Joint Expeditionary Base (JEB) Little Creek – Application of Active Materials as a Component of Contaminated Sediment Remediation

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WEDA
Western Dredging Association

Midwest Meeting 2019

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AquaBlok®
Composite Particle System

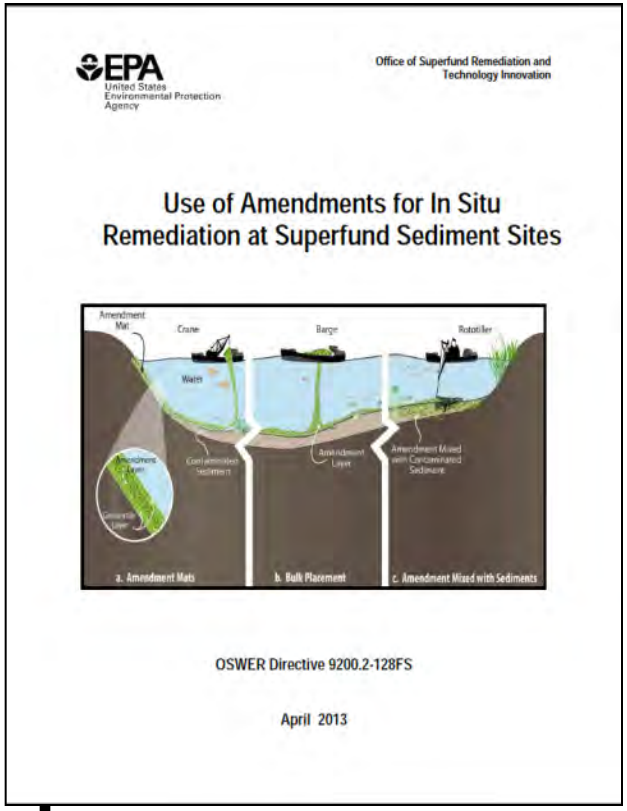
TETRA TECH EC, INC.

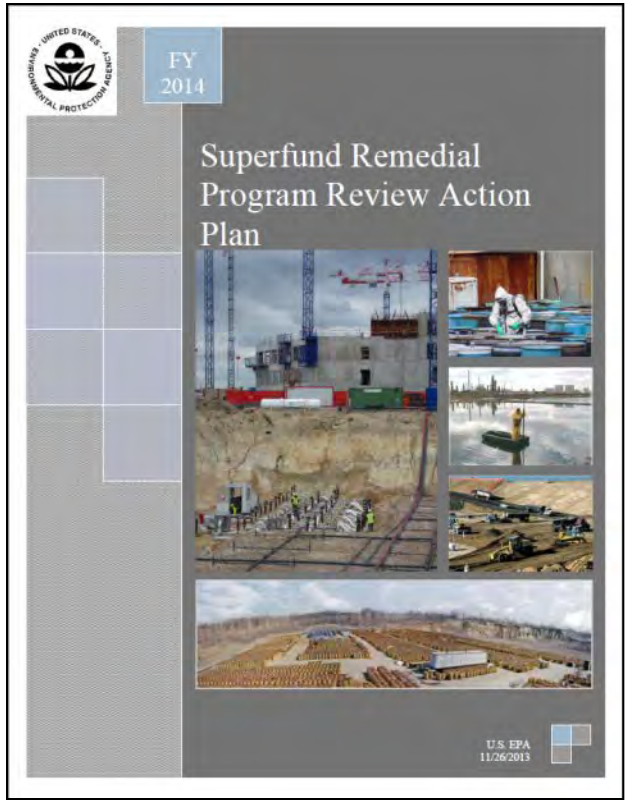
www.aquablok.com

Topics for Presentation

I. Why Amendments – Regulatory Acceptance
II. Activated Carbon – Updated Performance Information
III. Application at Joint Expeditionary Base (JEB) Little Creek
IV. Cost Comparison for GAC/Sand vs. AquaGate Approach
V. Questions

