Oil Spill Emergency Response
Killer Whale – Hazing Implementation Plan

I. Introduction and Background

This implementation plan provides guidance for killer whale monitoring and hazing activities as part of the Northwest Area Contingency Plan. Hazing activities during emergency oil spill response is authorized under MMPA/ESA Research and Enhancement Permit 932-1905 issued to the NOAA Fisheries Marine Mammal Health and Stranding Response Program (MMHSRP), Dr. Teri Rowles. The Federal On- Scene Coordinator in the Unified Command has been delegated authority as a Co-investigator under Permit 932-1905 and may initiate certain pre-approved hazing activities to minimize killer whale exposure to oil or other emergency spill response activities.

The Southern Resident killer whale population is listed as endangered under the U.S. Endangered Species Act (ESA) and is also protected under the Marine Mammal Protection Act (MMPA). Oil spills have been identified as a primary threat to this population and the *Recovery Plan for Southern Resident Killer Whales* calls for developing strategies to deter killer whales from entering spilled oil (NMFS 2008). Evidence suggests that killer whales are unlikely to detect and avoid spilled oil, and exposure can result in population-level impacts (Matkin et al. 2008). During the initial phases of a spill response the Unified Command will take appropriate action to monitor and/or haze killer whales to minimize their exposure to spilled oil. Prior to full mobilization of the Unified Command and the field response effort under its direction, NOAA Fisheries has pre-approved monitoring activities and three hazing actions for consideration and emergency implementation by the Command. Hazing activities that have not been pre-approved must be coordinated with and authorized by NOAA Fisheries (see section V. below).

II. Monitoring

Beginning with notification of a spill, the Wildlife Branch Director will ascertain whether killer whales have been observed or are likely to be within 50 miles (8-10 hours) of the spill event. If killer whales have been observed or are likely to be within 50 miles, the Branch Director will designate a killer whale liaison to initiate communications with killer whale experts, researchers, sighting networks and advocacy groups to monitor/track the whale's movements relative to clean-up activities and the spill trajectory. Once whales have been located, the Branch Director (or designee) will determine whether it is safe to dispatch a trained whale observer to the scene to identify the type of killer whales (residents or transients) and, if residents, which members of the Southern Resident killer whale population are present. If dispatch of a trained observer to the scene is not safe or feasible, the Branch Director (or designee) should order appropriate resources to collect high definition digital photographs of individual whales at the surface for use by identification experts off scene to identify which whales are present (see photo instructions below). The Branch Director (or designee) will order real-time reconnaissance (vessels or aircraft) for continuous monitoring if killer whales appear to be moving toward the spill, the spill trajectory, or clean-up activities and/or are found within 20 to 30 miles (6 hours) of oil or trajectory. Once monitoring begins, the Branch Director (or designee) will consider hazing to deter the whale's progress toward the spill and will identify available assets to conduct hazing. Monitors that are tracking whales in the field must provide periodic location updates for comparison with spill

location and trajectory forecast information to ascertain if the whale's path may intercept the spill trajectory. If hazing assets have been identified they should be readied for deployment and staged to be on scene if whales are expected to approach within 10 miles (2 hours) of oil or spill trajectory. The following hazing techniques have been pre-approved for consideration and emergency use without prior consultation, if NOAA Fisheries staff are unavailable (see section III below). The Branch Director may choose to consult with NOAA Fisheries marine mammal resource specialists, if they are assigned to the spill, prior to hazing implementation but such consultation is not required for pre-approved techniques. Regardless of whether hazing is implemented, real time monitoring of whale movements within 20 to 30 miles (6 hour reconnaissance buffer) relative to the spill or spill trajectory should be conducted to a) determine if whales have been or are likely to be exposed to oil; and b) to remain prepared for the potential of killer whales encountering oil or spill response activities.

III. Pre-approved Methods

In situations where immediate action is necessary to prevent killer whales from entering oil NOAA Fisheries has pre-approved; *helicopters, Oikami pipes, and underwater firecrackers* (*seal bombs) deployed from vessels;* for use by response personnel under the direction of the Branch Director and Unified Command to attempt to herd/move whales. Pre-approved deterrents should be deployed if the risk of entering oil exceeds the risk of disturbing the whales through hazing techniques. Risk to the whales should be assessed based on the proximity of the whales to the oil and their likelihood of entering the oil as well as the type and condition of the oil. The Branch Director will determine whether to activate the Marine Mammal Hazing Unit to implement hazing activities or, if exposure is imminent, to order "on-scene" personnel to attempt hazing. Selection of the most appropriate hazing technique will depend on the particular spill conditions, location of whales, level of risk to the whales, and available assets. Helicopter hazing may be the most immediately available technique, particularly if there are aircraft available and in use for Reconnaissance. Multiple pre-approved techniques may be implemented in combination (i.e., oikami pipes and firecrackers deployed from the same vessels) or in sequence based on observations of the whales and time needed to mobilize hazing teams. Deployment of pre-approved hazing methods will be directed by the following decision tree (Figure 1).

