



ADSORBSIA™ Arsenic Removal Media – Properties and Performance

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The Challenge

- EPA Lowers the Arsenic Maximum Contaminant Level (MCL) from 50 ppb to 10 ppb
- Announced January 2001
- Goes into effect January 2006
- Affects Group A community water systems (>25 people served)
- Affects Non-transient, non-community public water systems





“Some people who drink water that contains arsenic in excess of the MCL over many years could experience **skin damage** or **problems with their circulatory system**, and may have an **increased risk of getting cancer.**”

Table I-1. CCR Informational Statements¹ and Health Effects Language,
<http://www.epa.gov/safewater/ccr/chgtable.html>





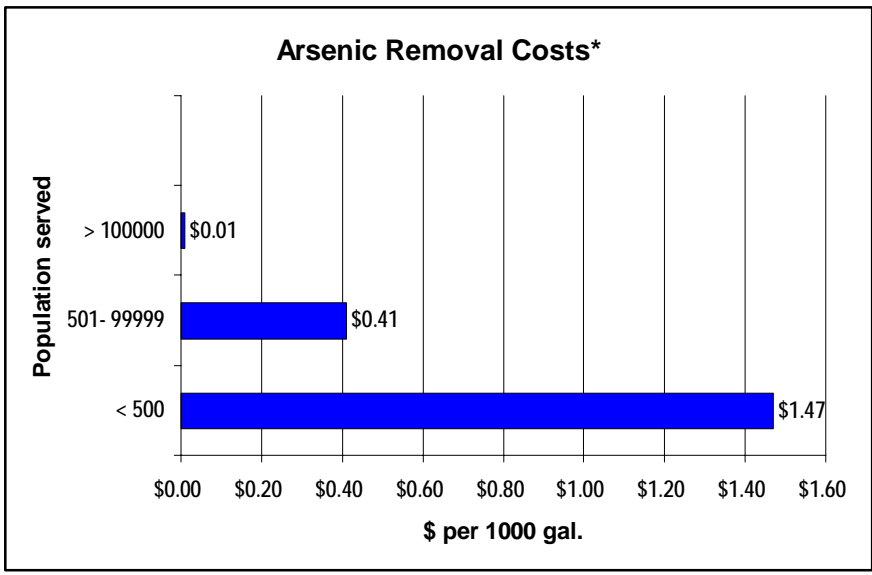
Treatment Options

- **Large Municipal** systems **can** cost effectively use conventional processes such as enhanced coagulation, direct filtration, coagulation assisted microfiltration, etc.
- **Small Municipalities** (<3300 people) **can't** cost effectively use conventional coagulation / filtration. Their most cost effective option is to treat with one of several media's.
- Conventional media's include Ion Exchange and Activated Alumina.
- A host of new adsorbent media's are being developed including Granular Ferric Hydroxide (GFH) and various versions of mixed metal oxides.



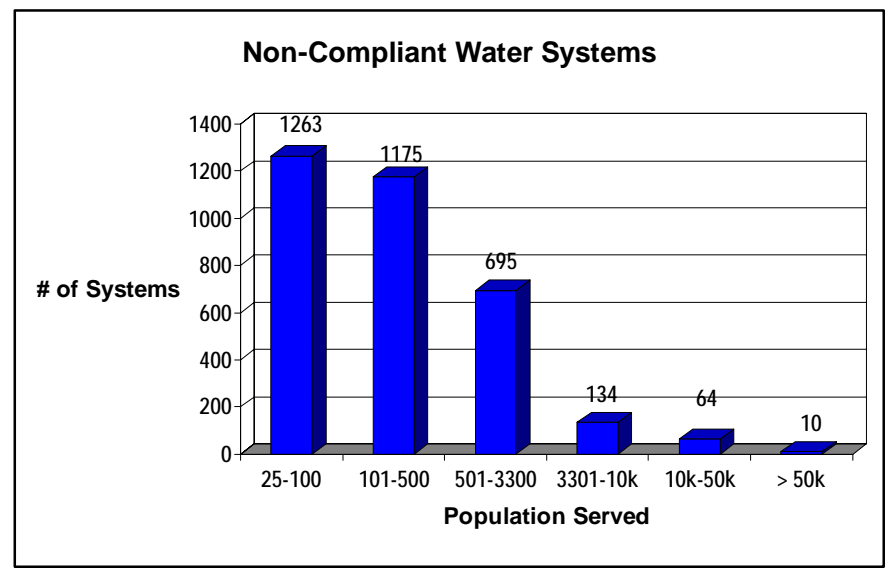


Arsenic Removal Costs



Costs rise drastically for smaller systems using conventional technology

Vast majority of systems are small





Why use ADSORBSIA media

Dow technology applied to develop a formulation that provides *physical strength* to compliment the *adsorptive capacity* and *fast kinetics* of Titanium Oxide

