Role of Solidification/Stabilization in Sustainable Development of Contaminated Brownfield Sites

Portland Cement Association

SS Science Forum
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Cement Association of Canada
Association Canadienne du Ciment

Question answered by this presentation

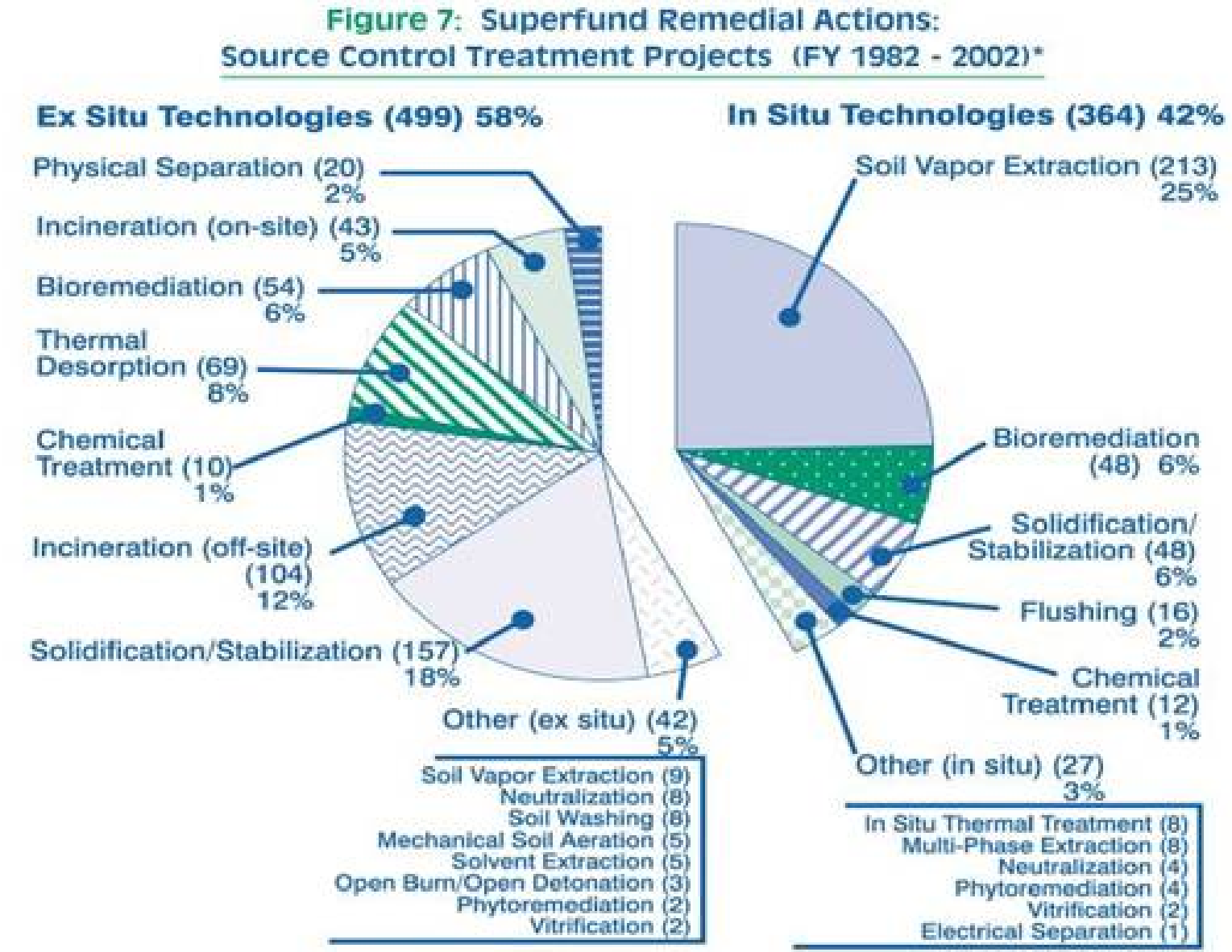
- When and where has S/S been employed in remediating brownfield sites?
- Is S/S technology a viable solution for sustainable development remediation projects?