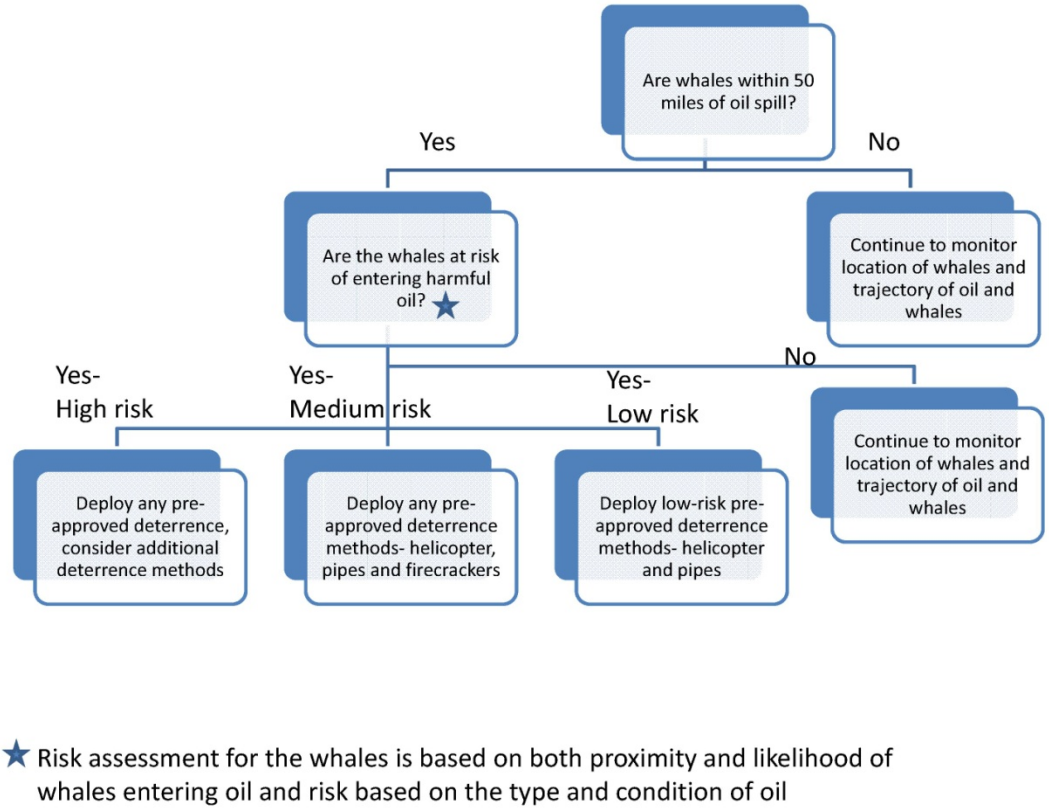

Figure 1. Decision Tree for immediate deployment of pre-approved hazing techniques

Helicopter

Background - Helicopters are effective tools for herding livestock in open terrain. There have been observations and reports of killer whales diving and changing direction when confronted by a helicopter hovering in their path. This technique is considered experimental and should be accompanied by detailed monitoring and observations of whale behavior (direction of travel, rate of speed, pod cohesion etc.) before close approach and during hazing by the helicopter. The expected response is aversion or avoidance of the helicopter. The stimulus that triggers the response is unknown but may be visual (approach from overhead), surface disturbance from prop wash (whales detect approaching change in surface condition (turbulence)), or acoustic engine or propeller noise transmitted to the water below the helicopter. Noise transmission into the water is most efficient in a circle below the helicopter roughly ½ the diameter of the flight altitude (for altitudes below 1000 feet).

Safety First – For personnel - Hazing whales with a helicopter requires low altitude maneuvering and hovering low over the water. Pilots should assess environmental conditions (visibility, turbulence etc.), surrounding air traffic (search and rescue, media), and surface vessel proximity to determine if it is safe to proceed with this technique. *For the whales* – The potential for whale

injury using this technique is low. Helicopter sound levels transmitted into the water are not sufficient to injure whale hearing even in the most intense area directly below the aircraft. No physical contact with whales is anticipated. There is some potential that aerial hazing could affect pod cohesion if different whales in the group respond differently to the helicopter. If the helicopter gets too close to the whales the potential for pod scattering may increase so cautious approach to the whale's position while monitoring for behavioral response is advised. If the pod breaks apart monitoring may become more difficult and require additional resources.