High capacity and fast kinetics makes ADSORBSIA media well suited for single use in Municipal /POS/POE /POU operations

With many tools available to us, Dow believes ADSORBSIA GTO™ media is the best solution for arsenic removal



ADSORBSIA GTO TiO Media



Physical Properties:

Product form	Dry Granule
Moisture Content	< 15%
Particle Size Range	10-60 US mesh
Bulk Density	44 lbs/ft ³





- Effective for both As(III) and As(V)
- Highest effective arsenic capacity available
- Fast kinetics allow for flexible system design
 - Smaller footprint
 - Lower capital costs
- Easy to use
 - No pre-treatment necessary
 - No arsenic containing regenerant or concentrate waste streams





More Advantages

- Effective removal of Arsenic over a wide range of water conditions
- Best performing media in high silica and/or high phosphate waters
- Stable performance during pH fluctuations
- Dry, White granule that is easily installed and maintained





More Advantages

- **NSF/ANSI 61 certified (without limitations)**
- **Passes extractive tests for:**
 - **TCLP (Toxic chemical leaching procedure)**
 - **CA WET (California Waste Extraction Test)**
 - **CA STCL (Solute Threshold Concentration Limit)**
- **Disposable as non-hazardous waste.**
 - **Customer should confirm that spent media meets their local landfill requirements.**





NSF Standard 53 Challenge Water for Arsenic

Data on the following slides was generated using the challenge water described in ANSI/NSF standard 53.

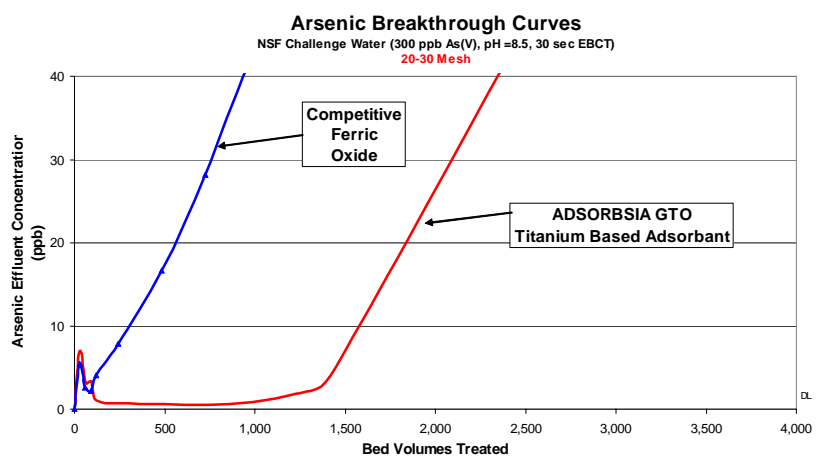
Mg	12 ppm	SiO ₂	20 ppm
SO ₄	50 ppm	PO ₄	0.04 ppm
NO ₃	2 ppm	Ca	40 ppm
F	1 ppm		

Challenge Water was designated by NSF to represent “typical water” and allow for “apples to apples” comparisons.