Amendments & Acceptance





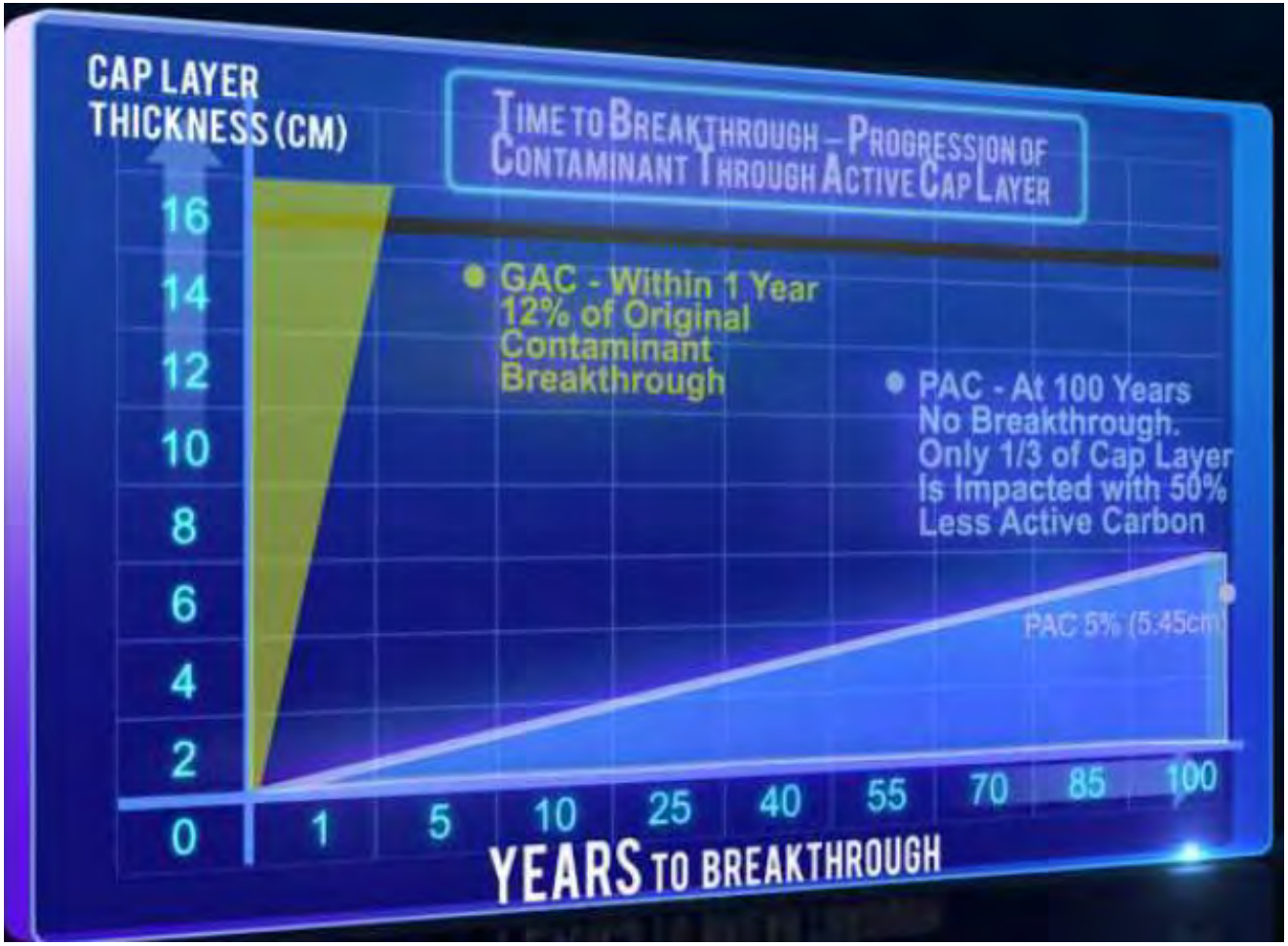
"The appropriate use of amendments has much potential to limit exposure to contaminants and, thus, to reduce risks."