Operational Instructions – The optimal personnel complement aboard the aircraft during hazing is three: 1) the pilot, 2) a lead observer to continuously monitor the animals, provide whale information to the pilot and direct maneuvering, and 3) a data recorder/photographer to record notes of the encounter including pre- and post-hazing observations and take identification photographs. If fewer personnel are used, the observer can assume data collection and photography duties. To attempt a herding maneuver to divert the whale's path, the pilot should position the helicopter so that it will approach the whales from the direction of the spill. If safe to do so the helicopter should begin maneuvering at an altitude of 300 to 500 feet approximately ¼ to ½ mile from the whales maintaining its position between the whales and the direction of the oil, gradually reducing the distance to the whales and altitude. Observers should monitor closely for a response from the whales and pilots should continue to maneuver as necessary to obstruct paths to the oil. Pursuing the whales and closing the distance to the whales is permissible to maintain their retreat with aircraft maneuvering (hovering, zigzagging, and adjusting altitude) to reinforce the direction of travel away from the oil. Once whales have established, and are maintaining, a path away from the spill hazard, gradually increase distance from the whales (retreating toward the spill), increase altitude and continue monitoring effort. If the whales do not respond to the helicopter and continue travel along their original path unimpeded, notify the WBD of the whales' last position, direction and proximity to spill before leaving the whales to arrange for continued monitoring as whales approach the oil and/or deployment of alternate hazing resources. If the pod fragments when the helicopter approaches, notify the WBD and pass along the available information to inform subsequent hazing activities. If whales do not respond to helicopter hazing and enter the oil, monitoring should continue if possible to document the exposure of whales to the oil (record individuals in oil and length of exposure to oil).

Reporting – Aerial hazing is harassment and any animals subjected to this technique must be included in a take report to be delivered to the NOAA Fisheries representative in the Wildlife Branch. Reports should include the number of animals subjected to the hazing, date, location, information on any photos taken, and response of the animals to the hazing. Take reports will be compiled by NOAA Fisheries and communicated to the Branch Director for use by the Unified Command and for use in reporting activities under Permit 932-1905 and for emergency consultation under Section 7 of the ESA. Monitoring information on exposure of individuals to oil should be reported to the Natural Resource Damage Assessment team.

Oikami Pipes

Background - Oikami pipes, reverberating pipes suspended from a vessel into the water and struck with a hammer, have been effective tools for herding/moving small cetaceans and killer whales in near-shore or enclosed waters. This technique should be accompanied by monitoring and observations of whale behavior (direction of travel, rate of speed, pod cohesion etc.) and vessel

deployment configuration. The expected response is aversion or avoidance of the approaching line of noisy vessels. The stimulus that triggers the response is sound from the pipes, but vessel presence and engine noise may contribute to the effect. Sound transmission from the pipes is assumed to be omni-directional but killer whales are capable of resolving the position of the source, so orientation and spacing of the vessels and pipes is likely to be important.

Safety First – For personnel - Oikami pipes are deployed over the side of small boats and operated manually by striking with a hammer or rounded metal bar. The pipe can be struck on top or on the side of the pipe exposed above the water. Vessels selected as platforms should be large enough for safe operation under the existing environmental conditions, while providing a stable platform that is close enough to the water so that personnel can work safely at the gunnel for extended periods. Caution should be used when deploying vessel less than 18 feet in length or with very low freeboard to insure stability with the pipe deployed in the anticipated sea conditions.Vessels need to be equipped with a means of suspending the oikomi pipes far enough over the side of the vessel that they do not touch the hull. The top 1.5 to 2 feet of the pipe should remain above the water's surface and care should be taken to avoid flooding the pipes. Flooded pipes need to be recovered and drained prior to redeployment. Crew members aboard hazing vessels must be equipped with appropriate personal protection equipment for the level of spill exposure that may be encountered during deployment this should include PFDs for all crew and hearing and eye protection for the pipe striker. Since hazing operation may need to be sustained for extended periods of time the person striking the pipe should be positioned in an ergonomic way that minimizes reaching and stretching to strike the pipe. Movements of multiple vessels should be closely coordinated for safe operation. *For the whales* – The potential for whale injury using this technique is low. Sound levels from the banging pipes transmitted into the water will be most intense within a few yards of the pipes but source levels are not sufficient to injure whale hearing. No physical contact with whales is anticipated. Vessels deploying pipes should be operated at slow displacement speed when in proximity to whales to minimize the risk of collision. Engines should be shifted to neutral (no spinning prop) within 100 yards of whales.