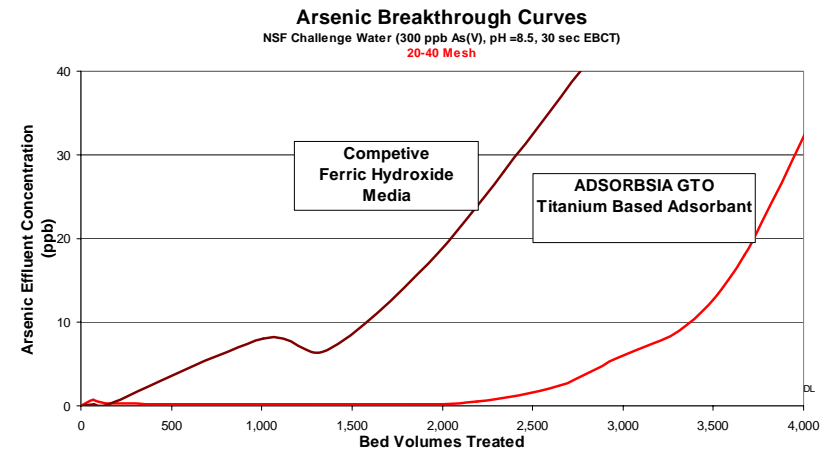


Fast Kinetics



Dow's proprietary granulation process combined with nanocrystalline technology provides the fastest kinetic performance available today.

The performance advantages of ADSORBSIA media are especially obvious under the most severe test conditions.

