing industry, such as a cannery, which may have to lay off workers and cancel contracts if the supply declines. While it is relatively easy to locate those local workers, the purchasers can be more difficult to locate. Consumer's perceptions of seafood can affect purchasing behaviors in areas that extend well beyond the geographic location of a spill. Thus, social networks and communication pathways require special attention when considering human dimensions impacts.

Second, it is often difficult to identify who or what group is at risk because the human world is so dynamic. Take the example of the cannery again. Today, it is not unusual for a business to contract with multiple suppliers and to be able shift to alternative supplies quickly. One day they are buying fish from one regional wholesaler, but they can arrange shipping and purchase from somewhere else. These market dynamics could apply to packaging companies or purchasers of the variety of materials shipped on barges. Some of these economic relationships change frequently while others can be quite stable in a region. It will be helpful to learn about the degree of flexibility for key sectors in advance of an event. Given that it could be very difficult to keep up with all of businesses ties; it will also be useful to know what type of information local businesses will need to communicate directly with their partners.

Third, the response capacity of humans can be enhanced through management actions such as appropriate risk communication as well as a number of programmatic options. Communication media and processes that influence formation of risk perceptions insert an additional complexity into human systems (Pidgeon et al. 2003).

These differences require different methodologies to anticipate impacts and vulnerabilities. Some elements can be counted and mapped, but many others are best understood by consulting directly with the people who know the local area, including the potentially impacted parties (PIPs). Depending on the level of precision and reliability of information needed, it is valuable to ask several people and clarify with them the reasons for any differences in their answers. This consultation can bring added benefits in the form of better working relationships if an event occurs and people feel that their particular situation was not overlooked.

One way of thinking about PIPs is illustrated by Table 2. This generic table highlights groups and scales. In specific cases, it will be important to think about who is included in the general categories. For example, "industry" may be split into commercial fishing, commercial shipping, oil refining and processing, agriculture, etc. Government agencies may include departments dealing with public health, water sanitation, transportation, business development and regulation, tourism, etc. The number of rows and columns will depend on the size and socio-economic complexity of the region, the number of potentially impacted parties, and other factors.

Table 2. Examples of potentially interested parties (PIPs) that will be important to contact about potential human dimension impacts of oil spills.

PIP	Local	Regional	National	Tribal	International
Public	Residents, homeowner associations	Recreational fishermen	Tourists	Tribe members	Tourists
Industry	Restaurant and hotel businesses	Chamber of Commerce	Trade Associations	Tribal businesses	Shipping companies
Non-governmental organizations	Community churches or synagogs	Regional food bank	Audubon society	Tribal community center	Catholic charities
Scientists and academia	Local colleges	Nearby research universities	National specialists	Tribal colleges	Universities
Government agencies	Local government agencies	State and County government agencies	Federal government agencies	Tribal government agencies	European Union

Table 3 provides another example of how you might think through who is at risk and why. It suggests questions that can be asked to identify potentially impacted parties in a region. Probing questions can help make clear the individuals, groups, and organizations within each category shown in Table 2. Make a thorough list of all of the potentially impacted parties relevant to planning in your area. One place to start is with Appendix A. It contains a long list of PIPs. But keep in mind that the list in Appendix A will not include all of the groups that are important in your area. Aim to produce as thorough a list as possible. In latter steps we will talk about how to narrow this down for a single spill scenario.

Step 3. Design draft spill scenarios that emphasize human impacts

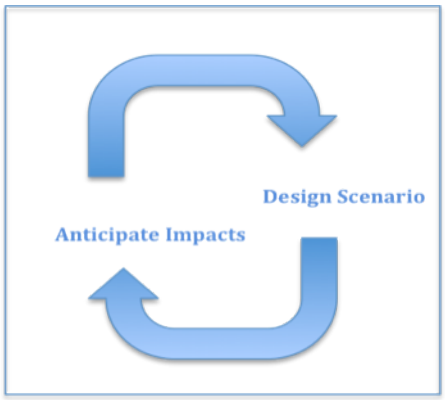
Scenarios are often used to give structure to a planning process. Scenarios provide a basic "storyline" for a spill and spill response. We expect that Core Team members will have experience designing and using scenarios for planning and training. When designing spill scenarios that focus on ecological resources, planners design scenarios that result in a wide range of outcomes to the full diversity of ecological habitats. These scenarios are a kind of "stress test" that allow planners to assess the adequacy of the response plan to

Table 3. Categories of potentially impacted parties and ways to flesh those categories out in your region.			
Category	**Probing questions**	**Sources of Information**	**Hypothetical Examples**
Cleanup workers	Does the Area Contingency Plan include a definition of cleanup workers? Does it define volunteers? Is there a specific contractor? Are there contractors already identified who will handle the cleanup? Is there an organization responsible for training and coordinating volunteers? Is there an organization that regularly deals with one specific part of the cleanup?	Area contingency plans	Cleanup Associates, Inc. Tri-State Bird Rescue
Residents	Which shoreline residents will be most affected by a spill? Who is likely to have their daily way of life affected?	US Census Data www.uscensus.gov	Mayor's office
Fishermen	Are there commercial fishermen's coops or organizations? Who are the commercial fishermen? Who are recreational fishermen?	NOAA	Portsmouth Fish Coop
Ethnic groups	Are there ethnic groups that might be disproportionately affected because of their ethnicity? Are there community leaders of key ethnic communities?	Leading ethnic community organizations	Casa Latina Social Club Vietnamese religious organizations;
Subsistence fishermen	Where do subsistence fishermen fish or harvest shellfish?	Department of Environmental Management or Natural Resources; the Dept of Public Health.	
Formal associations	Are there professional, residential or homeowners associations in the area (e.g. an island community?)	Which groups have been involved in other collaborative planning activities, such as National Wildlife Refuge management planning?	Riverboat Captain's Association Friends of the Bay Oceanview community association
Tribal communities	Are there Native Americans who are likely to be affected? Are they organized with tribal governments or tribal corporations?	Bureau of Indian Affairs	Tribal Government Natural Resource Planner
Tourism industry	Which sectors of tourism might be affected (whale watching, recreational fishing, beach-goers, camping, cruise ships...)?	Local government Chamber of commerce Local sea grant extension specialists	Caribbean Cruise Lines
Social service NGOs	Which groups currently provide public support services to any of the parties listed above?	Ask the groups	Fisherman's Families Support
Governments	Which agencies at each level of government have an interest in oil spills or disaster management?	Which agencies are already involved in ACP?	OSHA, EPA, Homeland Security, counties, parishes, councils of governments, etc.

those resources. The same logic can be applied to human dimensions impacts. Establishing the geographic extent of the area contingency plan is a major element in any planning effort. In defining this area, it is important to consider the "human geography" of the region. By "human geography" we mean the geographic extent of social networks and institutions that can be affected by a spill in the area.