Operational Instructions – The minimum operating unit for oikami pipe hazing is three vessels each deploying a single pipe and the minimum personnel complement for this unit is seven. During hazing, each vessel should have a driver and a pipe banger. A hazing team leader will accompany the unit to coordinate vessel maneuvers within the unit, maintain communications with other units, and serve as an observer/data recorder to monitor the animals, record notes of the encounter including pre-, during, and post-hazing observations, and take identification photographs. Additional pipe bangers can be assigned to vessels for relief of the pipe banger or if multiple pipes are deployed from each boat. A field hazing supervisor should be assigned to coordinate maneuvers if more than one hazing unit is deployed. It is vital to establish an effective means of communication between the field hazing supervisor, the hazing team leader(s) and all participating vessels. The use of VHF radio on an appropriate working frequency is recommended. It is further recommended that all vessels be identified with a visible number/letter for easy field identification and that when possible the vessels be deployed in numerical or alphabetical order. This will facilitate the field hazing supervisor with providing effective direction to the vessel for maintain the position of the vessels.

To attempt a herding maneuver to divert the whale's path, the hazing unit(s) should approach the whales from the direction of the spill and intercept the whales' path. Vessels should be positioned

beam to beam at no more than 200 yard intervals. To establish the initial position and orientation of the hazing barrier, vessels may be assigned a specific latitude and longitude and be directed to maintain that position using GPS. Banging should commence in unison but does not need to remain synchronized when vessels are in position approximately 800 yards (1/2 mile) ahead of the whales. The recommended strike interval is two seconds but may be altered as dictated by the whale's response. The distance to the whales may gradually be reduced while assessing their direction of travel and response behavior.

The team leader should monitor closely for a response from the whales and coordinate vessel maneuvers as necessary to obstruct paths to the oil. Pursuing the whales and closing the distance to the whales is permissible to maintain their retreat with vessel maneuvering (circling, zigzagging) and occasional banging as required to reinforce the direction of travel away from the oil. Banging should cease immediately if the whales cross the line of vessels (penetrate the barrier). If whales penetrate the barrier, units should be repositioned in the path ahead of the whales between the whales and the oil. Vessels should retrieve their pipes before getting underway and stay at least ½ mile away from the whales while en route to the next deployment location. Once whales have established a path away from the spill hazard, gradually increase distance from the whales (remaining stationary or retreating toward the spill), and continue monitoring effort. If the whales do not respond to the hazing and continue travel along their original path unimpeded, notify the Branch Director of the whales' last position, direction and proximity to spill before leaving the whales to arrange for continued monitoring as whales approach the oil and/or deployment of alternate hazing resources. If the pod fragments during hazing, notify the WBD and pass the available information to inform subsequent hazing activities. Vessels involved in hazing/monitoring should remain on scene with the whales until they are a) directed to leave; b) replaced by other hazing/monitoring units; or c) the whales are more than 20 miles from the oil or trajectory (reconnaissance buffer); or conditions are unsafe for continued activity. If whales do not respond to hazing and enter the oil, monitoring should continue if possible to document the exposure of whales to the oil (record individuals in oil and length of exposure to oil).

Reporting – Oikami pipe hazing is harassment and any animals subjected to this technique must be included in a take report to be delivered to the NOAA Fisheries representative in the Wildlife Branch. Reports should include the number of animals subjected to the hazing, date, location, information on any photos taken, and response of the animals to the hazing. Take reports will be compiled by NOAA Fisheries and communicated to the Branch Director for use by the Unified Command and for use in reporting activities under Permit 932-1905 and for emergency consultation under Section 7 of the ESA. Monitoring information on exposure of individuals to oil should be reported to the Natural Resource Damage Assessment team.

Underwater Firecrackers

Background - Underwater firecrackers (or seal bombs) are primarily used as an intentional form of harassment for pinnipeds, but have also been effective tools for herding small cetaceans and killer whales. This technique should be accompanied by monitoring and observations of whale behavior (direction of travel, rate of speed, pod cohesion etc.) and detailed descriptions of deployment. The expected response is aversion or avoidance of the vicinity where detonations are occurring. The stimulus that triggers the response is sound from detonation that propagates well over a long

distance. Sound transmission from a detonation is omni-directional but the intense sound may be subject to reverberation or reflection from sub-surface topography.

