physical contact with the exposed natural resource (e.g., oil transported from an incident by ocean currents, wind, and wave action to directly oil shellfish); or

(b) The sequence of events by which the discharged oil was transported from the incident and caused an indirect impact on a natural resource and/or service (e.g., oil transported from an incident by ocean currents, wind, and wave action cause reduced populations of bait fish, which in turn results in starvation of a fish-eating bird; or, oil transported from an incident by currents, wind, and wave action causes the closure of a fishery to prevent potentially tainted fish from being marketed).

Pathway determination does not require that injured natural resources and/or services be directly exposed to oil. In the example provided above, fisheating birds are injured as a result of decreases in food availability. However, trustees must always determine the existence of a plausible pathway relating the incident to the injured natural resource and/or service, even if the injury is not caused by direct exposure to oil.

Pathways can include, but are not limited to, movement/exposure through the: water surface; water column; sediments, including bottom, bank, beach, floodplain sediments; groundwater; soil; air; direct accumulation; and food-chain uptake.

As with exposure determination, procedures for pathway analysis include field investigations, laboratory studies, modeling, and the literature. As noted above, this proposed rule emphasizes that these procedures may be used alone, or in combination, depending on the specific nature of the incident. Trustees must determine the most appropriate approach to determine whether a plausible pathway exists on an incident-specific basis.

Understanding the potential pathways will also help to narrow the scope of the NRDA investigation, and may be important in deciding which assessment procedures to use. For example, the Type A model does not address injuries that occur via air or terrestrial pathways, thus it would not be appropriate in such cases.

4. Selection of Injuries to Include in the Assessment

During the Preassessment Phase, trustees may collect information on a wide range of potential injuries. As a result, a long inventory of potential injuries resulting from the incident is often developed. Because the collection of information on injury must be directly related to the incident and consistent with restoration planning, developing scientific knowledge for its own sake is not appropriate under this rule.

To compile the inventory of potential injuries, trustees should determine the extent to which the following information is known or can be obtained for each injury:

(a) The natural resource/service of concern;

(b) The adverse change that constitutes injury;

(c) The potential degree, and spatial/

temporal extent of the injury;

(d) The evidence indicating injury; (e) The mechanism by which injury occurred;

(f) The evidence indicating exposure;(g) The pathway from the incident to

the natural resource/service of concern; (h) The potential natural recovery

period;

(i) The kinds of primary and/or compensatory restoration actions that are feasible; and

(j) The kinds of procedures available to evaluate the injury, and the time and money requirements.

The result of the above analysis will be a list of injuries to be evaluated in the assessment.

## C. Injury Quantification

Injury quantification is the process by which trustees determine the degree and spatial/temporal extent of injuries. Thus, injury quantification is the means by which appropriate restoration is determined.

1. Conceptual Approaches to Quantification

Trustees may pursue one or more of several different conceptual approaches to injury quantification. Under these approaches, injury may be quantified in terms of: (a) The degree and spatial/ temporal extent of injury to a natural resource; (b) the degree and spatial/ temporal extent of injury to a natural resource with subsequent translation of that change to a reduction in services provided by the natural resource; or (c) the amount of services lost as a result of the incident. Examples of the first approach include quantifying the number of seabird mortalities caused by a discharge of oil, or measurement of the area of a river in which hydrocarbon concentrations exceed water quality standards. Examples of the second approach include quantifying reductions in fish populations with subsequent estimation of the number of recreational fishing days lost as a result of this injury, or quantifying the amount of lost spawning habitat as a result of

oiling with subsequent estimation of the number of fish that would have been produced by that habitat. An example of the third approach includes direct measurement of the number of beach user days lost as a result of a beach closure. Trustees are encouraged to use whichever approach, or combination of approaches, is most appropriate to the circumstances of the incident.

For reasons indicated in subpart C under the definition of baseline in the preamble, site-specific baseline information may not be required.

2. Injury Quantification Information Needs

Because the purpose of injury quantification is to design and scale restoration actions, a large number of quantification measures may be adopted by trustees. In general, injury quantification should be designed to evaluate injury by addressing the following:

(a) Degree of the injury. Degree may be expressed in terms of percent mortality, proportion of a population, species, community, or habitat affected, extent of oiling, and availability of substitute services.

(b) Spatial extent of the injury. Spatial extent may include quantification of the total area or volume of injury.

(c) Temporal extent of the injury. Duration of injury may be expressed as the amount of time that the natural resource and/or service will be injured until natural recovery occurs, including past and interim injury periods.

In order to scale restoration actions, trustees may find it useful to develop an estimate of the total quantity of injury that integrates severity, and spatial and temporal extent of injury. For example, quantification of the total losses of wetland habitat injured by oil could be obtained by estimating the: (a) Total number of acres of severely oiled wetland in which vegetation is totally killed; (b) natural recovery time for severely oiled wetland; (c) total number of acres of moderately oiled wetland in which vegetation is not completely killed but the wetland has lower levels of productivity; and (d) natural recovery time for moderately oiled wetland. This information could be combined to quantify the total number of "acreyears" of wetland injury to scale restoration actions.

## D. Analysis of Natural Recovery

Trustees must estimate the time for natural recovery without restoration, but including any response actions. Recovery is defined as a return of injured natural resources and services to baseline. Analysis of recovery times