A spill scenario generally specifies the location of the spill, type of oil, time of year, time of day, current, weather, assumptions about oil transport and weathering processes, and complicating factors (Aurand et al. 2003, Verma et al. 2008). Because outcomes can vary widely under these conditions, spill scenarios also need to appropriately consider the human dimensions of the spill scenario, particularly in identifying complicating factors.

In the planning process there is a cyclical relationship between the identification of human impacts and the design of a spill scenario or set of scenarios. The scenarios should be designed to create a number of risks to human systems, but to design such scenarios, one needs understandings of the ways human systems are vulnerable to spills. Scenarios should be realistic, and detailed enough to represent the concerns of a broad range of PIPs. In other words, you need to know what are the possible human impacts in order to create good scenarios, but you need scenarios to understand what are the possible human impacts. This "chicken and egg" type problem can be addressed by beginning with using general information contained in factsheets as a starting point and by adopting a step-wise, iterative process.



The Core Team should use the information developed in Step 2 to design spill scenarios that will present a range of plausible and diverse risks to different groups and institutions. Begin by mapping the different kinds of resources used and activities undertaken by the people and groups identified in Step 2. It helps to identify the following human infrastructure:

- cultural sites (historical, religious, cultural),
- recreational resources (birding, hiking, bathing, diving, surfing, etc.),
- fishing grounds (commercial, recreational, subsistence),
- retail business or shopping areas that could see or smell oil,
- the distribution of municipalities in counties, regional planning districts, fire districts, state department of transportation regions, emergency planning districts and so on,
- the location of transportation pathways and hubs, and
- "bridging" institutions, which are institutions that coordinate certain functions across a population of individual organizations (e.g., an association of marinas may serve as a lobbying arm for the interests of all marinas in the region, homeowner associations, chambers of commerce, campground associations, and recreational fishing groups.

Spill scenarios should be designed to create simulated stresses of these human resources and activities. For instance, cultural sites can be threatened by rapid, heavy oil that physically stains and fouls the resource. Recreational resources can be stressed by oil that washes up in light, but repeated patterns over significant periods of time. Retail business and residents can be stressed by oil that creates obnoxious smells for lasting periods of time.

Outcomes will lead to different kinds of human impacts depending upon different modifying variables. Seasonality, for example, is a modifying variable for impacts to beach use and tourism industry. For example, a spill that threatens beaches on the 4th of July weekend will create very different impacts than the same spill in early November.

Fishing operations are also highly dependent on seasonality. For instance, because of the *Cosco Busan* spill in San Francisco Bay, the Governor of California closed the Dungeness Crab Fishery just weeks before the opening of the season. Obviously, a closure after the fishing season ended would have produced very different impacts.

Modifying variables amplify or reduce risks. Table 4 lists some examples of modifying variables in oil spills. These can be a starting point for integrating modifying conditions into scenarios. These variables can also function as "injects" in a spill scenario.

At present, there is no scientific consensus on how to best design spill scenarios that "stress test" these human dimensions. This is poorly chartered territory. In the absence of extensive research, a great deal of judgment and local knowledge must be incorporated. Consequently, we recommend designing a set of preliminary spill scenarios to stress test the response to protect human resources, and then consult with PIPs about the details of these scenarios. PIPs who are intimately familiar with the resources at risk will have detailed knowledge of how these resources manifest or how the human system will respond to the spill. They will be able to identify further modifying variables and insight into limitations of response capabilities. These consultations can take place one-on-one over the phone or in small working groups. The advantage of small groups is that people focus more on the task at hand and build off of each other's contributions. Of course, it is difficult to bring people together in one place.

Step 4. Assemble a Human Dimensions Team.

The Human Dimensions Team (HDT) should be a larger, broader group that can provide input and review draft documents prepared by the Core Team. The HDT should have representation from the major groups that were identified in Step 2. We recommend that the size of this team should not exceed more than a dozen or so individuals. There is no hard and fast rule for this, it is simply better to have a group that has significant breadth, but is still small enough to foster rich discussions.

At this point, it is much better to bring the HDT together in one physical location in order to work on a specific task. Face-to-face dialogue is richer and more satisfying than technology-mediated dialogue. Since the plan requires the Core Team to do the bulk of the design work—drafting documents and gathering resources, etc.—the HDT basically serves in an oversight function. Their discussions of lists of PIPs, geographic areas,

Table 4. Examples of modifying variables that influence vulnerability of potentially impacted parties to human dimension impacts from oil spills		
Impact	**Modifying Variable**	**Example**
Physical and Mental Health		
Injuries from slips and falls	Knowledge of best practices for safety.	Coast Guard can instruct crew on best practices for dealing with hazards associated with oil
Social		
Change in relationships	Number of hours of downtime each day	People who take time to get away from the stress of the spill and spend time with family are better able to weather the event without it damaging their family.
Economic		
Change in income	Ability to take on other forms of work	People put out of work by the spill may switch to other means of making an income.
Cultural		
Violation, damage, destruction of cultural sites	Delineation of sites	If sites are clearly fenced and identified, cleanup workers who happen upon them may be less likely to "explore" the sites.
Experience and use of the natural environment		
Interrupted ferry service	Availability of bridges	If there are bridges that can absorb the additional traffic, then the impact may be small.
Governance		
Quality of everyday government functions	Simultaneous emergency events	Fire departments are expected to take part in cleanup activities while also responding to normal load of emergencies in their service area.

and spill scenarios will validate the review. The HDT also makes important decisions about setting the priorities among potential impacts. At the end of the process, the HDT also establishes a plan for moving forward with filling data gaps.

Step 5. Refine the Human Dimensions scenarios

By carefully selecting members, the Core Team should ensure that the Human Dimensions Team (HDT) has specialized knowledge about the human impacts of potential spills. In this step, they apply that knowledge to revise and refine the draft spill scenarios that were designed by the Core Team.

Step 6. Use the scenarios to identify priority impacts

In this step, the HDT (including the Core Team) uses the revised scenarios to brainstorm a list of human dimensions impacts and then develops a short list of priority impacts.

Sub-step 6-1. Brainstorm a list of possible HD impacts for each spill scenario

A facilitated group dialogue is the best strategy to accomplish the goal of this step. The facilitator should be knowledgeable in techniques for promoting brainstorming. The scenario can be introduced by the Core Team, followed by the HDT discussing their ideas of how such a spill might affect the community. Another possibility is to bring a number of PIPs together and run a focus group (see below).

Holding these meetings face-to-face is the best approach to encourage people to build off of each others' comments. If it is not possible to bring people together as a group, then meeting one-on-one with individuals is the next best choice. One-on-one telephone conversations are a marginal strategy. The calls can be aided by first emailing a list of questions, so that the individual is prompted to think through all the dimensions of the issue. Whether input is collected via focus groups, face-to-face interviews, phone calls, or email, the Core Team should record all the ideas that arise.