Safety First – For personnel - Seal bombs are Class 1.4E explosives, UN number 0471, marketed as explosive pest control devices, and controlled as "high explosives" under the jurisdiction of the Bureau of Alcohol, Tobacco, and Firearms. Seal bombs have a charge similar to an "M-80" firecracker and detonate with an **explosive force capable of causing severe injury or death** to personnel. Personnel must attend a safety briefing before going to the field to familiarize them with the units and with safe handling procedures. While in the field, seal bombs should be kept in a container away from ignition sources and accessed one at a time to avoid accidental ignition. Hearing protection should be worn to avoid direct exposure to "in air" detonation that may cause permanent hearing loss. Once ignited, seal bombs should immediately be thrown overboard into the water on the downwind side of the vessel. Ignition torches should be extinguished when not in use. Avoid using sources of ignition near fuel storage tanks or vent lines or in locations where explosive fumes or flammable spilled product may be concentrated. Crew members aboard hazing vessels must be equipped with appropriate personal protection equipment for the level of spill exposure that may be encountered during deployment. *For the Whales* – There is some potential for whale injury using this technique. Seal bombs produce intense sound pressures (200 -220dB re 1 µPa or more at 1 meter from the source) and have the potential to damage whale hearing at close range (within a few meters). Seal bombs should not be deployed within 200 yards of killer whales to avoid inducing long-term hearing impairment.

Operational Instructions – The minimum operating unit for deploying seal bombs is two vessels and the minimum personnel complement for this unit is five. During hazing each vessel should have a driver and a bombardier that will deploy bombs. A hazing team leader will accompany the unit to coordinate vessel maneuvers within the unit, maintain communications with other units, and serve as an observer/data recorder to monitor the animals, record notes of the encounter including pre-, during, and post-hazing observations, and take identification photographs. A field hazing supervisor should be assigned to coordinate maneuvers if more than one hazing unit is deployed. To attempt a herding maneuver to divert the whale's path, position the hazing unit(s) to approach the whales from the direction of the spill and intercept the whales' path. Vessels should be positioned beam to beam at 200 yard intervals. The first bomb should be deployed at a distance greater than 1/2 mile ahead of the whales. (Note: The acoustic harassment threshold for disturbance is approximately 1000 yards from the point of detonation.) It is recommended that bombs be used sparingly. After the initial detonation, the hazing team leader should observe the reaction of the whales to determine whether they have responded by changing direction, if the pod has coalesced or scattered. While an orderly retreat from the area is the desired response, it is possible that the bombs could cause panic flight of whales in multiple directions.

Once the initial reaction has been determined the hazing unit should move to intercept and obstruct paths to the oil. Pursuing the whales and closing the distance to the whales is permissible to maintain their retreat with vessel maneuvering (circling, zigzagging) and occasional detonations as required to reinforce the direction of travel away from the oil. Vessels should avoid deploying bombs within 400 yards of whales unless the whales exhibit growing tolerance or reluctance to maintain a course away from the oil. Bombs should not be deployed within 200 yards of the whales. Bombing activity should cease immediately if whales penetrate the hazing line and are seen between the hazing teams and the oil. If whales evade the hazing team and are on course

toward the oil, hazing units should be repositioned in the path ahead of the whales between the whales and the oil. Vessels should stay at least ½ mile away from the whales while en route to the next deployment location. Once whales have established a path away from the spill hazard, gradually increase distance from the whales (remaining stationary or retreating toward the spill), and continue monitoring effort. If the whales do not respond to the hazing and continue travel along their original path unimpeded, notify the WBD of the whales' last position, direction and proximity to spill. Vessels involved in hazing/monitoring should remain on scene with the whales until they are a) directed to leave; b) replaced by other hazing/monitoring units; or c) the whales are more than 20 miles from the oil or trajectory (reconnaissance buffer); or conditions are unsafe for continued activity. If whales do not respond to hazing and enter the oil, monitoring should continue if possible to document the exposure of whales to the oil (record individuals in oil and length of exposure to oil).

Reporting – Deploying seal bombs within 1000 yards of a marine mammal may constitute harassment and any animals subjected to this technique must be included in a take report to be delivered to the NOAA Fisheries representative in the Wildlife Branch. Reports should include the number of animals subjected to the hazing, date, location, information on any photos taken, and response of the animals to the hazing. Take reports will be compiled by NOAA Fisheries and communicated to the Branch Director for use by the Unified Command and for use in reporting activities under Permit 932-1905 and for emergency consultation under Section 7 of the ESA. Monitoring information on exposure of individuals to oil should be reported to the Natural Resource Damage Assessment team.

