

Exposed sites

Cliffs and rocky headlands	
<i>characteristics</i>	<i>behaviour and impact of oil</i>
<ul style="list-style-type: none"> - steep cliffs - very restricted intertidal zone, generally free of sediment - plant species absent from the foreshore but dense in the subtidal zone - reduced number and variety of animal species on the foreshore - often shelter large bird colonies 	<ul style="list-style-type: none"> - the oil is most often kept away by wave movements - rapid self-cleaning due to wave energy except sometimes for oil deposited during storms above the high tide line - limited ecological impact, except for birds and close subtidal flora and fauna in the case of supratidal dispersed pollutant (naturally or chemically)
Abrasion platform	
<i>characteristics</i>	<i>behaviour and impact of oil</i>
<ul style="list-style-type: none"> - platform or rock bench formed by marine erosion in the widest sense - intertidal zone of varying width - back beach either low or high - possible accumulation of boulders, stones and coarse sediments on the upper beach - surface may be very irregular (cracks, rock pools) meaning that fine to coarse sediments may be deposited in the crevices - ecologically rich and diverse 	<ul style="list-style-type: none"> - does not stick, or not for long periods, to exposed rocky surfaces - tends to accumulate on the upper foreshore and in sheltered areas (dips, rock faces...) - likely incorporation of sediments (with variable persistence) - variable impact according to how ecologically rich the site is and the levels reached
Structures in ports and harbours	
<i>characteristics</i>	<i>behaviour and impact of oil</i>
<ul style="list-style-type: none"> - steep or vertical hard walls of the most exposed structures in ports - usually smooth stonework - very limited to no ecological value 	<ul style="list-style-type: none"> - the oil is most often kept away by wave movements - can only stick to the upper parts of structures, above the high tide level - low persistence - little to no ecological impact
Riprap	
<i>characteristics</i>	<i>behaviour and impact of oil</i>
<ul style="list-style-type: none"> - riprap which is constantly in contact with water: large tetrapod boulders used to shelter jetties, breakwaters, reclaimed land; varies from very ecologically rich (crustaceans) to little ecological importance - riprap positioned on the upper beach and subject to considerable erosion; not ecologically rich 	<ul style="list-style-type: none"> - often act as traps for oil: considerable penetration, high risk of later release of oil
Boulder fields	
<i>characteristics</i>	<i>behaviour and impact of oil</i>
<ul style="list-style-type: none"> - cover exposed rocky outcrops - often conducive to thin deposits of fine to coarse sediments, in the sheltered area at the base of boulders - variable ecological density and diversity according to exposure 	<ul style="list-style-type: none"> - generally kept away by the effect of turbulence - can only stick to the upper parts of boulders and outcrops (above the high tide level) - persistence: low to high (if oil cannot be reached by sea) - variable ecological impact according to richness and type of oil
Fine-grain sand beaches	
<i>characteristics</i>	<i>behaviour and impact of oil</i>
<ul style="list-style-type: none"> - generally vast foreshores with a large area uncovered at low tide and often bordered with dunes or protective walls to prevent erosion - firm, compacted ground - moderate to limited density of fauna and varies greatly according to the season 	<ul style="list-style-type: none"> - accumulation on the upper foreshore or over practically the whole beach, according to the extent of the pollution - limited infiltration (< 10 cm), especially in the case of ground water emergence, but possibility of burying due to beach growth (20 to 30 cm, or a lot more at the beginning of the beach growth stage) and by wind-borne sand - effective self-cleaning as of the first storms - low to moderate ecological impact, with a short duration, except for vegetation on the upper beach (at the foot of the dunes)

- **Coarse-grain sand and gravel beaches**

<i>characteristics</i>	<i>behaviour and impact of oil</i>
<ul style="list-style-type: none"> - moderate to steep slope - very mobile sand - limited ecological diversity and density 	<ul style="list-style-type: none"> - high infiltration potential - possible rapid and large-scale burial (fluid oil) due to seasonal beach growth or a storm; potential gradual migration towards the lower beach (washing by falling tide) - low to moderate ecological impact

- **Stony beaches**

<i>characteristics</i>	<i>behaviour and impact of oil</i>
<ul style="list-style-type: none"> - in rocky creeks at the foot of cliffs or in exposed bays and coves protecting a low back beach - generally well sorted sediments, at least local homogeneous distribution - steep (upper beach) to moderate (mid beach) slope, proportional to the average grain size - variable degree of ecological richness (flora, nesting birds at upper levels) 	<ul style="list-style-type: none"> - high degree of infiltration especially in the coarser sediments (50-60 cm or even 1 m or more) with slow breakdown of oil - possibility of burial (1 m and more) due to beach growth on the upper foreshore - possible formation, in the long run, of hardened deposits (heavy fuel oil) in sheltered areas - relatively low persistence (intensive washing) but can be high in the case of buried oil or large-scale infiltration - limited ecological impact except at high and very high levels of the foreshore