The HDT may decide that this process should be supplemented with information gathered from interviews with PIPs in the region. Such interviews are best done in a semi-structured format, which means having an interview guide, or set of topics to cover, but not having to follow the order or wording of questions precisely. To focus the interviews, the HDT can prepare an interview guide to ensure that all of the kinds of impacts are covered, but that also allows flexibility to explore newly discovered issues. Try to explore all the main categories of impacts (see Table 5). An example of the kinds of questions that can be used to learn about the human dimensions impacts people care about is in the Interview Guide in Appendix B. Allow the interview to flow freely so that people can raise the points most important to them and frame the issues in the way that he or she ordinarily thinks. Its purpose is to *guide* the conversation, not simply ask questions, which means there is room for deviating from the guide to explore interesting issues that arise. The guide ensures that the interviewer is thorough and uses the interviewee's time efficiently.

This activity should result in a long list of potential impacts about which people are worried. It will also yield supplemental explanations about why they are worried. All this information should be recorded by the Core Team and organized according to the type of impact. One way to do this is to type-up notes, which can then simply be cut and pasted into a Word document, which has sub-headings for each impact discussed. This information will be used in the next step of the assessment process.

Sub-step 6-2. Prioritize human dimensions impacts for area contingency planning

The list of potential impacts that emerges from the last step will mostly likely be very long. Prioritizing what is most important is, of course, a goal of planning. For ecological systems, this priority setting is based on the identification of sensitive ecological areas. A

similar set of critical human dimensions impacts should be identified to facilitate spill response planning and management in the event of a spill.

Table 5. Taxonomy of human dimensions impacts from oil spills and spill response.

Health	Social
Acute health	Change in behaviors
Chronic health	Change in relationships and interaction
Injuries	Change in make-up of community
Mental anguish	Infrastructure and social services
Mental trauma and depression	Stigmatization
	Unfair treatment
Economic	**Cultural**
Change in income	Degradation of natural heritage
Change in expenses	Interruption of customary activities
Damage to tangible private property	Loss of identity
Disruption of normal economic activities	Violation, damage, destruction of cultural sites
Lost livelihoods	Change in values
Experience and Use of Natural Environment	**Governance**
Access to natural environment and infrastructure	Crime enforcement
Deterioration in non-market use	Hearings and new legislation or regulation
Impaired experience	Participation
Loss of recreation opportunity	Preparedness and capacity of response and planning
Quality and availability of housing	Quality of everyday government functions
Quality of community infrastructure	Trust

The National Contingency Plan (NCP) requires that items of *economic* and *environmental* importance that are threatened by a spill be covered in the plan. It would be wise to also ensure that other important human impacts also be included. After all, an oil spill response is defined as encompassing all activities involved in containing and cleaning up the oil in ways that achieve the following over-arching goals:

1. Maintaining safety of human life;
2. Stabilizing the situation to preclude it from worsening; and
3. Minimizing adverse environmental and socioeconomic impacts by coordinating all containment and removal activities to carry out a timely, effective response.

Clearly the NCP defines primary objectives for a spill response, but it is wise to consider how other impacts could be reduced at the same time. For example, public health and major economic activity such as shipping traffic are priorities during an emergency response. Suppose that closing a ferry crossing would expedite shipping but would also disrupt the commute for thousands of residents. The HDT can explore how to manage non-critical impacts while also achieving the primary objectives.

This sub-step is focused on *how* to make those initial choices. Of course, based on future steps there may be reason to revise this preliminary list (and we will discuss this issue below). Again, it is important to realize that setting these priorities is not a question

that can be answered objectively. Priorities are based on people's values about what is important – potential for loss of life, financial loss, trade-offs between short-term and long-term impacts, and that vague but often used term "quality of life." Understanding this informs the ways that choices about priorities should be made. One consideration is about who should be involved. This goes back to the issue of who should be a member of the HDT. Another consideration is about how choices can be made. This involves making sure that people feel heard, that they have good information to inform their thinking, that they have adequate time to discuss their concerns, and the like.

There are a variety of ways to identify priorities for planning. You can just ask people to vote. You can also ask them to discuss the issues until they reach some sort of consensus. However, just involving the spill managers and other spill response experts in this decision risks raising questions about the legitimacy of the choices – as in "who are you to decide"?

A better way to prioritize is through facilitated group discussions. Various approaches to gathering information from groups include focus groups and structured group priority setting. A focus group is a carefully guided group discussion intended to generate a rich understanding of participants' experiences and beliefs. Focus groups are a proven research technique appropriate for a project that is exploratory and/or descriptive in nature (Morgan and Krueger 1998, Patton 1987, Santos et al. 2007). They are particularly well suited to evaluation research. They are essentially group in-depth interviews with eight to twelve individuals brought together at a convenient and comfortable location to discuss a particular topic under the direction of a trained moderator. In a structured group priority setting workshop, a facilitator helps gather input from a broad range of people. Multiple workshops can be held. Participants are guided by a moderator through a series of worksheets in which they generate, select, and rank concerns.

Each of these methods (and there are many others as well!) has strengths and weaknesses that shape their effectiveness in gathering different types of information and in working with different types of individuals and group dynamics. No matter which method is used, the Core Team should give PIPs who are not part of the HDT the opportunity to give additional feedback. It is important to hear what they say to avoid surprises later. For instance, you don't want to find out too late that a key concern is missing.

Step 7. Characterize the priority impacts

Once the priority impacts have been identified, the Core Team can move forward with learning as much as they can about how those impacts emerge and what can be done to mitigate or eliminate them. To accomplish this step the Core Team can take the lead, and then gather feedback from the HDT, by developing a data-gathering strategy that draws on expert and local knowledge. It will be important to draw on both expert knowledge and local knowledge to identify impacts. Keep in mind that it is important to identify both what impacts people *are worried about* and what impacts scientists or professionals say people *should be worried about.* Risk perceptions of lay people do not always match those of experts, but that does not mean the risks that lay people care about

are unimportant! Plans can be improved by thinking beyond the minimal standards related to *economic* and *environmental* impacts established in the National Contingency Plan (NCP). It would be wise to also ensure that all other important human impacts also be included.

Sub-step 7-1. Gather expert knowledge

First, the Core Team pulls together existing reports, papers, and databases that provide information about the human dimensions of the planning region being studied. In some cases this information will be specific to oil spills and spill response in the area. But in most cases, the information may come from investigations conducted in other places. For example, incident reports and scholarly articles may have been written about past spills. In other cases, the information may be about specific groups, sectors, or organizations in the area being studied. For example, there are prior studies of fishing communities in New England (e.g., Hall Arber et al. 2001, Georgianna and Shrader 2005, Georgianna and Shrader 2008). Text Box 4 describes our CIVIC database of impacts to different potentially impacted parties that has been compiled using information about past oil spills. Existing reports and databases are useful because they give a "first cut" at identifying potentially important consequences and vulnerabilities. However, they rarely provide detailed enough information about all the important variables in a particular locale. As part of this project, we prepared a report that provides additional information about databases and assessment tools that may also be of use to planners (Dow et al. 2010).