IV. Hazing Team Instructions

This section contains hazing team instructions for implementing each of the three pre-approved techniques described above are attached to this implementation plan. The instructions are short outlines include brief description of each hazing activity, safety precautions for personnel and whales, hazing unit staffing recommendations, abbreviated operational instructions, and reporting formats. Copies of the instructions should be given to each field team, during the pre-deployment and safety briefing, to be carried into field as a ready reference.

A. Hazing Team Instruction - Helicopter hazing

The purpose of helicopter hazing is to intercept whales that are approaching the oil and change their direction to avoid oil exposure. The desired outcome is that maneuvers result in an orderly change in the whale's direction of travel and that as a result they move a sufficient distance from the oil to allow re-engagement by hazing assets as necessary to block the whale's path to the oil. If whales are already in the oil slick, maintain altitude greater than 500 feet, collect photographs of the whales that are present in the oil, for later identification. Contact the Branch Director (or designee) to report observations and receive instructions before attempting hazing maneuvers.

Human Safety precautions

Hazing whales with a helicopter requires low altitude maneuvering and hovering low over the water. Assess environmental conditions (visibility, turbulence etc.), surrounding air traffic (search and rescue, media), and surface vessel proximity to determine if it is safe to proceed with this technique.

Whale Safety precautions

The potential for whale injury using this technique is low sound levels from the helicopter will not be sufficient to injure whale hearing. No physical contact with whales is anticipated. Aerial hazing could affect pod cohesion if different whales in the group respond differently to the helicopter and group information should be recorded to assess impacts to the whales.

Operating unit size and configuration

Optimum unit size: three

1) pilot,
2) lead observer to continuously monitor the animals, provide whale information to the pilot and direct maneuvering, and
3) data recorder/photographer to record notes of the encounter including pre and post hazing observations and identification photographs.

If fewer personnel are used, the observer will assume data collection and photography duties.

Beginning position

Position the helicopter to approach the whales from the direction of the spill. If safe to do so the helicopter should begin maneuvering at an altitude of 300 to 500 feet approximately ¼ to ½ mile from the whales. Noise transmission into the water is most efficient in a circle below the helicopter roughly ½ the diameter of the flight altitude (for altitudes below 1000 feet).

Approach to divert path of the whales

Maintain a position between the whales and the oiled area, gradually reducing the distance to the whales and altitude.

Once whales have established and are maintaining a path away from the spill hazard, gradually increase distance from the whales (retreating toward the spill), increase altitude, and resume monitoring effort to document post-hazing movements. If possible, avoid leaving the whales in the vicinity of the spill if other monitoring/hazing assets are not available to intercept the whale's path should they turn again toward the spill. Contact the Branch Director (or designee) to determine the availability of other monitoring assets prior to leaving the area.

Contingencies

If the whales do not respond to the helicopter and continue travel along their original path unimpeded, notify the Branch Director (or designee) before leaving the whales to arrange for continued monitoring as whales approach the oil and/or deployment of alternate hazing resources. If the pod fragments when the helicopter approaches, record the response and notify the Branch Director (or designee) to pass along the available information. If whales do not respond to hazing and enter the oil, monitoring should continue if possible to document the exposure of whales to the oil (record individuals in oil and length of exposure to oil).

Monitoring and take reports

Monitoring of whale's position and exposure:

Date/time	# whales	Location of whales	Whale heading	Group spread	Photos taken	Whales in oil?

When hazing is initiated:

Date/time	# whales	Location of hazing unit	Distance to whales	Response of whales	Photos taken

B. Hazing Team Instruction - Oikami Pipes

The purpose of oikami pipe hazing is to intercept whales that are approaching the oil and change their direction to avoid oil exposure. The desired outcome is that maneuvers result in an orderly change in the whale's direction of travel and that as a result they move a sufficient distance from the oil to allow re-engagement by hazing assets as necessary to block the whale's path to the oil. If whales are already in the oil slick, vessels should maintain a distance greater than 200 yards, collect photographs of the whales that are present in the oil, for later identification. Contact the Branch Director (or designee) to report observations and receive instructions before attempting hazing maneuvers.

Human Safety precautions

Oikami pipes are deployed over the side of small boats and operated manually by striking with a hammer. Vessels selected as platforms should large enough for safe operation under the existing environmental conditions while providing a stable platform that is close enough to the water so that personnel can work safely at the gunnel for extended periods.