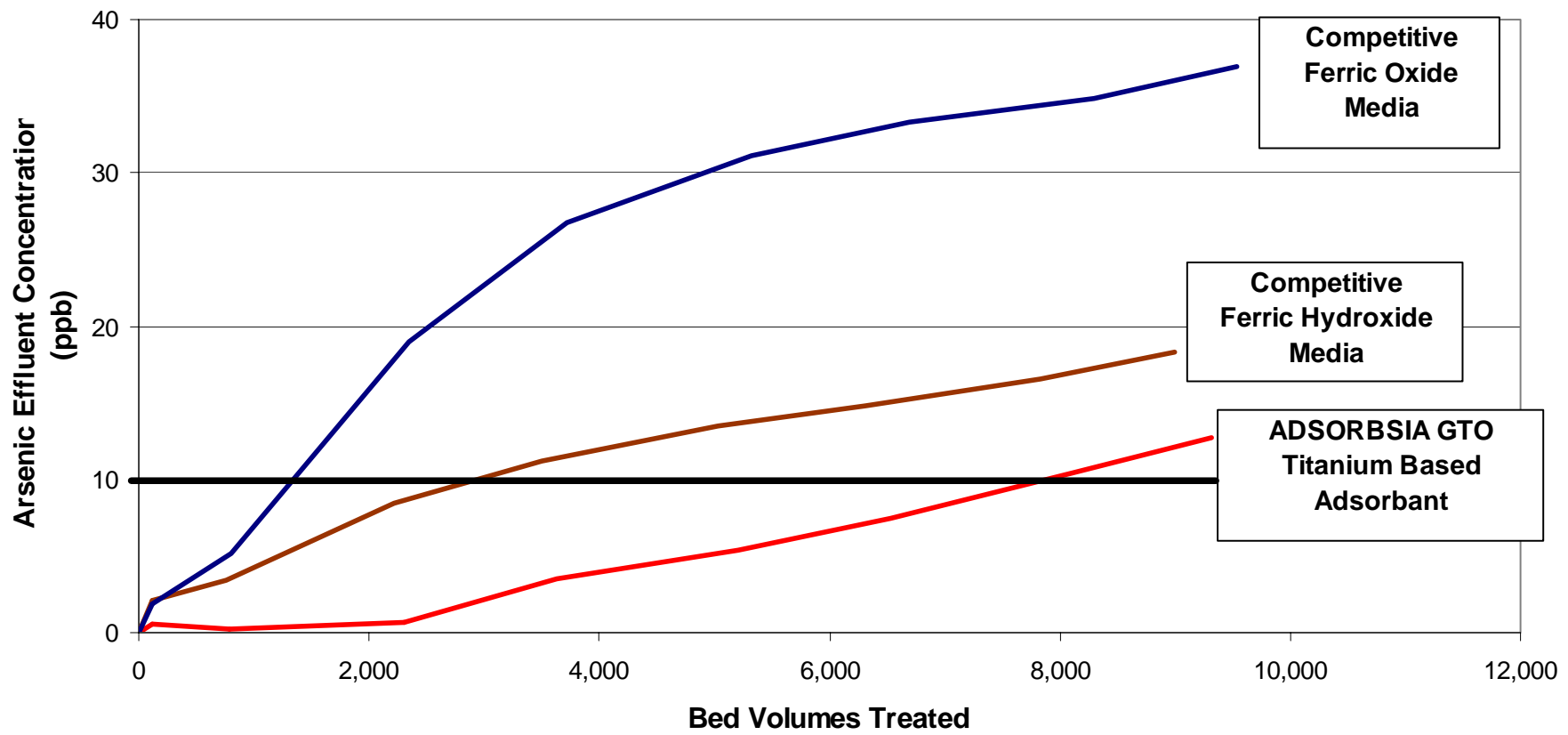




Highest Effective Arsenic Capacity

Arsenic Breakthrough Curves

NSF Challenge Water (50 ppb As(V), pH =8.5, 30 sec EBCT)

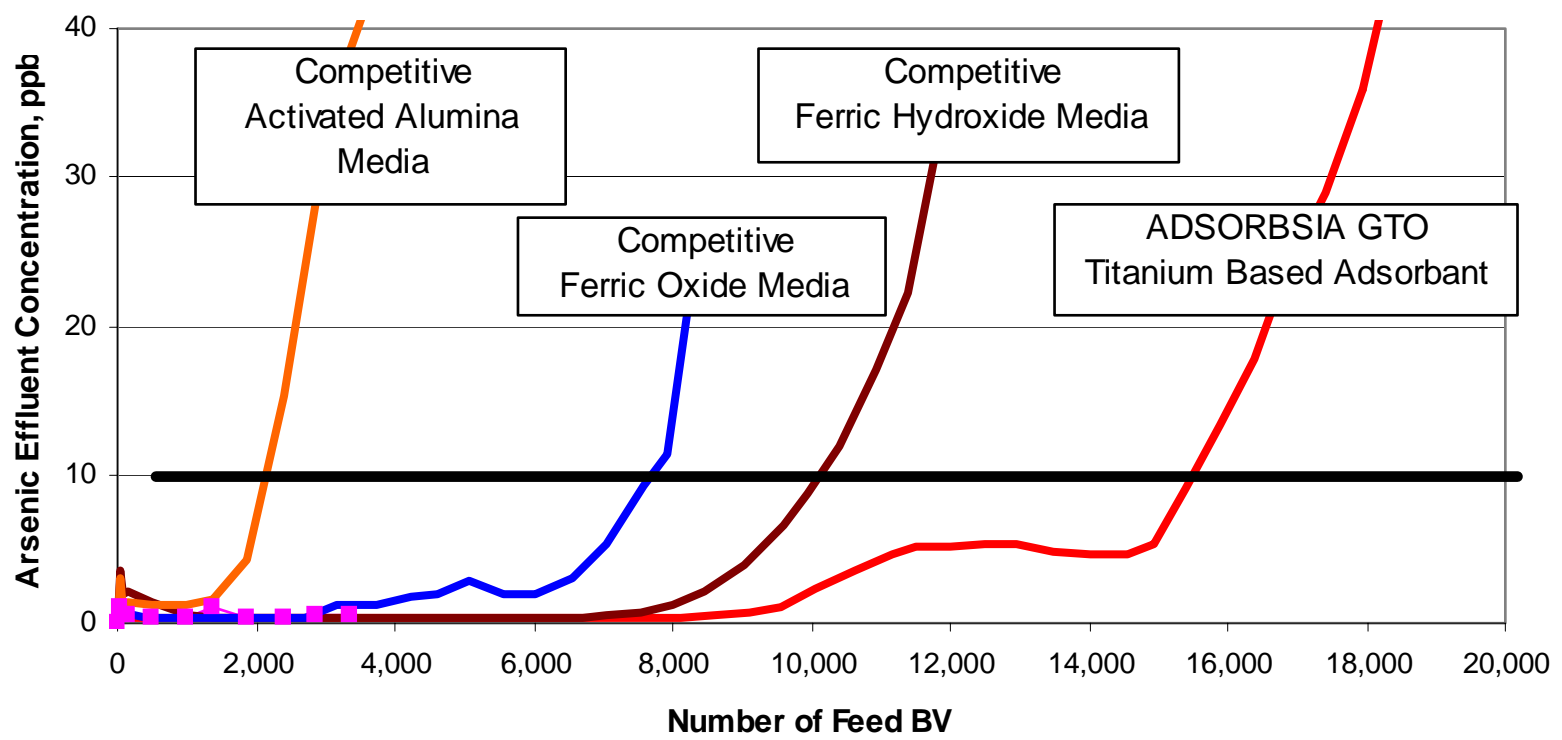




Highest Effective Arsenic Capacity

Arsenic Breakthrough Curves

NSF Challenge Water (300 ppb As(V), pH =7.5, 180 sec EBCT)
Low Silica (10ppm)