Text Box 4: The CIVIC database.

CIVIC stands for: Classification of Impacts and Vulnerability Influencing Components. This is a Microsoft Access database of the published literature on the human dimensions of oil spills. It includes data tables on impacts, sensitivities, and response actions. The database is fully searchable and can be programmed to produce custom-tailored output reports. For instance, a report can be generated on all the impacts that have befallen commercial fishermen. This database only includes documented impacts, not possible or hypothetical ones. In addition, the database can be supplemented with new entries specific to an Area Committee's local need.

Second, the Core Team should identify experts who can provide information or insights about human dimensions impacts. These may be people who live locally, or they may be quite distant. Where ever there have been large oil spills, local scholars have stepped forth to investigate the human impacts. By far, the *Exxon Valdez* is the most widely studied spill. Dozens of scholars have published papers or reports on the impacts of that event. Table 6 is a list of scholars who have worked on human dimensions impacts of oil spills in the past. You might start by researching these individuals, or contact a local university.

Table 6. Experts with knowledge about human dimensions impacts of oil spills and spill response		
Name	**Expertise**	**Spill**
Thomas Birkland	Law and regulation	*Exxon Valdez*
Stephen Braund	Socio-economics	*Exxon Valdez*
So-Min Cheong	Geography	*Hebei-Spirit*
Christopher Dyer	Culture	*Exxon Valdez*
James A. Fall	Subsistence cultures	*Exxon Valdez*
Maria Deloras Garza	Economics	*Prestige*
Duane Gill	Sociology	*Exxon Valdez*
Maria Lourerio	Economics	*Prestige*
Rita Miraglia	Anthropology	*Exxon Valdez*
Lawrence Palinkas	Psychology	*Exxon Valdez*
J.D. García Pérez	Socio-politics	*Prestige*
John Petterson	Social impact assessment	*Exxon Valdez*
Steve Picou	Social psychology	*Exxon Valdez*
Liesel Ritchie	Social capital	*Exxon Valdez*
B. Suarez	Health	*Prestige*

Sub-step 7-2. Gather local knowledge

While the previous step addressed getting expert knowledge, this step addresses getting "local" knowledge to inform understandings of priority impacts.

The same methods for gathering input as in Step 6 can be used here. For example, in one-on-one meetings or small group meetings, the Core Team can meet with representatives of the parties possibly impacted by spills in the scenarios. The goal is to produce more detailed understandings of what the impacts would be and how they come about. It is best to choose a group of people who have different perspectives and who would be impacted in different ways. People with in-depth experience and understandings of the community, region, or sector are ideal. A good place to start is with the individuals, groups, or institutions that have already attended an Area Planning Committee meeting and that you identified in Step 2. However, it is important to realize that people's perspectives are not different just because they are members of different groups. Even within a single organization, people's views may differ.

We also recommend that:

- If an individual or group says they are concerned about a certain impact, and you don't think that is a reasonable concern, *don't argue* with them! Any risk perceived as real has real consequences.
- You do not make it your mission to bring other people's risk perceptions in line with those of experts.

Step 8. Draw vulnerability tree diagrams to highlight vulnerabilities to potentially impacted parties

In Step 6, the HDT used the HD spill scenarios to identify and prioritize impacts. In Step 7 the Core Team and the Human Dimensions Team gathered information to better understand the impacts and how they arise. In this step, the Core Team starts with the highest priority impacts and continues to characterize them, but in a more structured way. Characterizing impacts means more than simply elaborating on who is impacted and how. It also means characterizing why they are impacted, including what makes them more or less vulnerable, more or less able to cope, and why two similar PIPs may experience very different impacts, even if they were exposed to the same hazards. Such information is critical to planners, because it helps ensure that the response expends its resources in places where they are needed and can make a difference.

This step progresses in an iterative manner. In the first iteration, the Core Team takes the lead in drafting *Vulnerability Trees* for all the priority impacts that were identified in Step 6, using the information gathered in Step 7. It is a good idea for the Core Team to write up a short narrative that goes along with each tree. This can include additional information or qualifications about what is known. It can also identify data gaps and clarify the levels of certainty.

In the second iteration, the HDT reviews the draft vulnerability trees, refining and validating them. The HDT may also choose to bring in additional PIPs who have specialized experience and knowledge to assist with this process.

Vulnerability Trees are simple diagrams that are easy to make. A vulnerability tree starts on the left with a problem that comes from the oil spill. This can be a direct outcome such as: oiled beaches. Or it can come about indirectly because the spill contaminated something. For example, water rationing is an indirect outcome of oil contaminating a drinking water supply; this is a problem with spills that occur near water desalination plants (Elshorbagy 2008) or in river systems (Tuler et al. 2010). Outcomes can also be caused by the response itself such as: interruption in ferry service. Both direct and indirect outcomes affect a number of parties and lead to a number of impacts. Other possible stressors include:

- Oiling of docks and boats
- Strong odor
- Closure of fishing grounds
- *In situ* burning
- Wildlife death
- Closure of shipping lanes
- Unavailable emergency services

Begin drawing the Vulnerability Tree by selecting one outcome to focus on first. A different tree will be made for each outcome. Figure 1 shows a tree that is rooted in the outcome: Oiled Beaches. (It's usually easier to draw the tree lying on its side!)

Continue the tree by identifying the first set of branches of the tree as the Potentially Impacted Parties (PIPs). In this case, the PIPs would include: residents who use the beaches for various purposes, the general public who may come to the shore to vacation, the tourism sector of the local economy, which would include campgrounds, hotels, spas,

restaurants, and so on. Table 2 can be helpful for thinking about the range of PIPs that may be impacted.

Figure 1. Example of a Vulnerability Tree

OUTCOME	PIPs	MODIFYING VARIABLES	RESPONSE ACTIONS
		Cancellation policies	Work with Chambers of Commerce
	Residents	Mode of transit	Work with airlines
	Vacationing public	Access to other beaches	Open alternative beaches
Oiled Beaches	Tourism economic sector	Weather	Status updates
	Beach Users	Economic conditions	Compensatory funding
	Property owners	Personal cash flow needs	Short-term loans
		Time of year	Status updates

The second set of branches follows from these PIPs to identify what might modify the impacts that they experience. To develop the scenarios in Steps 3 and 5 we identified some modifying variables. These now need to be elaborated with a focus on how the modifying variables can affect the ways impacts are experienced by PIPs. Table 3 is a useful starting point for thinking about modifying variables that can be important. Table 7 provides another way of thinking about potential modifying variables. The elements of the taxonomy shown in Table 5 refer to different parts of human-ecological systems that may influence cause-effect relationships. It is also useful to distinguish these variables according to how stable or fixed and dynamic or changeable they are. Text Box 5 gives more detailed examples associated with economic stressors for different kinds of social entities.