Whale Safety precautions

Sound from the banging pipes and transmitted into the water will be most intense within a few yards of the pipes but will not be sufficient to injure whale hearing. No physical contact with whales is anticipated. Vessels deploying pipes should be operated at slow displacement speed when in proximity to whales to minimize the risk of collision. Engines should be shifted to neutral (no spinning prop) if within 100 yards of whales.

Operating unit size and configuration

Hazing unit size: three vessels

Optimum crew size per unit: seven

1) three boat drivers (one per boat),
2) three pipe bangers (one per boat),
3) one hazing team leader, coordinate vessel maneuvers within the unit, maintain communications with other units, and serve as an observer/data recorder to monitor the animals, and to record notes of the encounter including pre and post hazing observations and identification photographs.

Additional pipe bangers can be assigned to vessels if multiple pipes are deployed from each boat. A field hazing supervisor should be assigned to coordinate maneuvers if more than one hazing unit is deployed.

Beginning position

Position the hazing unit(s) to approach the whales from the direction of the spill and intercept the whale's path. Vessels should be positioned beam to beam at 200 yard intervals. Banging should commence in unison when vessels are in position approximately 800 yards (1/2 mile) ahead of the whales. The recommended strike interval is two seconds but may be altered as dictated by the whale's response.

Approach to divert path of the whales

The distance to the whales may gradually be reduced while assessing their direction of travel and response behavior. Monitor closely for a response from the whales and maneuver as necessary to

obstruct paths to the oil. Pursuing the whales and closing the distance to the whales is permissible to maintain their retreat with vessel maneuvering (circling, zigzagging) and occasional banging as required to reinforce the direction of travel away from the oil.

Once whales have established a path away from the spill hazard, gradually increase distance from the whales (remaining stationary or retreating toward the spill), and resume monitoring effort to document post-hazing movements. If possible, avoid leaving the whales in the vicinity of the spill if other monitoring/hazing assets are not available to intercept the whale's path should they turn again toward the spill. Contact the Branch Director (or designee) to determine the availability of other monitoring assets prior to leaving the area.

Contingencies

Banging should cease immediately if the whales cross the line of vessels (penetrate the barrier). If whales penetrate the barrier, units should be repositioned in the path ahead of the whales between the whales and the oil. Vessels should retrieve their pipes before getting underway and stay at least ½ mile away from the whales while en route to the next deployment location.

If the whales do not respond to the hazing and continue travel along their original path unimpeded, notify the Branch Director (or designee) before leaving the whales to arrange for continued monitoring as whales approach the oil and/or deployment of alternate hazing resources. If the pod fragments, record the response and notify the Branch Director (or designee) to pass along the available information. If whales do not respond to hazing and enter the oil, monitoring should continue if possible to document the exposure of whales to the oil (record individuals in oil and length of exposure to oil).

Monitoring and take reports

Monitoring of whale's position and exposure:

Date/time	# whales	Location of whales	Whale heading	Group spread	Photos taken	Whales in oil?

When hazing is initiated:

Date/time	# whales	Location of hazing unit	Distance to whales	Response of whales	Photos taken

C. Hazing Team Instruction - Underwater Firecrackers

The purpose of underwater firecracker hazing is to deter whales from entering the oil and drive them away from the oil to avoid oil exposure. The desired outcome is aversion or avoidance of the vicinity where detonations are occurring. (Panic flight is a less desirable response from the whales than orderly retreat from the area.) The stimulus that triggers the response is intense sound from detonation that propagates well over a long distance. If whales are already in the oil slick, vessels should maintain a distance greater than 200 yards, collect photographs of the whales that are present in the oil, for later identification. Contact the Branch Director (or designee) to report observations and receive instructions before attempting hazing maneuvers.

Human Safety precautions

Seal bombs have a charge similar to an "M-80" firecracker and detonate with an **explosive force capable of causing severe injury or death** to personnel. Personnel should be given a safety briefing before going to the field to familiarize them with the units and with safe handling procedures.

Whale Safety precautions

Seal bombs produce intense sound pressures (200 -220dB re 1 µPa or more at 1 meter from the source) and have the potential to damage whale hearing at close range. Seal bombs should not be deployed within 200 yards of killer whales to avoid inducing temporary hearing impairment.

Operating unit size and configuration

Hazing unit size: two vessels

Optimum crew size per unit: five

1) two boat drivers (one per boat),
2) two bombardiers (one per boat),
3) one hazing team leader, coordinate vessel maneuvers within the unit, maintain communications with other units, and serve as an observer/data recorder to monitor the animals, and to record notes of the encounter including pre and post hazing observations and identification photographs.

