An example of an efficient management of industrial waste for coastal preservation in the PIC: use of nickel slag

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RECYCLING NICKEL SLAG

“ When man was small in numbers and earth was large, he could pollute it with impunity. Now man can no longer do this; he must live in the whole system, in which he must recycle his wastes and really face up to the problem of the increase in material entropy which his activities create. In a space ship there are no sewers.”

Kenneth E. Boulding (1910-1993) "Earth as a Spaceship" 10 May 1965

KEYPOINTS

- The nickel slag source in Doniambo Plant in Noumea
- Present recycling of nickel Slag
- Nickel slag: an efficient solution to the climate challenges facing tropical Pacific low islands ?

THE NICKEL SLAG SOURCE IN DONIAMBO (SLN)

SLN: Established in 1880 at Thio on the east coast of New-Caledonia

- Doniambo Plant is designed to produce 65 000 t/year of nickel metal
- Due to the low grade of the nickel ore (<3%), the electrical smelters produce 35 tons of slag for each ton of nickel
- Annual production of slag : around 2 to 2.5 millions tons (1.3 to 1.6 Millions m^3)
- Total production of slag since 1880 estimated to be above 100 millions tonnes

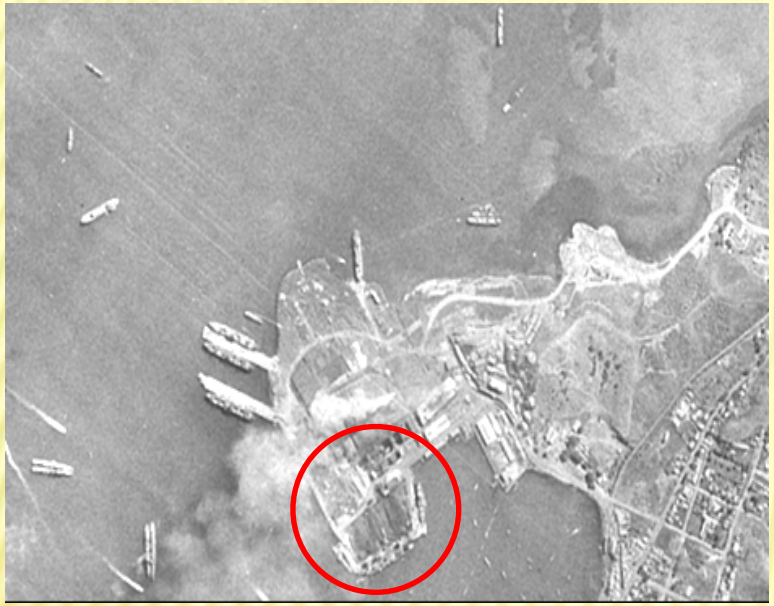
Chemical analysis									Size distribution			Density	
Ni	Co	FeO	Cr2O3	MN	SiO2	MgO	Al2O3	S	o-D	D50	D80	Bulk density	Real density
0,08	0,01	9,5 11,0	1,02	0,3 0,35	52,0 54,0	30,0 34,0	2,2 2,4	0,02	0-15 mm	2 mm	4 mm	1,4 - 1,6	2,8 - 3,0

THE SLAG OUTPUT

20 % of slag output (around 0.3 Millions m³) is recycled for the construction of domestic, public and industrial buildings, mainly in the Noumea Area