Table 7. Taxonomy of modifying variables that influence vulnerability to impacts.

Individual characteristics	Attributes of people: age, gender, ethnicity, health, ethnicity, language, skills, flexibility, education, experience, and willingness to take risks.
Social conditions	Attributes of social networks and social relationships: number of dependents, structure of family, membership or affiliation with social network, number of social service organizations in community, differential entitlements and access to resources, absence of social support mechanisms.
Economic conditions	Attributes of the economy and economic aspects of entities: flexibility, dependency on a single industry or employer, state of unemployment, market condition, debt, access to credit, etc.
Institutional characteristics	Attributes of institutions: robustness, resilience, connectedness.
Governance aspects	Attributes of government: staffing levels, regulatory environment, available financial resources, etc.
Cultural aspects	Customs and core beliefs/behaviors of communities: subsistence activities, recreational activities, etc.
Technological aspects	Attributes of the technologies and technological infrastructure: Access to internet, type of boat, alternative transportation routes, etc.
Ecological components	Attributes of the natural ecological system: geographic location, proximity to danger, marine productivity, exposure to natural hazards, etc.

In the example relating to oiled beaches, residents would experience less impact if they have alternative beaches that they can use. Members of the general public who have plans to vacation at the shore would see their impacts reduced if they could change their plans without suffering economic costs. Thus, the cancellation policies of the hotels or resorts are a modifying variable. Another consideration is how far these people are traveling. Those who purchased nonrefundable airline tickets would be more susceptible to impacts than people who had planned to drive. Another factor that is important here is the dates of their planned visit.

Text Box 5. Examples of fixed and changeable modifying variables that influence the effect of economic stressors on different social entities.

Modifying variables are qualities of the affected entity that amplify or attenuate the damage they experience because of exposure to a hazard. These can be relatively *fixed* or readily *changeable.* An example of a more fixed modifying variable is work experience. For example, five years of experience in a job is not something that can be acquired overnight. Training, on the other hand, is readily changeable. Skills can be taught quite quickly. For example, a crew member can be trained to cook, repair gear, and clean fish in a very short time period. When crew can perform multiple functions, their sensitivity to being put out of work is reduced. For affected businesses, debt burden and number of employees are characteristics of businesses that affect how an economic stress impacts them. The former is more difficult to change quickly, while the latter can be rapidly changed. For communities, economic diversity is a slow-changing variable, while enforcement of regulations is something that can be changed very quickly.

Examples of fixed and changeable modifying variables that influence the effect of economic stressors on different social entities.

	More fixed	**More changeable**
Individual	Work Experience	Training
Business	Debt burden	Number of employees
Community	Economic diversity	Enforcement

It is possible to now take these Vulnerability Trees back to the Area Planning Committee (APC) and incorporate them into the contingency plan. However, while the Trees help organize a large amount of material, they do not provide the clearest picture of how response actions can prevent or mitigate specific impacts to PIPs. A more rigorous approach to establishing a clear set of response actions is outlined in the following step.

Step 9. Draw causal pathways diagrams that link stressors, impacts, and response actions

The Vulnerability Trees bring together information about the prioritized impacts that response managers should plan for in an Area Contingency Plan. This includes; who might be impacted, how they might be impacted, and why they are vulnerable. However, the Vulnerability Trees do not provide organized information about response actions that can be taken to prevent or mitigate impacts. In this step, we describe a technique for drawing diagrams that link the spill stressors to impacts and also position response actions at specific points along this causal sequence. Text Box 1, on page 7, elaborates on the terminology and theory behind the causal structure of hazards.

The Causal Pathway Diagram and its accompanying narrative are a *composite* of all of the information gathered about the spill scenario, the PIPs, the modifying variables, the impacts, and the possible response actions that can be taken during a spill response to prevent or mitigate outcomes and impacts.

Drawing Causal Pathway Diagrams requires thinking about causal connections. One of the most difficult parts is to decide what is an *intermediary outcome* along the chain of events and what is an impact. (We consider "impact" and "consequence" to be synonyms, but outcomes are conditions or states-of-affairs that manifest in the process of the hazard event.) Along the chain of events, modifying variables work to intensify or lessen the size of the effect. *Modifying variables* can lessen intermediary outcomes or they can intensify or lessen impacts. *Response actions* are located next to the outcome or impact they seek to prevent. All of these things can be captured in a single diagram, but having an accompanying narrative helps people interpret the diagram accurately.

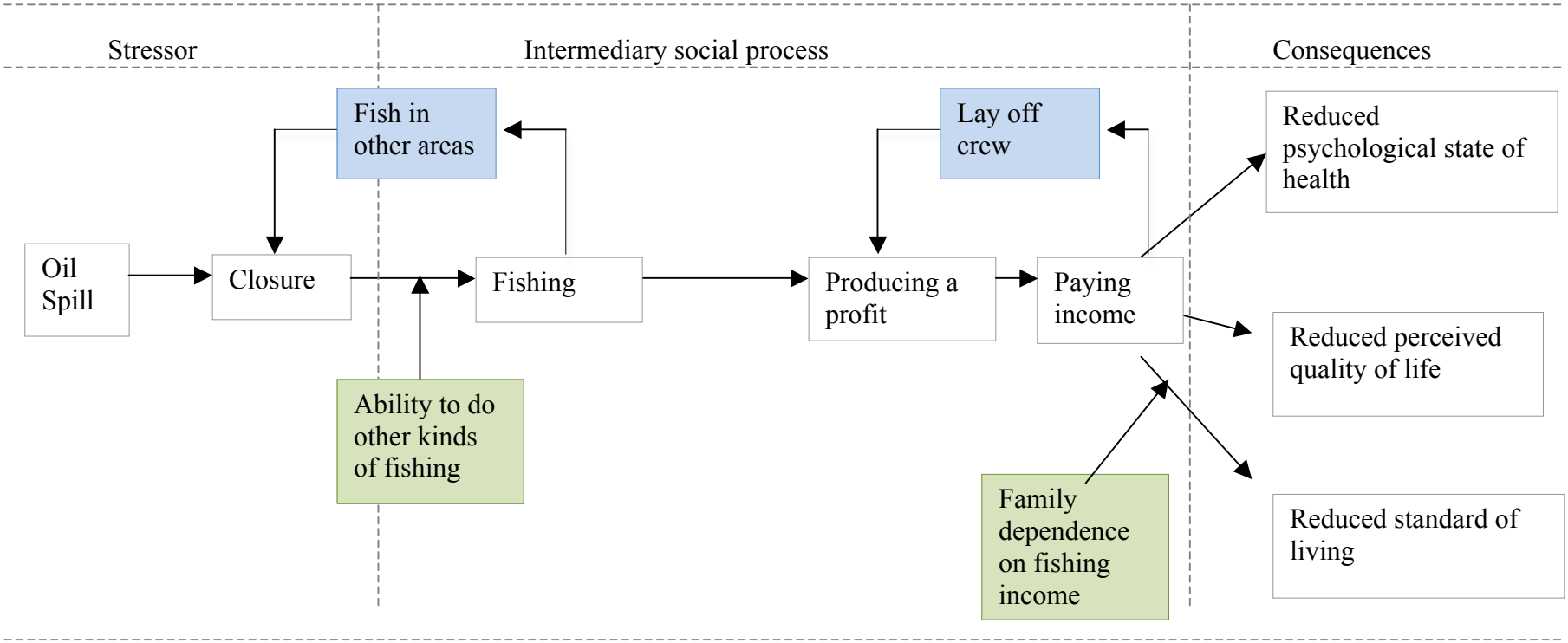
Figure 2 on the following page shows an example of a Causal Pathway Diagram that was composed for impacts associated with commercial fishing. The main causal pathway is in the middle. The green boxes below are examples of modifying variables. The blue boxes above are examples of response actions. Making these diagrams is quite complex and would certainly benefit from professional assistance.