A field hazing supervisor should be assigned to coordinate maneuvers if more than one hazing unit is deployed.

Beginning position

Position the hazing unit(s) to approach the whales from the direction of the spill and intercept the whales' path. Vessels should be positioned beam to beam at 200 yard intervals. The first bomb should be deployed at a distance greater than 1/2 mile ahead of the whales. (Note: The acoustic harassment threshold for disturbance is approximately 1000 yards from the point of detonation.) It is recommended that bombs be used sparingly.

Approach to divert path of the whales

After the initial detonation, the hazing team leader should observe the reaction of the whales to determine whether they have responded by changing direction, if the pod has coalesced or scattered. Once the initial reaction has been determined the hazing unit should move to intercept and obstruct paths to the oil. Pursuing the whales and closing the distance to the whales is permissible to maintain their retreat with vessel maneuvering (circling, zigzagging) using occasional detonations as required to reinforce the direction of travel away from the oil. Vessels should avoid deploying

bombs within 400 yards of whales unless the whales exhibit growing tolerance or reluctance to maintain a course away from the oil.

Once whales have established a path away from the spill hazard, gradually increase distance from the whales (remaining stationary or retreating toward the spill), and resume monitoring effort to document post-hazing movements. If possible, avoid leaving the whales in the vicinity of the spill if other monitoring/hazing assets are not available to intercept the whale's path should they turn again toward the spill. Contact the Branch Director (or designee) to determine the availability of other monitoring assets prior to leaving the area.

Contingencies

Bombing activity should cease immediately if whales are seen between the hazing teams and the oil. If whales evade the hazing team and are on course toward the oil, hazing units should be repositioned in the path ahead of the whales between the whales and the oil. Vessels should stay at least ½ mile away from the whales while en route to the next deployment location. If the whales do not respond to the hazing and continue travel along their original path unimpeded, notify the Branch Director (or designee) before leaving the whales to arrange for continued monitoring as whales approach the oil and/or deployment of alternate hazing resources. If the pod fragments during hazing, notify the Branch Director (or designee) and pass the available information. If whales do not respond to hazing and enter the oil, monitoring should continue if possible to document the exposure of whales to the oil (record individuals in oil and length of exposure to oil).

Monitoring and take reports

Monitoring of whale's position and exposure:

Date/time	# whales	Location of whales	Whale heading	Group spread	Photos taken	Whales in oil?

When hazing is initiated:

Date/time	# whales	Location of hazing unit	Distance to whales	Response of whales	Photos taken

V. Other Hazing Methods (not pre-approved)

As explained above, If NOAA Fisheries cannot be reached or the emergent nature of the event requires immediate intervention to protect endangered whales from oil exposure, the Wildlife Branch Director will coordinate with the Federal On-Scene Coordinator to implement hazing activities as authorized in the [date] delegation letter issued under MMPA/ESA Research and Enhancement Permit Number 932-1905. Only pre-approved hazing techniques will be considered in this case. In the event that other forms of take, (harassment (hazing using non pre-approved techniques), capture (rescue), or humane euthanasia) are considered, the Unified Command (Wildlife Branch Director, Federal On-Scene Coordinator) will consult with NOAA Fisheries (Regional Marine Mammal Staff and/or the Permit Holder (Dr. Teri Rowles, Marine Mammal Health and Stranding Response Program) to indentify and plan for alternative marine mammal response activities. NOAA Fisheries concurrence with proposed response plans is required before take can be authorized under Permit 932-1905.

If NOAA Fisheries marine mammal staff are assigned to the spill response, all marine mammal take activities including pre-approved and alternative hazing strategies will be discussed between the Wildlife Branch Director and NOAA Fisheries marine mammal staff before initiating field activities. Alternative hazing strategies, monitoring guidance, and resources lists can be found in the Northwest Area Contingency Plan Appendix, Killer Whale – Monitoring and Hazing Plan for Oil Spill Response in Washington and Oregon State.

VI. References

Matkin, C.O., E. L. Saulitis, G. M. Ellis, P. Olesiuk, and S. D. Rices. 2008. Ongoing population-level impacts on killer whales *Orcinus orca* following the 'Exxon Valdez' oil spill in Prince William Sound, Alaska. Marine Ecology Progress Series, Vol. 356: 269-281.

National Marine Fisheries Service. 2008. Recovery Plan for Southern Resident Killer Whales (*Orcinus orca*). National Marine Fisheries Service, Northwest Region, Seattle, Washington.