What is Solidification/Stabilization?

- Involves mixing portland cement into contaminated media such as soil, sediment, sludge or industrial waste.
- S/S treatment protects human health and the environment by immobilizing hazardous constituents within treated material.

- Established treatment technology.
- Selected by USEPA for 24% of Source Control Remedies in the Superfund Program.
- Proven technology that treats a wide variety of hazardous constituents.
- Remediation of Brownfield Sites enabling them to be redeveloped.
- Cost effective – treated material can often be used at the site.

Utilization of S/S



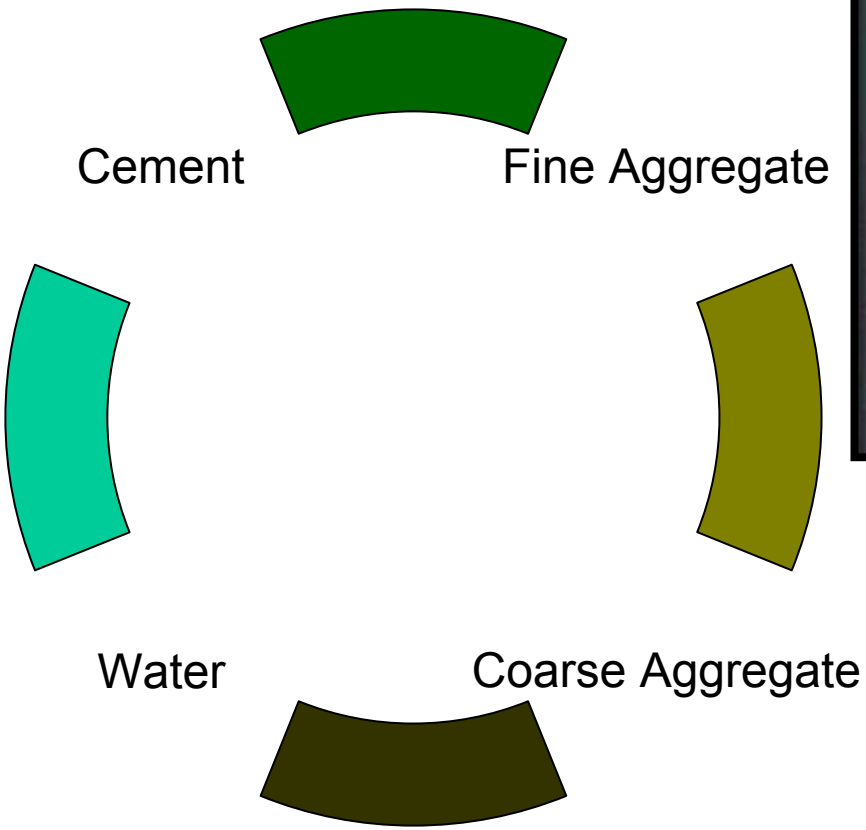
** Includes information from an estimated 70% of FY 2002 RODs.*

Sources: 3, 4, 5, 7, 11. Data sources are listed in the References and Data Sources section on page 50.

Solidification/Stabilization – S/S

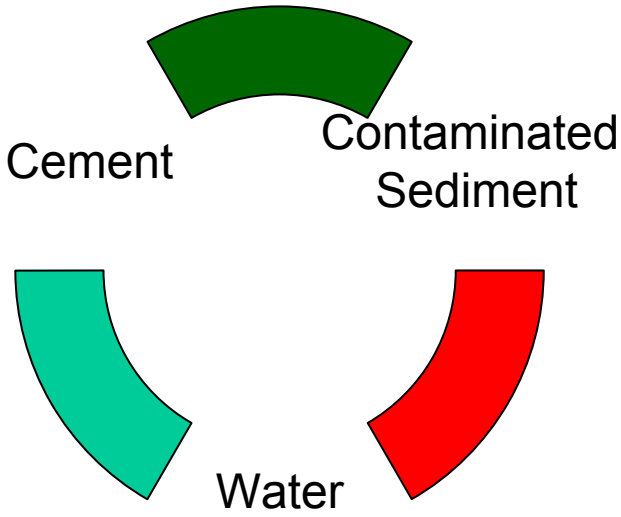
- Concrete vs. Cement
- Concrete vs. S/S