As with making the Vulnerability Trees, making the Causal Pathway Diagram would best happen in an iterative manner. In the first iteration, the Core Team takes the lead in drafting Causal Pathway Diagrams and accompanying narrative descriptions for all the priority impacts that were identified in Step 6. The information summarized in the Vulnerability Trees should inform this diagramming. Appendix C gives a more detailed example of how to interpret a Causal Pathway Diagram.

In the second iteration, the HDT reviews the draft Causal Pathway Diagrams and narratives, refining and validating them. The HDT may also choose to bring in additional PIPs who have specialized experience and knowledge to assist with this process.

While the Core Team can draft the Causal Pathway Diagrams and narratives, it can benefit from having them reviewed by the HDT and other key PIPs. The Core Team can coordinate getting feedback in the same way as described in Steps 5 and 6. By validating the findings, the Core Team can improve the credibility of the assessment and ensure the accuracy and completeness of the information. In addition, validating the findings in this way can improve the legitimacy of the assessment and, presumably, the contingency

Figure 2. Example of a Causal Pathway Diagram that focuses on impacts to commercial fishing



plan. This step can help people feel that their input was valuable because they can see their knowledge and input reflected in the causal diagrams and narratives. Finally, it can also makes the assessment process more transparent, which may increase support and cooperation in the response effort, if a spill should occur.

Step 10. Integrate information about human dimensions in Area Contingency Plans

The outputs of Steps 8 and 9 are a series of documents that describe:

- The potential human dimensions impacts that are of greatest concern in the area under consideration.
- A list of individuals, groups, and organizations (PIPs) and modifying variables that makes them more or less vulnerable to the impacts, in the form of Vulnerability Trees.
- Direct and indirect (downstream or secondary) impacts in the form of Causal Pathway Diagrams and narratives, which also describe how those impacts emerge.
- A list of potential Response Actions—ways that spill response can intervene to "break" the causal pathways that link the released oil to specific impacts in order to prevent or mitigate the severity of potential impacts.

These materials can be inserted into Contingency Planning documents, so that they are readily available in the event of an oil spill. They can also be used as part of training exercises.

The Core Team and Human Dimensions Team can also use these materials to develop spill response performance metrics. Performance metrics can be used to: improve oil spill response planning, promote institutional learning post-response, support public communication during and after spills, etc.

Over the last decade various approaches have been proposed to assess the quality of contingency *plans*, using expert input about the appropriate performance metrics to use (Haynes and Ott No date, Abordaif et al. 1995, Harrald and Mazzuchi 1993). However, the question of how best to assess *response* successes and shortcomings has not received the same level of systematic attention among planners, although some frameworks have been proposed (Kuchin and Hereth 1999, Lindstedt-Siva 1999). Proposals have also been made for ways to develop performance indicators in a collaborative process involving interested stakeholders (Tuler and Webler 2008; for more information about this project and other publications see: http://rfp.crrc.unh.edu/projects/viewProject.php?PROJECT_ID=12). This can be done by building off the experience and expertise of the Human Dimensions Team.

Conclusion

This document provided guidance for Area Planning Committees to systematically assess the potential health, social, economic, institutional, and cultural impacts of oil spills – what are often called "human dimensions impacts." This information can inform contingency planning and lead to more successful responses. The approach offered is called a *Human Dimensions Impact and Vulnerability Assessment.*

While there are many ways that Area Planning Committees can develop information about human dimensions impacts and integrate the information into Area Contingency Plans, this assessment approach is similar to the way that ecological risk assessments are routinely done as part of oil spill response planning. The guidance presented here instructs planners how to:

- construct spill scenarios that appropriately test response activities for human dimensions impacts;
- identify and prioritize human dimensions impacts that must be addressed, including downstream social and economic consequences that can arise from both spills and spill response activities;
- characterize the vulnerabilities of individuals, groups, communities, and economic industries and sectors to impacts; and
- identify effective response actions that can prevent or mitigate impacts and vulnerabilities.

The guidance provided here for *Human Dimensions Impact and Vulnerability Assessments* is based on extensive reviews of oil spill impact assessment tools, literature on vulnerability and risk assessment, and case studies of oil spill response. Additional materials produced as part of this project may be found at: http://www.seri-us.org/content/human-dimensions-of-oil-spills

This guidebook can be thought or as a do-it-yourself instruction manual. While it is feasible for experienced contingency planners to read through this guidebook and competently incorporate planning for the human dimensions of spills into their Area Contingency Plans, it is more likely that the process will be successful if guided, advised, or run by an expert in the area of human dimensions. Social scientists have experience thinking systematically about human systems and are accustomed to the conceptual models that form the basis of this approach.