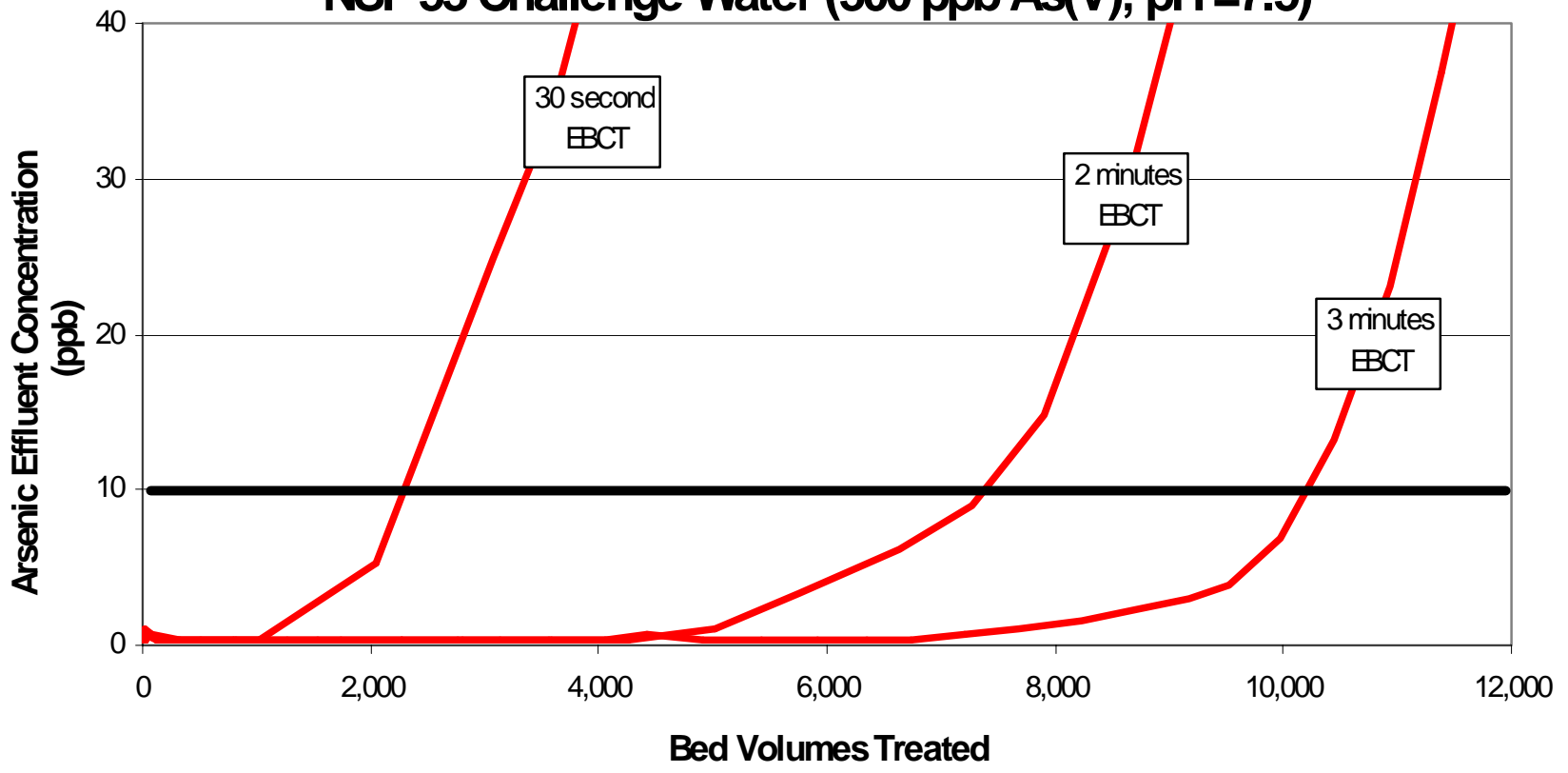




Fast Kinetics

Arsenic Breakthrough Curves

NSF 53 Challenge Water (300 ppb As(V), pH =7.5)