- Minimize dredging impacts
- Focused on contaminant bioavailability
- Shorten recovery time
- Less costly and more expedient

Activated Carbon - Updated Performance Information:

- PAC vs. GAC
- Kinetics/Capacity
- Not all AC is the same – Influence of NOM

PAC vs. GAC Modeling Outcome



Source: Sediment Pure.com
CapSim Model – Dr. Reible

Courtesy of Cabot Norit Activated Carbon

Greater Adsorption Capacity

Mass GAC (g)	--	43.1	129.4
Dose GAC (%)	--	5%	15%
Treatment	Control	GAC	

Mass PAC (g)	--	43.1	129.4
Dose PAC (%)	--	5%	15%
Treatment	Control	PAC	

Time	Contact Time - 1 week		
Median PCB Concentration (µg/L)	0.27	0.23	0.18

Time	Contact Time - 1 week		
Median PCB Concentration (µg/L)	0.27	<0.05	<0.05

Time	Contact Time - 3 weeks		
Median PCB Concentration (µg/L)	0.31	0.21	0.16

Time	Contact Time - 3 weeks		
Median PCB Concentration (µg/L)	0.31	<0.05	<0.05

Time	Contact Time - 10 weeks		
Median PCB Concentration (µg/L)	0.27	0.22	0.16

Time	Contact Time - 10 weeks		
Median PCB Concentration (µg/L)	0.27	<0.05	<0.05

After 10 Weeks 5% GAC Adsorbed Only 9.26% of PCBs

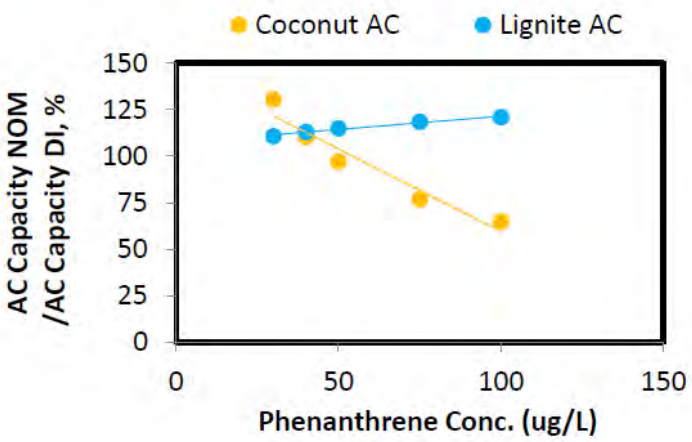
After 10 Weeks 5% PAC Adsorbed 100% of PCBs

Source: Geosyntec – Evaluation of Powder vs Granular Amendment for In-Situ Sequestration of Sediment Contamination

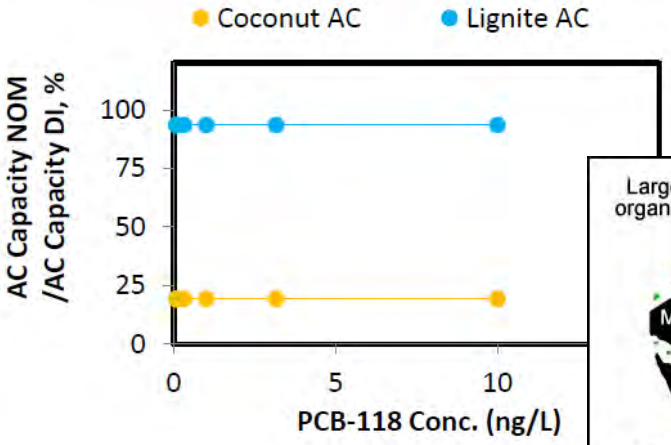
Not all Activated Carbon Performs Equally – Pore Geometry Impacts Performance - NOM

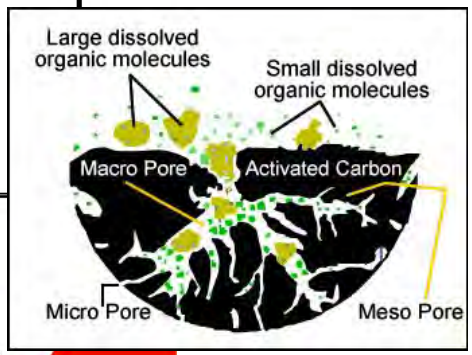
Compared to lignite carbon, coconut shell carbon is more sensitive to NOM impact

PHENANTHRENE



PCB 118





- Meso and macro-pores of lignite carbon minimize NOM impact
- NOM impact on lignite and coconut carbons is consistent with results from potable water and wastewater treatment plants

CABOT
NORIT ACTIVATED CARBON

Application at Joint Expeditionary Base (JEB) Little Creek & Technology Background

Joint Expeditionary Base Little Creek – Fort Story

Background:

Fort Story (Est. 1914), now known as JEB Fort Story, together with JEB Little Creek – is the major East-coast operating base supporting Overseas Contingency Operations, contributing to maximum military readiness. Providing front-line support personnel (SEAL, EOD and Riverine Squadrons), and training venues.