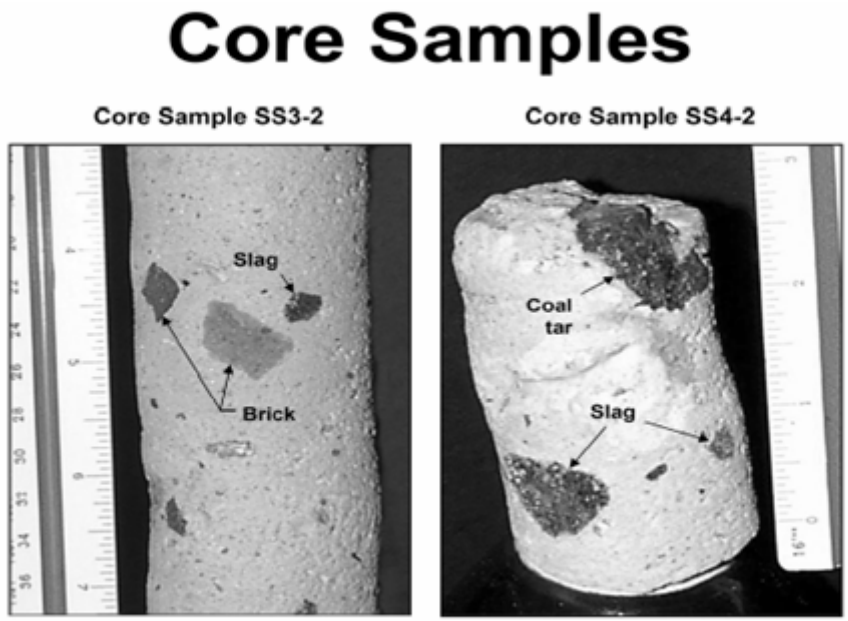
Concrete vs. Cement



- Cement
- Water
- Fine Aggregate
- Coarse Aggregate

Concrete vs. Solidification/Stabilization

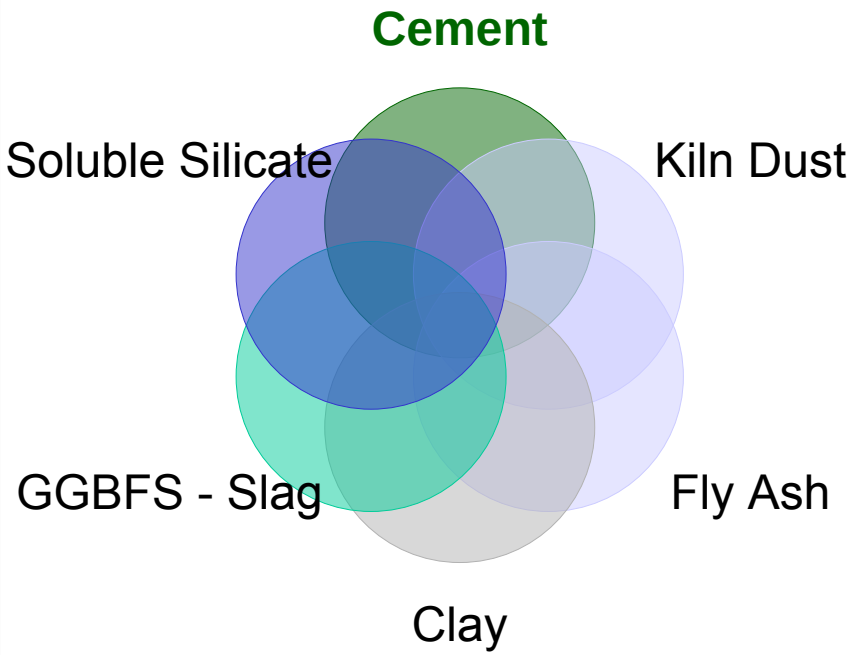




GEORGIA POWER

- Mix the waste with reagents (binders) that convert the target constituents into relatively immobile species
- Encapsulate the low mobility species in a matrix that reduces access by potential leachates and provides the necessary physical properties for handling and disposal

Basics of S/S Technology



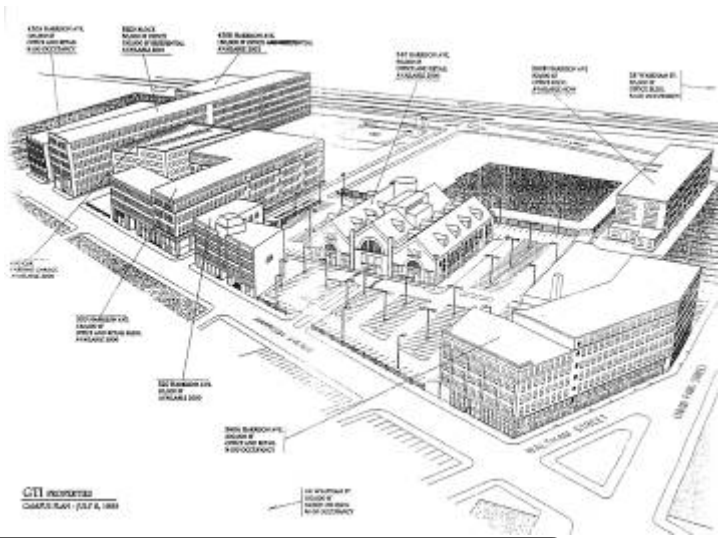
Why cement binder is most often used?

- Ties up water
- Supplies alkali for pH control
- Forms low-solubility metal species
- Matrix is durable and proven
- Ready available
- Stable competitive product

S/S Project Experience - Sustainable Development for Brownfield Sites

Canada, US and UK

Brownfield Site, Boston, MA



Challenge

- Former Electric Generation Site
- Flyash Fill Contaminated Site with As, Pb & Petroleum Products

Solution

- Remedy- On-site Ex-situ S/S treatment
- Reuse of treated material saved $500,000 USD

Former MGP Site, Augusta, GA

<u>Challenge</u>

- Coal tar contaminated site - 1.8 hectares

<u>Solution</u>

- In-situ Auger Mixing
- S/S of soil below groundwater table
- Depth - 9 meter

Former Wood Preserving Site Port Newark, NJ

Challenge

- 18,000 m^3 of Arsenic and Creosote Contaminated soil

Solution

- In-situ and Ex-Situ Mixing Methods
- Remediation of brownfield site
- Reuse of treated material reducing need for use of clean fill

Former Wood Preserving Site Port Newark, NJ

Port Newark reuse of treated soil as pavement base

West Side Former MGP, Milwaukee, WI

Challenge

- Coal tar (PAH) impacted soil resulting from a former MGP located in the downtown Milwaukee, Wisconsin on the Menomonee River

Solution

- In-situ S/S remediation of Inject grout into a column 8 metres
- Auger 3 cycles in column to facilitate mixing
- 375 columns in a 4 metre diameter over entire site
- Advantage of in-situ S/S was that excavation was eliminated and other technologies investigated were more expensive
- Land prepared for future development with improved soil conditions