Since 1940, the city of Noumea area has been increased by more 320 hectares

A PLANT BUILT ON THE SEA



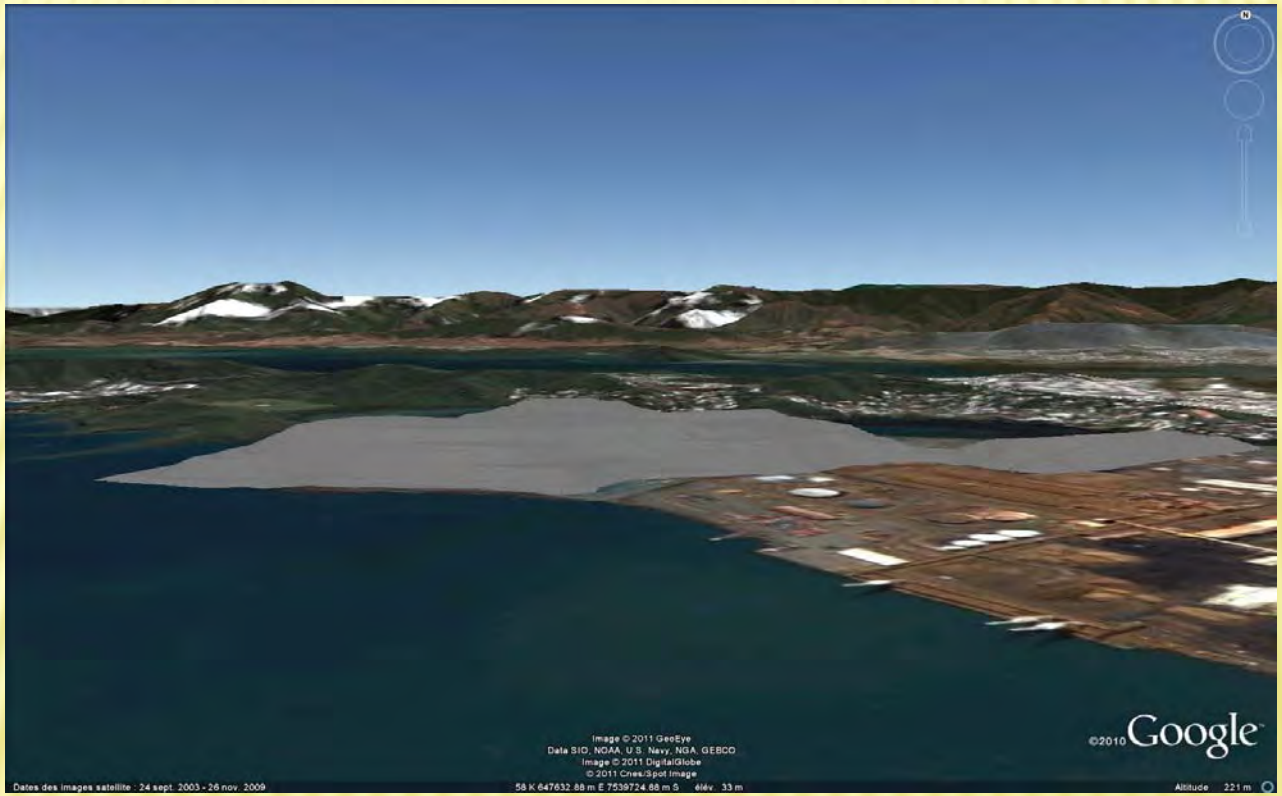
Year 1943

Year 2008

Around 80% of the total slag output has been stocked on the Doniambo site

THE SLAG OUTPUT

In the future, a large stockpile (more than 60 meters high) is planned to be erected on site.



RECYCLING SLAG : PRESENT USES

the slag is used in **Perpend stone:** as extra sand in the concrete mix

used as a **fill material** under concrete stabs

RECYCLING SLAG: PRESENT USES

The slag can be used to **backfill the trenches** for sewerage system

RECYCLING SLAG : PRESENT USES

Slag can be used as grading material for road and buildings

NEW NEEDS FOR TOMORROW

Beach aggregates are presently used to address the need for structures designed to prevent coastal erosion in PIC

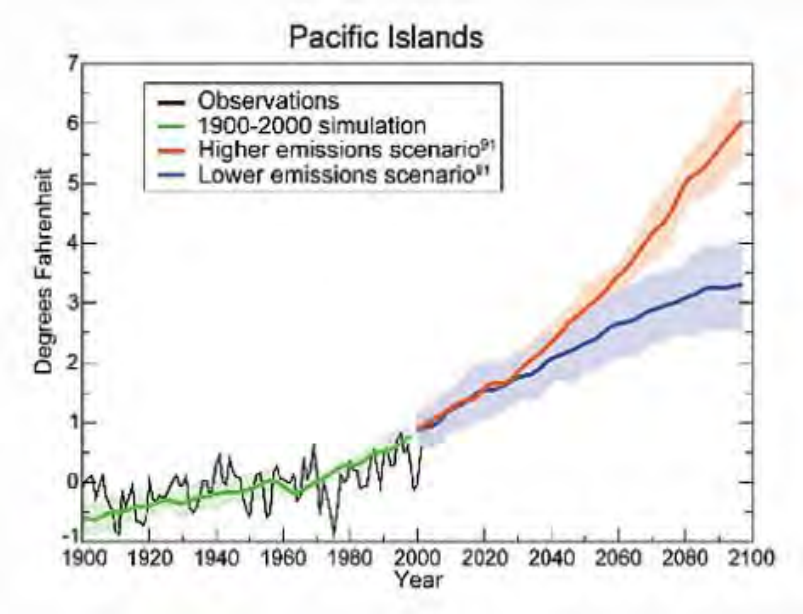
Serious shortcomings have been observed on the coastal zone and natural erosion is sometimes exacerbated by human errors

The need for efficient solutions will be exacerbated by global warming

ENVIRONMENTAL CHALLENGES

Climate change, sea level rise, coastal flood

Because of their low altitudes (often just a few meters above sea level), the islands and atolls in the western tropical Pacific would be one of the most vulnerable regions of the world. Recent studies (Australian Government climate commission and IRD) highlight the reality of the phenomenon and the particular vulnerability of certain islands and atolls, such as Funafuti (in the archipelago of Tuvalu) where the relative increase in sea level over the last 60 years was three times the world average



Moreover, complex ocean / atmosphere interactions (El Niño-La Nina cycles in the Pacific) and local geological context (subsidence, tectonics, volcanism, seismicity) could locally amplify the regional sea level rise