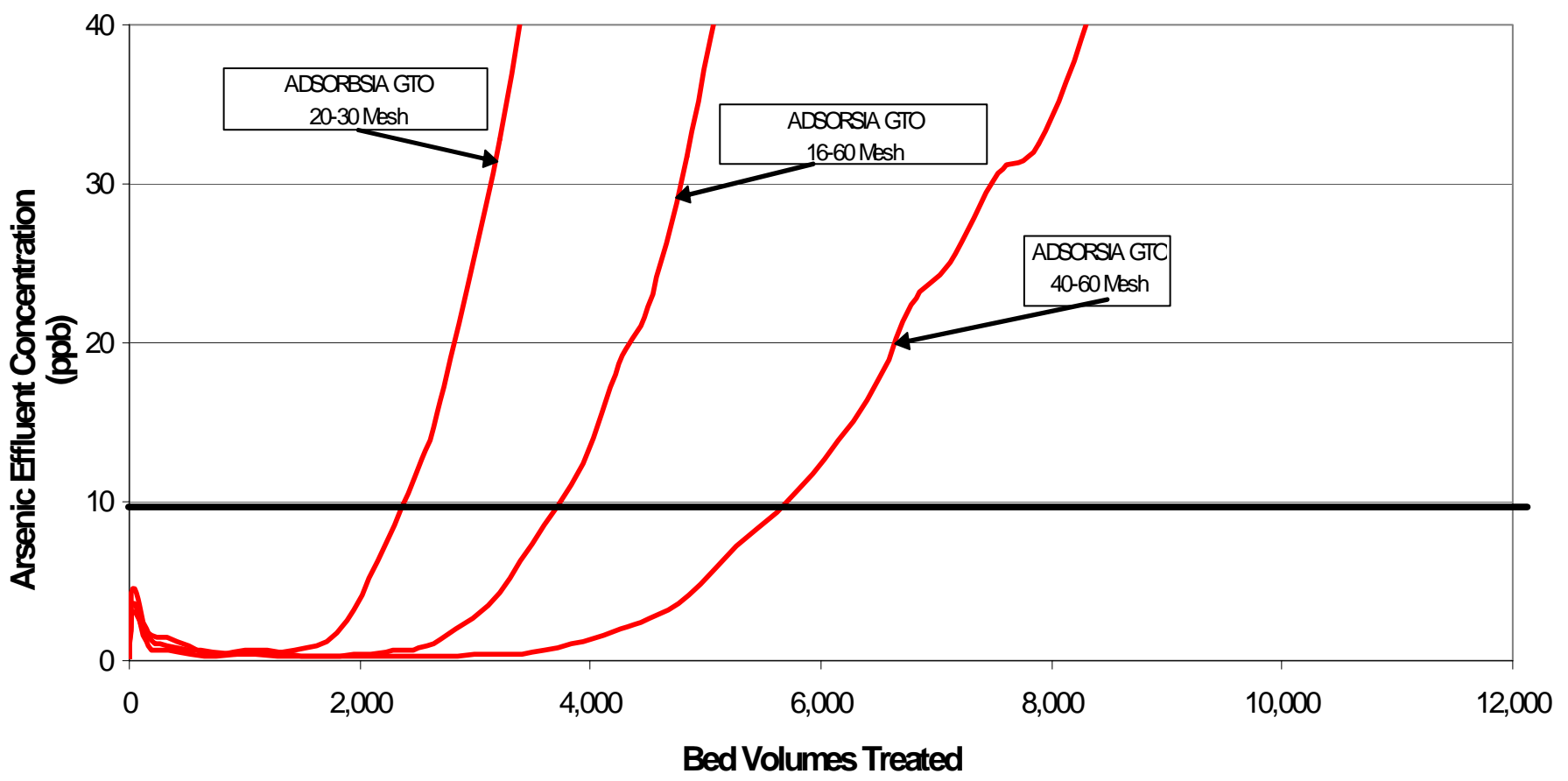


Fast Kinetics

Arsenic Breakthrough Curves

NSF Challenge Water (300 ppb As(V), pH=8.5, 120 sec EBCT)