NY/NJ Harbor Dredge Reuse

Challenge

- Millions of cubic meters of contaminated sediments

Solution

- S/S treatment and reuse as engineered fill
- Jersey Gardens Mall

NY/NJ Harbor Dredge Bayonne Golf Course

New Bedford Harbor, MA

Challenge

- Treatment of Harbor Sediment
- <50 ppm PCB -Contaminated Sediment

Solution

- Reuse of treated material as fill for bulkhead

90th South, Jordon, Utah

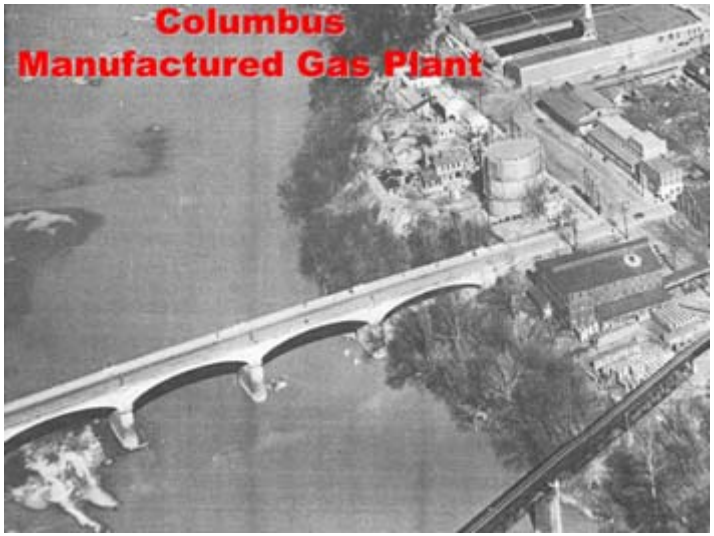
Challenge

- USEPA Emergency Response, ‘midnight dumping’ of waste found during highway works
- Pb contaminated soil from smelting & battery disposal

Solution

- Ex-situ treatment by pugmill
- Reuse as a base for pavement

MGP, Columbus, GA



Challenge

- Site owned by a utility transferred a municipality for use as a river front park

Solution

- Remediation by in-situ S/S treatment
- Subject of a long term performance study by EPRI

Long term effective solution

Evaluation of the Effectiveness of In-Situ Solidification/Stabilization at Georgia Manufactured Gas Plant (MGP) Site

1009095

Final Report, September 2003

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Former MGP Site, Cambridge, MA

Challenge

- Coal Tar Contamination
- Depth- 9 meter

Solution

- In-Situ Treatment

Genzyme Building, Cambridge, MA, 2001

Challenge

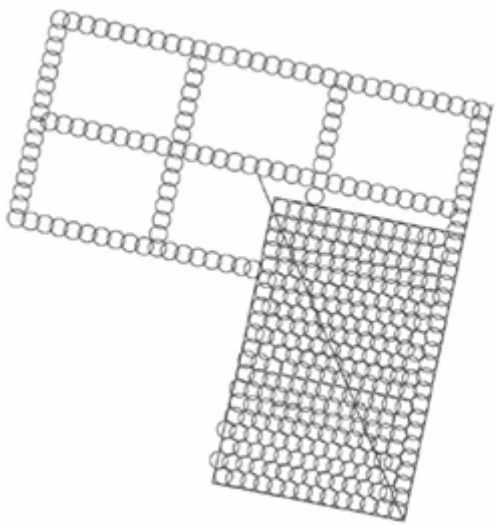
- Coal tar residue behaving as DNAPL & LNAPL

Solution

- In-situ S/S treatment for risk based closure Treatment to 6 metres depth by auger for 3.3 acres
- Treatment verified in lab treatability study

- Phoenix Award 2006 – US National Brownfield Award
- LEED Platinum Certified – SD rating

Sir Rogerson's Quay, Dublin, Ireland



Sir Rogerson's Quay Project

Former Western Steel Site, Vancouver, BC

Challenge

- The sources of the waste were from on-site settling ponds used for containment of electric arc furnace dust.
- 50,000 tonnes of Pb, Cd, Zn contaminated soil and sediment.
- Leachable concentrations of metals exceeded regulatory limits.