JEB Little Creek-Fort Story provides support and services to 155 shore-based resident commands and 18 home-ported ships. This joint base also consists of nearly 4,000 acres of land and more than 7.5 miles of beachfront training area with 58 piers.

For More Project Information:
https://www.denix.osd.mil/rec/regions/regioniii/actionspotlight/environmental-restoration/unassigned/jeblittlecreek/

Innovative Technology Demonstration/Validation/Implementation

In-Situ Treatment for Sediment Remediation

Problem Statement:

Although dredge removal of sediments was possible across most of the site, challenges associated with the adjacent marina made removal of all impacted media difficult to implement without disruption to JEB Little Creek's mission activities. In addition, proximity to bulkheads and piers made areas of the site inaccessible without the use of expensive engineering controls such as sheet piling or complete demolition and rebuilding.

Solution:

The Team, including the EPA biological technical assistance group, developed a solution that utilized an In-Situ treatment approach to address contamination in these areas. Through the placement of powdered activated carbon (PAC) with AquaGate+PAC, delivered to the sediment surface, the bioavailability of contaminants would be reduced in the upper biologically active zone (BAZ). Reducing the primary exposure pathway for benthic organisms.

Design/Application Method:

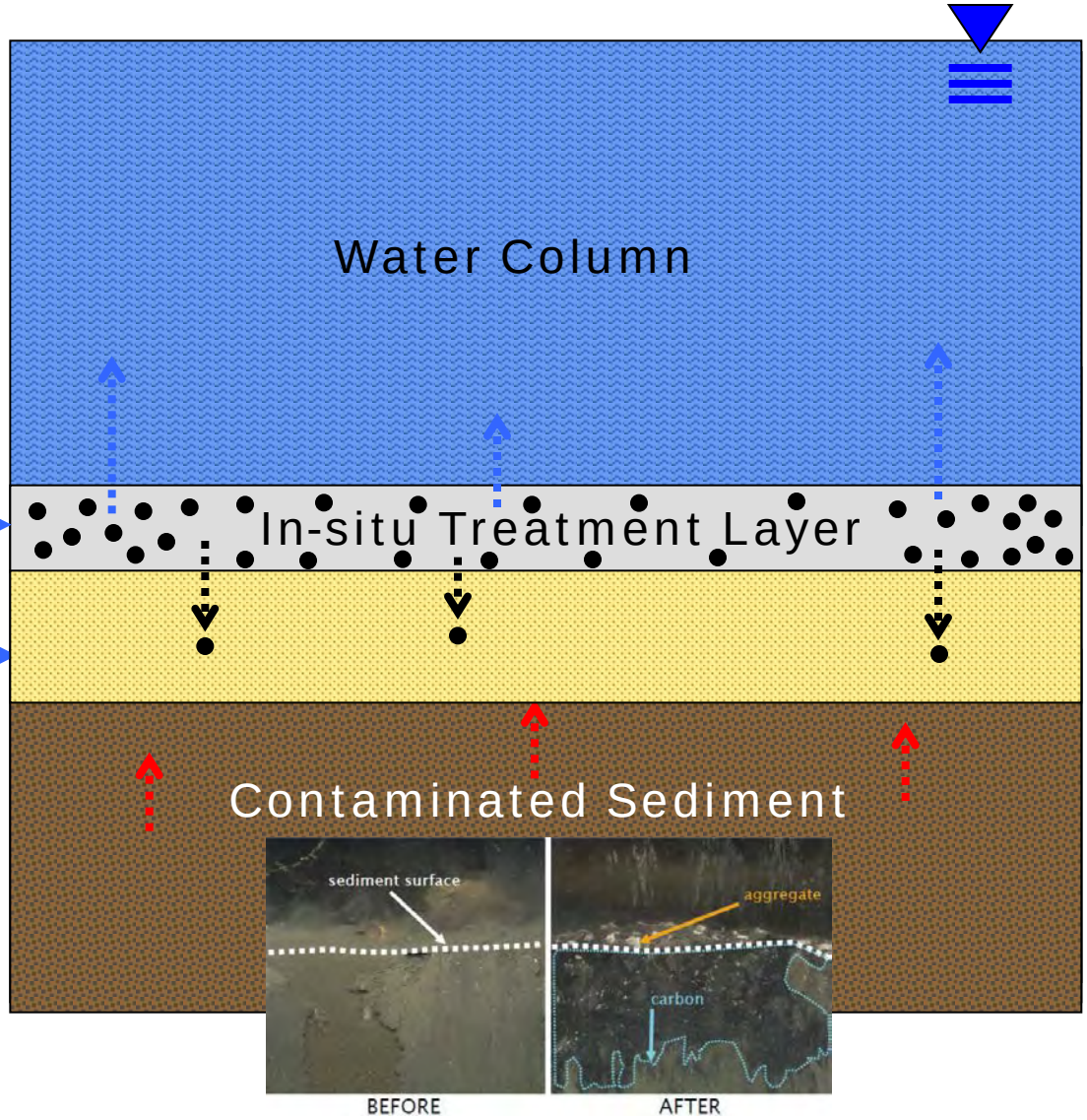
In-Situ Treatment via Thin Layer Application of Treatment Material

