

















Risk Matrix		Consequence					
		Disastrous	Severe	Serious	Considerable	Insignificant	
Frequenc	Frequency		4	3	2	1	
Very likely	5	Unacceptable	Unacceptable	Unacceptable	Unwanted	Unwanted	
Likely	4	Unacceptable	Unacceptable	Unwanted	Unwanted	Acceptable	
Occasional	3	Unacceptable	Unwanted	Unwanted	Acceptable	Acceptable	
Unlikely	2	Unwanted	Unwanted	Acceptable	Acceptable	Negligible	
Very unlikely	1	Unwanted	Acceptable	Acceptable	Negligible	Negligible	

	Disastrons	0	Continue	Ossaidaashia	Incinuition
	Disastrous	Severe	Serious	Considerable	Insignifican
Injury to workers and emergency crew (No. of fatalities / Injuries*)	> 30 F	3 <f<30< td=""><td>1-3 F 3-30 I</td><td>1-3 SI 3-30 MI</td><td>< 3 MI</td></f<30<>	1-3 F 3-30 I	1-3 SI 3-30 MI	< 3 MI
Injury to third party persons (No. of fatalities / Injuries*)	> 3 F	1-3 F 3-30 I	1-3 SI 3-30 MI	< 3 MI	-
Economic loss to third party (mio. Euro)	> 3	0.3 to 3	0.03 to 0.3	0.003 to 0.03	<0.003
Economic loss to owner (mio. Euro)	> 30	3 to 30	0.3 to 3	0.03 to 0.3	<0.03
Delay in construction (per hazard)					
Harm to the environment	Permanent severe damage	Permanent minor damage	Longterm effects	Impermanent severe damage	Impermanent minor damag

KISK Mitigat	tion (or risk response Planning)
Reduce likelihood	Contractual, design, organisational, technical, management controls
Reduce impact	Contractual, design, plans, engineering, separation, community relations
Transfer	In-whole or in-part Insurance, commercial arrangements
Avoid	Do not proceed with activity

















Phase	Total Cost (1998 data)	Unit Cost, \$/km ²	Unit Cost, \$/km ²
	(1990 data)	(1998 data)	(2007 value)
Preliminary (area=4 km²)	\$0.8 mil	\$0.2 mil	\$0.3 mil
Detailed (area=1 km²)	\$1.7 mil	\$1.7 mil	\$2.5 mil
Total	\$2.5 mil		



Summary of Main SI Work

Drilling	Soil boring; diamond core drilling		
Surface geophysical	Seismic refraction/reflection; electric		
surveys	resistivity tomography		
Borehole surveys and	Borehole logging; seismic logging;		
testing	borehole camera acoustic imaging;		
	impression packer; borehole radar; Lugeon		
	tests; rising head/falling head tests; cross-		
	hole tomography		
Laboratory tests	Point load; uniaxial/triaxial compression;		
	Brazil tensile; 3-point flexural		
In situ stress	Hydraulic fracturing; 3-D overcoring		







Гурісаl	Rock S	upport		
Class	Q	Type I	Type II	Type III
Α	>40	Spot	Spot	Spot
		40 mm	40 mm	40 mm
В	10-40	L3(2.4)	L4(2.4)	L5(2.4)
		40 mm	40 mm	50 mm
С	4-10	L3(2.2)	L4(2.2)	L5(2.2)
		40 mm	40 mm	50 mm
D	1-4	L3(1.9)	L4(1.9)	L5(1.9)
		50 mm	50 mm	75 mm
E	< 1	L3(1.5)	L4(1.5)	L5(1.5)
		75 mm	75 mm	100 mm