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Appendix A. Example list of potentially impact parties (PIPs)

Cleanup workers
- Cleanup contractor employees
- Part-time non-professional cleanup workers (e.g. fishermen)
- Organized cleanup volunteers
- Unorganized cleanup workers

Residents
- Landowners on affected shoreline
- Residents near affected shoreline
- Residents of an affected municipality
- Residents whose commute to work is affected

General public
- Residents, visitors, or tourists in the affected area
- Regional population
- National population

Fishermen
- Commercial
  - groundfishermen
  - lobstermen
  - shellfishermen
  - oyster aquaculturists
  - seaweed harvesters
- Recreational
  - sportfishermen
  - shellfishermen
  - abalone gatherers

Subsistence fishermen

Ethnic communities
- Portuguese fishermen (New Bedford, MA)
- Vietnamese fishermen (Gulf Coast)
- Cuban Americans (Florida)
- Haitian immigrant community

Economic entities

- Ferry service
- Tour boats
- Cruise lines
- Port authorities
- Power generating station
- Desalinization facilities
- Fishing support services
- Refineries
- Aquariums

- Whale watching
- Oil transport terminals
- LNG terminals

Environmental users

- Beachgoers
- Bird watchers
- Swimmers, surfers, divers, snorkelers
- Kayakers, paddlers
- Nature enthusists
- Pleasure boaters

Government

- Local government agencies (fire department, rescue services, public health board)
- State and regional authorities (water districts, fire districts, school districts, planning districts, sewer authorities)
- Tribal governments
- Federal governments (Coast Guard, OSHA, MMS, etc.)
- International governmental bodies

Appendix B Example Interview Guide

A. Introduction
Give overview of goals and generally what needs to be learned. Clarify that it is not about ecological impacts – the goal is to learn about human dimensions impacts (although sometimes ecological impacts can lead to socio-economic impacts).

B. Concerns about the spill and its impacts
Goal of questions: Gather information about each person's concerns related to oil spills and spill response.

If there was a previous spill in the area, use it to make the discussion more concrete.

Where you around for the previous spill? If YES or if you heard about it:

- When the spill happened, what non-ecological impacts were you most worried about?
  - To whom?
  - Why?
- Were some groups, sectors, communities, or areas more sensitive to these impacts? If so, how + why? What are the forces that shape vulnerabilities to these impacts?
  - Biophysical environment
  - Economic
  - Social relations
  - Demographic
  - Institutions
  - Individual perceptions and decision-making
  - Technology
- Have such impacts "cascaded" to other groups, sectors, communities, and regions? If so, how + why?
- As spill response activities unfolded, did your worries change? If so, how?
- Do you still have worries, in the aftermath of the spill response? What are they?
- Were there impacts from the response and clean-up themselves?

Possible probes:

- How were you personally (and family) affected by the spill and response?
- How was your community affected by the spill and response?
- How was your organization or business affected by the spill and response?
- What was the most important response need? (e.g., recover oil? Reduce impact to scallop beds?)
- What do you think that the federal agencies were most concerned about?
- What do you think that the state was most worried about?
- What do you think that local community members were most worried about?

- How has your business, household, community, fishing port, sector reacted to impacts from oil spills in this area? → *anticipatory actions, coping, adaptation afterward*
    - What did they do?
    - What could they do?
- Did any response activities during a previous spill have much of an impact on ameliorating the impacts of the spill?

When you think of a possible future oil spill in this area:

- What non-ecological impacts are you most worried about?
    - To whom?
    - Why?
- Will some groups, sectors, communities, or areas be more sensitive to these impacts? If so,
    - Which ones?
    - how + why?

Appendix C. An example of a causal pathway diagram and narrative

On April 27th, 2003, the commercial tanker *Bouchard-120* spilled about 98,000 gallons of No. 6 oil into Buzzards Bay after grounding on a reef (Lord et al. 2010). The *Bouchard-120* spill led to a wide range of impacts on social entities in the Buzzards Bay region. Economic, social well-being, quality of life, mental anxiety, and stress impacts were experienced. The impacts occurred over different periods of time and different scales.

Important impacts were related to commercial shellfishing. Buzzards Bay is one of Massachusetts's most lucrative fishing areas producing quahogs, soft-shell clams, scallops, and oysters. Both commercial and recreational shellfishing are common along its shores. Individual towns issue the permits for shellfishing and this is a significant revenue stream for some towns. The commercial shellfishing industry is mostly owner-operated. According to local officials, about 500 commercial permits are sold annually by Buzzards Bay towns, recording about $4 million in annual shellfish sales (Associated Press 2003).

Figure C-1 sketches the impacts experienced by commercial shellfishermen and the causal linkages and processes by which they arose. The diagram starts on the left side with the stressor that initiates the changes in the status and condition of the commercial shellfishermen. In this case, the initiating event is the oil spill, but the stressor that directly exposes shellfishermen to harm is the response action of closing shellfish beds.

Commercial shellfishermen were affected by the *Bouchard-120* spill when, two days after the spill, Massachusetts Division of Marine Fisheries officials imposed a fishing ban on the entire Bay. The closure was intended to prevent both the sale of tainted seafood and public perception that seafood was tainted, which was feared would lead to further disruption of sales. After 23 days officials re-opened 51% of the bay for shellfishing. During the fall, the Massachusetts Division of Marine Fisheries reopened additional areas. By November, eight months after the spill, 97.7% of the bay was open to shellfishing (BBNEP 2009a). Still, even as late as 2009, 135 acres of shellfish beds remained closed because of residual buried oil (BBNEP 2009b).