Sheltered sites

- **Sheltered cliffs**

<i>characteristics</i>	<i>behaviour and impact of oil</i>
<ul style="list-style-type: none"> - steep cliffs such as fjords or "calanques" in the Mediterranean - very small, steep intertidal zone - ecologically rich (subtidal, intertidal) 	<ul style="list-style-type: none"> - deposits in strips - persistence of oil mainly on the upper part, not permanently in contact with the water - variable impact according to levels

- **Platforms and rocky outcrops**

<i>characteristics</i>	<i>behaviour and impact of oil</i>
<ul style="list-style-type: none"> - generally scattered, or even covered, with boulders and unsorted, very heterogeneous finer sediments (from broken stones to silt) - extension of a low or steep rocky coast, or sometimes a small crumbly and eroded cliff, with clastic fossil deposits - numerous crevices, cracks and rock pools - great variety of species and ecologically rich (abundance, diversity) 	<ul style="list-style-type: none"> - deposits over the whole foreshore but the oil deposited on the lower beach, generally saturated with water, is moved up the beach with the following tides - vertical infiltration: strong tendency through large stones and boulders, less through smaller sediments; concerns the surface layer made of the coarsest sediments; practically impermeable to oil below due to the presence of fine to very fine sediments - high persistence in sediments and crevices - very high ecological impact

- **Infrastructures in ports and harbours**

<i>characteristics</i>	<i>behaviour and impact of oil</i>
<ul style="list-style-type: none"> - sheltered parts of all types of structures in ports and harbours (quays, riprap...) - generally steep to moderate slope - smooth, rough or chaotic surfaces - often colonised by seaweed 	<ul style="list-style-type: none"> - particularly conducive to accumulation - oil is deposited with the falling tide on the upper foreshore in the form of stripes - oil released in the long term - ecological impact varies according to the sensitivity of the species affected (of which some are already suited to a chronically polluted environment)

- **Fine- to medium-grain sand beaches**

<i>characteristics</i>	<i>behaviour and impact of oil</i>
<ul style="list-style-type: none"> a) narrow sandy foreshores b) generally very wide muddy/sandy foreshores, possibly with tidal channels 	<ul style="list-style-type: none"> (a) moderate to high persistence of oil especially in the case of large initial deposits with the formation of hardened crusts on the beach's surface - very limited possibility of oil being buried (except by wind-borne sand) - possible deposit on the whole foreshore (fluid pollutant) - in principle limited infiltration due to the presence of very fine sediments, and saturation with water, but risks of penetration via animal burrows - high persistence (several months or years) - moderate to high ecological impact (b) can be deposited in different places on the foreshore but ends up moving to the upper beach - infiltration impossible on sediments saturated with water (except via animal burrows) - very severe ecological impact
<ul style="list-style-type: none"> - (a) high (b) relatively high to low load-bearing capacity 	

- **Mixed beaches with fine- to coarse-grain sand and stones**

<i>characteristics</i>	<i>behaviour and impact of oil</i>
<ul style="list-style-type: none"> - deposits of heterogeneous sand, mainly from local sources, due to erosion or reworking of crumbly cliffs - irregular profile and surface - generally narrow foreshores or upper part of very wide foreshores with fine-grain sediments 	<ul style="list-style-type: none"> - limited infiltration due to the presence of very fine sediments in the spaces between the gravel and stones - formation of hardened crusts in the long run in the case of major deposits especially on upper beach - very high persistence - potentially high ecological impact

- **mudflats**

<i>characteristics</i>	<i>behaviour and impact of oil</i>
<ul style="list-style-type: none"> - made up of fine to very fine sediments (silt, clay) and free of vegetation but with colonisation in the long run - ground almost constantly saturated with water - very low load-bearing capacity of ground - generally has a network of tidal channels - very ecologically rich (diversity, abundance) 	<ul style="list-style-type: none"> - does not stick to the mud saturated with water - tends to accumulate on the upper beach - mixture with the mud only possible before sedimentation (in the case of high turbidity or a storm during the pollution) - ecological impact can be very severe - very high persistence if incorporated in the mud

- **Marshes**

<i>characteristics</i>	<i>behaviour and impact of oil</i>
<ul style="list-style-type: none"> - located at the base of bays, sheltered from behind by relief (spit or bar) on the banks of an estuary - vegetated areas with clearly marked belts of species according to their tolerance in terms of frequency of immersion and level of salinity - ground generally has a low load-bearing capacity and is sensitive to trampling (deconstruction, erosion) - generally bordered with mudflats - very ecologically rich and important (diversity and abundance) - very fragile and sensitive 	<ul style="list-style-type: none"> - extent of spreading varies according to tidal cycle - high adherence to plants - tends to be deposited on the upper stratum then run down towards the base of the plant - if fluid, can penetrate the substrate via animal burrows and tunnels - impact by smothering (heavy oils) or by direct toxicity (light oil) - potentially severe ecological impact, but: varies according to species, the season, the oil - very high persistence in the case of infiltration of the substrate

Shoreline classification: physical characteristics of shores, behaviour and impact of oil