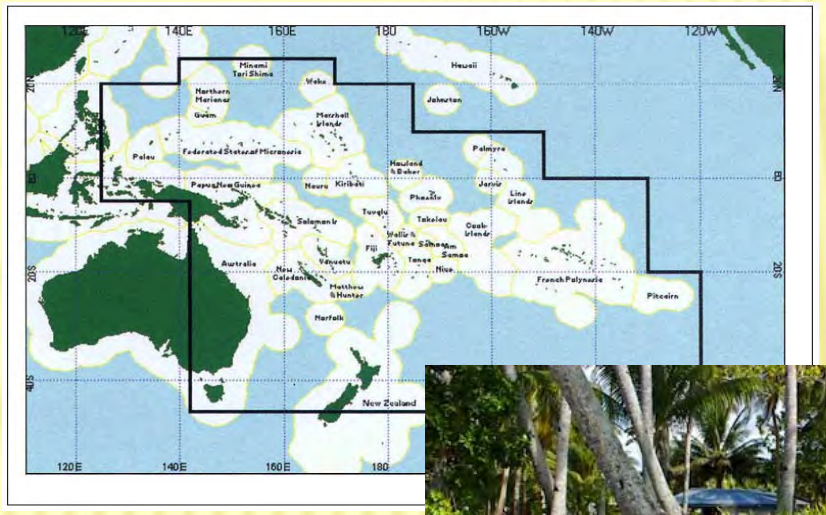
EXPORT SLAG RECYCLING PROSPECTS

Use of nickel slag as an substitution for beach aggregates and for efficient coastal protection structures should be considered in the PIC

Studies to be completed:

- Environmental Impact

- Economical Feasibility



FEASIBILITY OF SLAG EXPORT

Nickel slag has been classified an inert waste, allowing its commercial export (Annexe n°1 of the Basel Convention)

Efficient technical solutions have been identified for the maritime export of the slag from the SLN Doniambo site (A2EP, 2011)

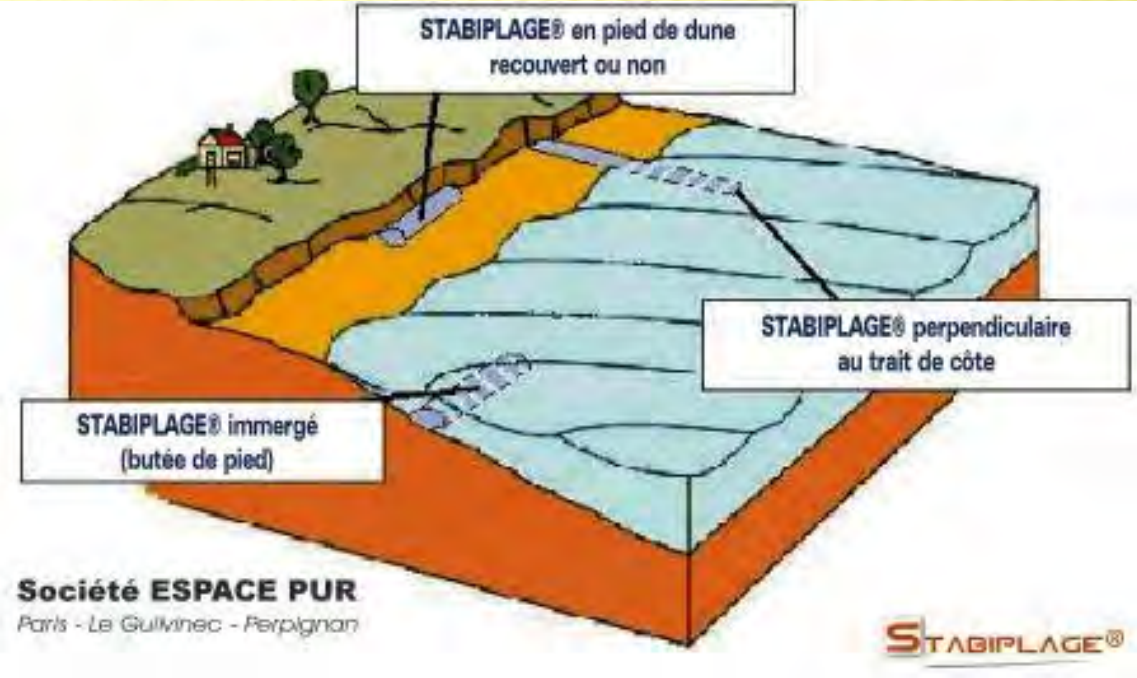
Economically feasibility from 400,000 tonnes + per year

AN EXEMPLE OF POTENTIAL SLAG RECYCLING USE

Fighting against coastal erosion: geosynthetic solutions have emerged over the world as part of the fight against erosion and for marine protection structures

The initial concept is to fill the empty structures and geosynthetics with an injection of sand. In our situation, slag could be used as a sand substitute

STABIPLAGE ® by Espace Pur (France)



NEXT ? NICKEL SLAG as A SUSTAINABLE DEVELOPMENT OPPORTUNITY IN THE PIC

Environment: sand mining prevention and coastal protection
Sand mining accelerates the coastal erosion
Coastal protection structures requires large volumes of aggregates

Economics:
Economical development can be induced by innovative nickel slag concepts (ex: transport facilities: road, ports, airports)

Social:
- population protection
- environmental refugees prevention