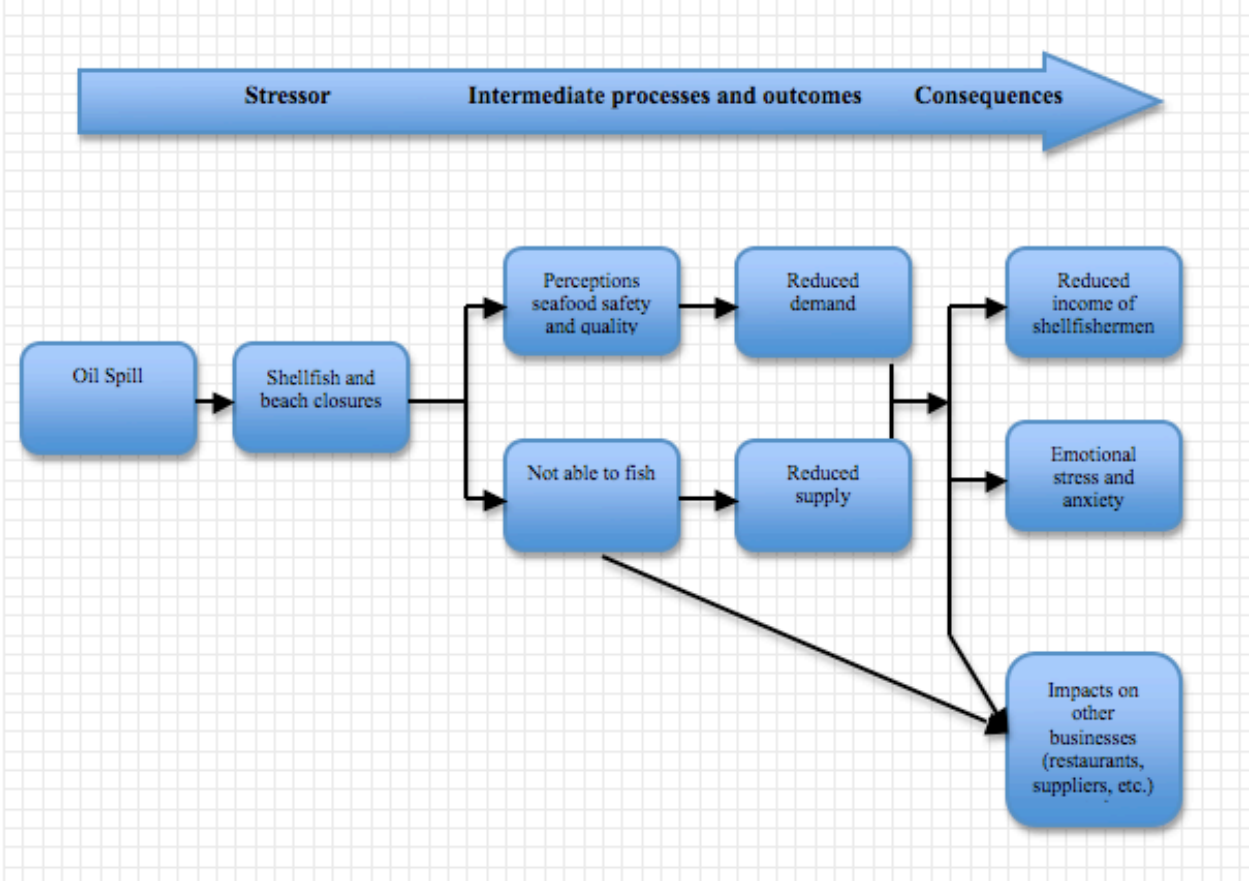

Figure C-1 Example of a Causal Pathway Diagram for impacts related to shellfishing.

The main reported impacts to commercial shellfishermen were a loss of income and an increase in emotional stress. Emotional stress comprises a set of negative emotional responses to the spill. For example, some felt hopelessness regarding the losses. Two shellfishermen offered statements reflecting perceived loss of autonomy and aspiration:

> "I feel like I just got my legs cut off below me, instantly. It looks like I'll have to start all over. And I don't know where to start […] I built up my business from scratch and now I'll have to give up my independence and go work for somebody else. This thing has made me feel like I'm a prisoner within my own self, if you know what I mean" (White 2003).

Stress was exacerbated by the uncertainties about the duration of closures and contamination of shellfish. Although half of the bay reopened three weeks after the incident, many shellfishermen could not work and had no alternative place to shellfish during the closures. Permit regulations limited them to a certain area and reduced their ability to cope with the adverse impacts by fishing elsewhere.

As shown in the bottom right of Figure D-1, impacts also accrued to other businesses, such as restaurants that distribute or sell fresh shellfish in regional markets. People expressed concern about the larger scale of impacts and about a domino effect on other sectors of the economy. For example, one individual quoted in a newspaper said:

> "I began to worry about the long-term effects this spill would have on my living and that of charter boat captains, shellfishermen, bait and tackle dealers, motel and restaurant operators

and all the other businesses that benefit from the robust fishing economy in this area" (Soares 2003).

Another dynamic identified was that shellfish buyers serving restaurants both within and outside the immediately impacted region could not get the product they desired, even though a relatively small percentage of areas were affected:

> "It was big. Nine percent of our areas were closed and the dealers were begging for shellfish even though you have different areas. It is amazing, from one shellfish how many people are affected all the way up to the food [service industry]. It affects the dealers, the people digging them; it affects the purchase of the shellfish."

The seafood industry suffered from the spill because of strong concerns about the potential risk of contamination. The stigma of contamination led to a downturn in business at local restaurants and seafood stores. The closure of shellfishing for a period of time along with the visibility of oil on rocks made some people worried about consuming seafood. As this man reported almost two months after the incident, "I wouldn't put my body in that water and I wouldn't eat anything that came out of there either" (Martineau 2003a,b).

However, not all commercial shellfishermen were equally impacted. A variety of factors affected their exposure, sensitivity, and resilience, as shown in Table D-1, which summarizes the factors reported by our interviewees and secondary documents that contribute to greater or lesser impacts experienced by individual commercial shellfishermen. First, their levels of "exposure" varied. The magnitude of the exposure depended on where the shellfishermen held permits, and the extent of closure in these areas. Some shellfishermen held permits in multiple towns and thus had a better chance of maintaining a portion of their income than those with a permit in one town only.

Table D-1. Factors that affected sensitivity and resilience of commercial shellfishermen during the *Bouchard-120* spill.

Modifying Variables	Response Actions
Degree of reliance on shellfishing for income Degree of income dependence on fishing fulltime or part-time (and working other part-time jobs as well) Prior financial stability, credit obligations, and standard of living Timing and duration of oiling and response relative to location of closures, permits held, and availability of permits	Fish in other areas Fish for other species Layoff crew Find another job Tap other sources of family income Receive compensation for lost income and damage/replacement of equipment Work with Fishermens' Legal Network to pursue claims further

The characteristics of their fishing operation relative to the spill and the closures, and their economic and employment situation affect shellfishers' sensitivity to harm from the spill. Those who fished full time were more sensitive to the impacts than those who fished part time (and may have worked other part-time jobs as well). Fishermen with high personal expenses and/or high operating costs (i.e. permits, boat mortgages, boat maintenance and repairs) were also more sensitive to the closures than others.

Response actions focus on the abilities to restore or recover from losses. Resilience of commercial shellfishermen is related to their access to resources needed to take actions to

mitigate or overcome losses. For example, the financial hardship caused by shellfish closures was sharper for those who had no alternative to fishing work. Some who experienced financial stress were at a loss for what to do. A Dartmouth shellfisherman was quoted in a local newspaper as saying: “I've got four bucks in my pocket and no money in the bank," adding that he didn't know whether he should start looking for other work. "I need answers” (Moore 2003). On the other hand, commercial fishermen, unlike most other people who may be impacted by an oil spill, have a significant source of resilience because they are eligible for compensation from the responsible party for their losses (Bardick 2000). In the month after the spill, more than 150 shellfishermen filed a claim for losses (Paletta 2003), although compensation was not always adequate to cover losses. Claims were not immediately forthcoming due to the processing time of the claim. Time spent waiting for compensation for lost income caused financial hardships for some commercial fishermen. It was also the case that compensation did not always reflect the actual losses incurred. Finally, the accuracy of fishermens’ prior catch reports had an impact on their compensation and therefore ultimate losses.

In addition to financial and institutional/legal resources that contributed to people’s ability to take response actions, some shellfishermen were able to turn to social networks. Those who were not satisfied with the claims process and compensations filed a class action lawsuit against Bouchard Transportation Company. The Fishermen Legal Network, which represents 30 shellfishermen, aquaculture fisheries and landowners, tried to recoup lost wages and damages (Urbon 2003; Heslam 2003).

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