Goal: Reduce Pore Water Concentration of Target Contaminant in the Biologically Active Zone (BAZ)

Thin Layer of Treatment Material is Applied Directly to Sediment Surface – No Modification or Removal

Treatment Material Slowly Mixes with Sediment in the BAZ through Natural Bioturbation

Concentrations of Contamination in the BAZ Pore Water are Reduced



Advantages of AquaGATE+ for Amendment Placement

- *No Pre-Saturation of Activated Carbon Required*
- *Flexible/Rapid Installation*
- Low Cost – Typically less high-value material is used due to 'positive placement'
- Variety of innovative or conventional equipment approaches can be used
- Allows use of *Powder Materials* – which provides improved material performance
- Placement can be made *through deep/moving water*
- *Eliminates Risk of Separation* – compared to mixing bulk materials

Implementation of AquaGATE+ Amendment Placement

- Material was conveyed using high pressure air via a pressure vessel.
- Diver-assisted placement allowed for *accurate delivery of material under structures* and around infrastructure.
- *Little or no turbidity* or suspension of powder was witnessed during placement.
- High Bulk Density – provide for *precise placement without losses* of powder activated carbon in the water column.

Manufacturing & Project Experience

AquaGATE+ PAC

Projects Completed or Scheduled:

United States:
- Aberdeen, MD Proving Grounds – Pilot
- Bremerton, WA Navy Shipyard – Pilot
- Norfolk, VA (Little Creek) – Full Scale
- Pearl Harbor, HI (Sub Base) – Pilot
- Passaic River (RM10.9) – Full Scale
- Hunters Point, CA (Navy) – Pilot
- Columbia River, OR – Pilot
- Willamette River, OR – Full Scale
- Middle River, MD – Full Scale

International:
- Sandefjord Harbor, Norway – Pilot
- Bergen Harbor, Norway – Pilot
- Leirvik Sveis Shipyard, Norway – Full Scale
- Naudoddan, Farsund, Norway – Full Scale

Tons of Material:

United States: + 4,500 Tons
International: 1,500 MT

Note: Total Production of all AquaGate Products Exceeds 25,000 tons, including the above

Cost Comparison of Granular Mixtures vs. AquaGATE+

Engineer: ***"We specified 5% because we want to make sure we get a minimum of 2.5% in the cap."***

Goal: Construct a 12 inch thick Active Cap – Amended with Activated Carbon (GAC vs PAC)

AquaGate+PAC

Sand/Gravel (100lb/CF Bulk Density)
AG+PAC 10% (74lb/CF Bulk Density)