Solution

- Characteristic waste treated to non-hazardous enabling disposal

Former Battery Breaking Site- Brandon, MB

Challenge

- The City of Brandon. 10,000 meter^2 site, occupying almost a city block, was home to a local company that broke up lead cell batteries.

Solution

- Cement-based S/S successfully remediated 600 tonnes of contaminated soil.
- Result - stable, non-hazardous material accepted by the local landfill.
- City of Brandon is eager to see this brownfield property back in service, location is very central and an optimal location for their police and fire services.

Glacier National Park, BC

Challenge

- Lead contaminated soil that was contaminated with disposal of road paint waste

Solution

- Soil treated with S/S returning the site to parkland

Southeast False Creek, Vancouver, BC

Challenge

- City of Vancouver transforming zinc plating plant contaminated soil with zinc sulphate

Solution

- S/S was employed to remediate the soil
- Brownfield site is being developed for use as residential space for the 2010 Winter Games

SYSCO (former steel mill), Sydney, NS

Challenge

- Decades of storage and handling of products near a shoreline area
- 100,000 tonnes of Bunker C and Coal Tar contaminated industrial fill

Solution

- NS Lands (client) – SEACOR (consultant) – Hazco (remediation contractor)
- Excavate upper contaminated soil – treat soil using cement-based S/S and bioremediation – replace treated material – cover with clean fill
- Brownfield site available for development

Former Rifle Range, Burnaby, BC

Challenge

- 1.8 hectares of land used as a private gun range since 1950s contaminated with lead, zinc, copper and antimony
- Returned to park use by the City of Burnaby

Solution

- Used BC risk-based regulations for contaminated soil
- S/S contributed to rehabilitation of land into safe, green parkland that is enjoyed as an oasis in this growing urban setting
- Process took 12 weeks and saved city $1 million versus ‘dig-and dump’

Sydney Tar Ponds Project – SYSCO Cooling Pond

Challenge

- Built in 1912 - 122 meter diameter 4 meters deep, received wastewater from cooling process in steelmaking
- approximately 50,000 tonnes contaminated sediments

Solution

- Sydney Tar Ponds Agency (client) - EarthTech/CBCL(Construction) Manager) - Aboriginal Set-aside Program (time and material contractors)
- Treatment and disposal of water in the pond - Dismantling and disposal of the wooden cribwork - Removal and disposal of an old suction line on the pond bottom, and of a wastewater treatment tank - Stabilization and solidification of sludge in the pond - Covering the solidified area with clean fill and topsoil or mulch to promote surface water drainage.
- Brownfield site available for development

Dockside Green Project, Victoria, BC

Challenge

- Situated in Victoria, Dockside Green is being built on fifteen acres of former industrial brownfield site adjacent to the Upper Harbour and downtown with a planned total of 1.3 million square feet. Dockside Green represents the largest development of city land in Victoria's history.
- Striving to achieving the highest level of certification under the LEED® green building program, Dockside Green will be the first entire development to accomplish this goal that has only been reached by four buildings in the world.

Dockside Green Project, Victoria, BC

Solution

- Before construction began, a pocket of lead contamination that exceeded the B.C. Hazardous Waste Leachate Standard was discovered on the site. This contamination was treated using S/S that was found to be a cost-effective and efficient manner if the project was to continue.

Properties of Cement-based S/S Systems

SUMMARY

- Relatively low cost
- Good long-term stability
- Documented use over time
- Wide-spread acceptance
- Non-toxicity of ingredients
- Treat hazardous waste (bottom ash)
- Wide range of volume increase factors
- Inert to radiation
- Resistant to biodegradation
- Low water solubility
- Relatively low water permeability
- Good physical characteristics

Contact Information

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