Sand/Gravel (100lb/CF Bulk Density)
GAC (30lb/CF Bulk Density)

Specified Sand/Gravel

SIEVE SIZE		% FINER	
INCHES	mm	LOWER BOUND	UPPER BOUND
1	25	85	100
¾	19	70	90
⅜	9.5	55	75
4	4.75	40	60
8	2.36	35	45
16	1.18	15	35
50	0.3	10	25
200	0.075	5	15

Sand/Aggregate Thickness = 8in = 67lb/sf
AG+PAC Thickness = 4in = 25lb/sf
Total Cap Material (per SF) = 92lb.

Quantity of PAC at 10% =2.5lb = 2.72% (per CF)

So, – 25 lb/sf of AquaGate+PAC X 1-acre Cap = 544.5 tons

Pricing: AG+PAC Based on **545 tons at $400/ton** = $218,000
Freight: 24 truckloads @ $2,500/truck =$60,000

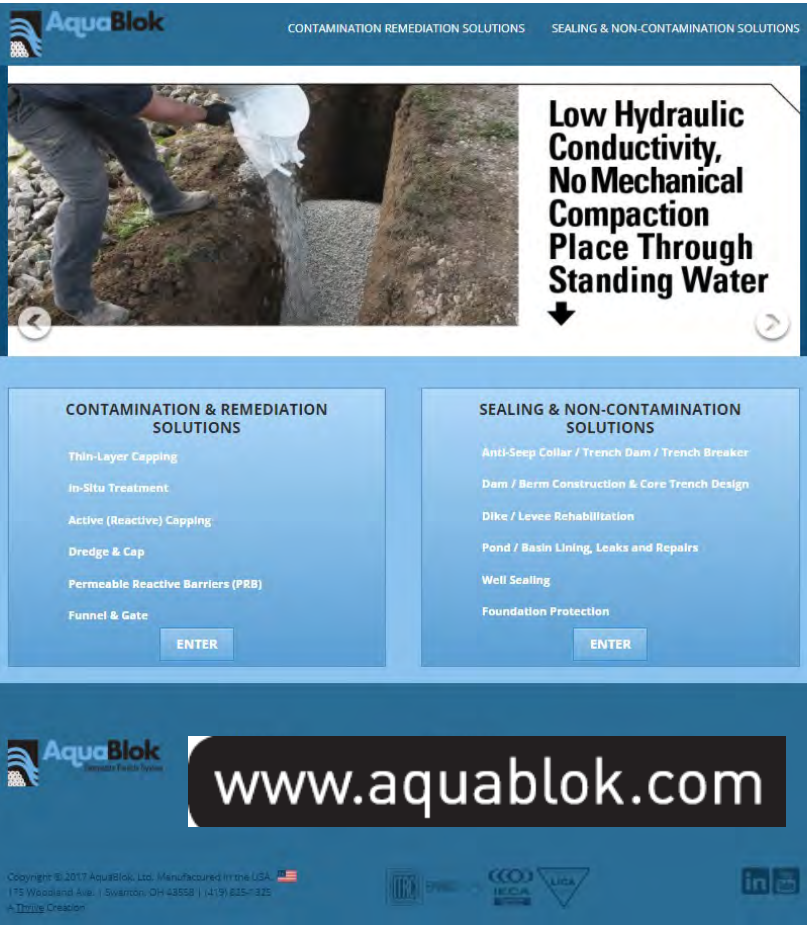
Total Delivered Cost = $278,000 / Acre

Sand/Aggregate Thickness = 10.25in = 85.4lb/sf
GAC Thickness = 1.75in = 4.5lb/sf
Total Cap Material (per SF) = 89.9lb.

Quantity of GAC at = 4.5lb = 5.01% (per CF)

So, – 4.5lb/sf of GAC X 1-acre Cap = 196,020lb.

Pricing: GAC - Based on **196,020lb at $1.50/lb.** = $294,030
Plus – Additional Sand/Aggregate = +400 tons x $25 = $10,000
Freight: 6 truckloads @ $2,500/truck = $15,000
Total Delivered Cost = $319,030 / Acre *
* (not including saturation or mixing cost)



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