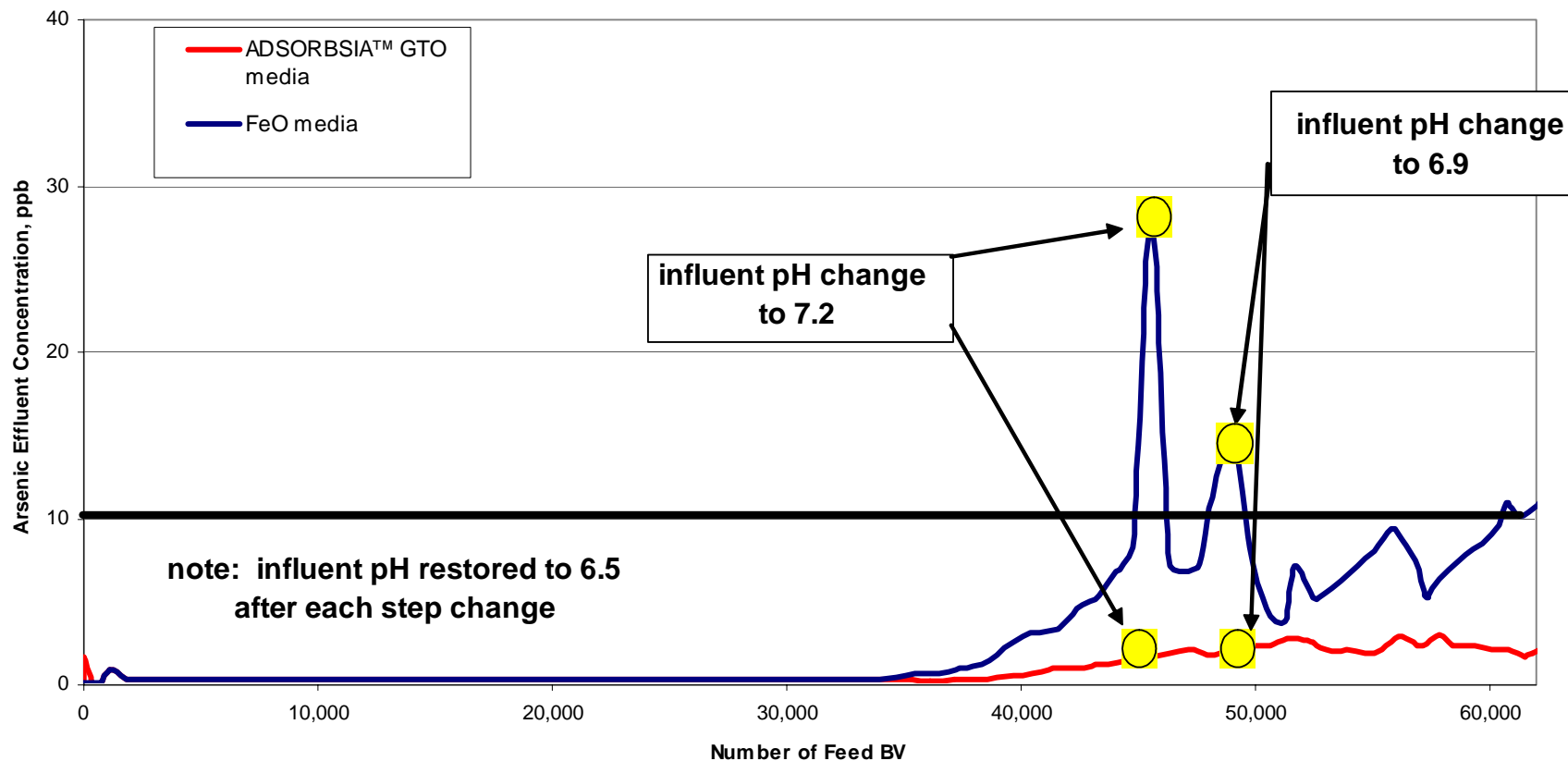
Impact of Particle Size





Best Over Wide Range of Water Conditions

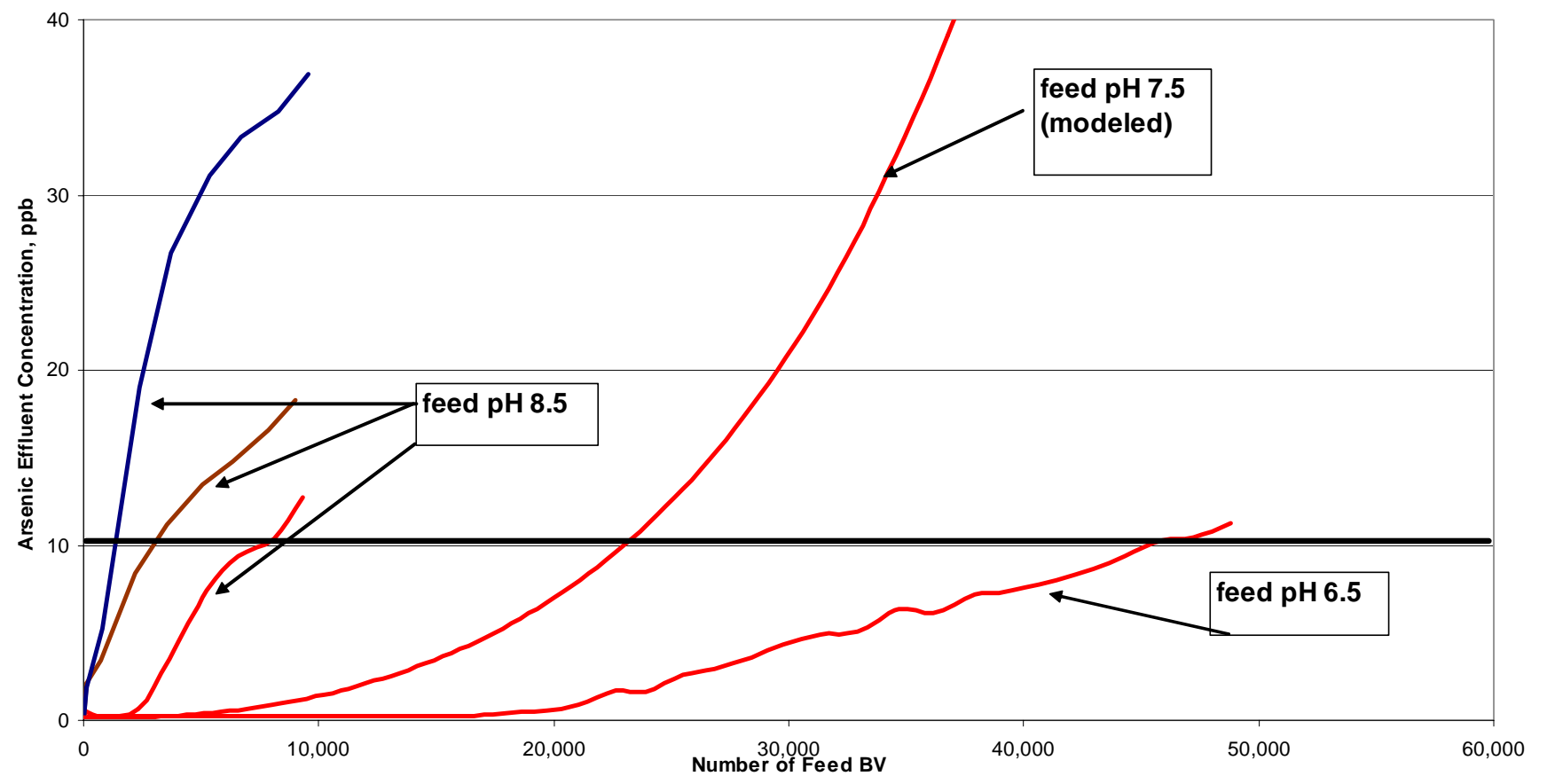
Arsenic Breakthrough Curves: NSF Challenge Water (50 ppb, pH =6.5, 120 s EBCT)





Best Over Wide Range of Water Conditions

ADSORBSIA GTO media Performance at various PH NSF 53 Challenge Water (50 ppb As(V), 30 sec EBCT)

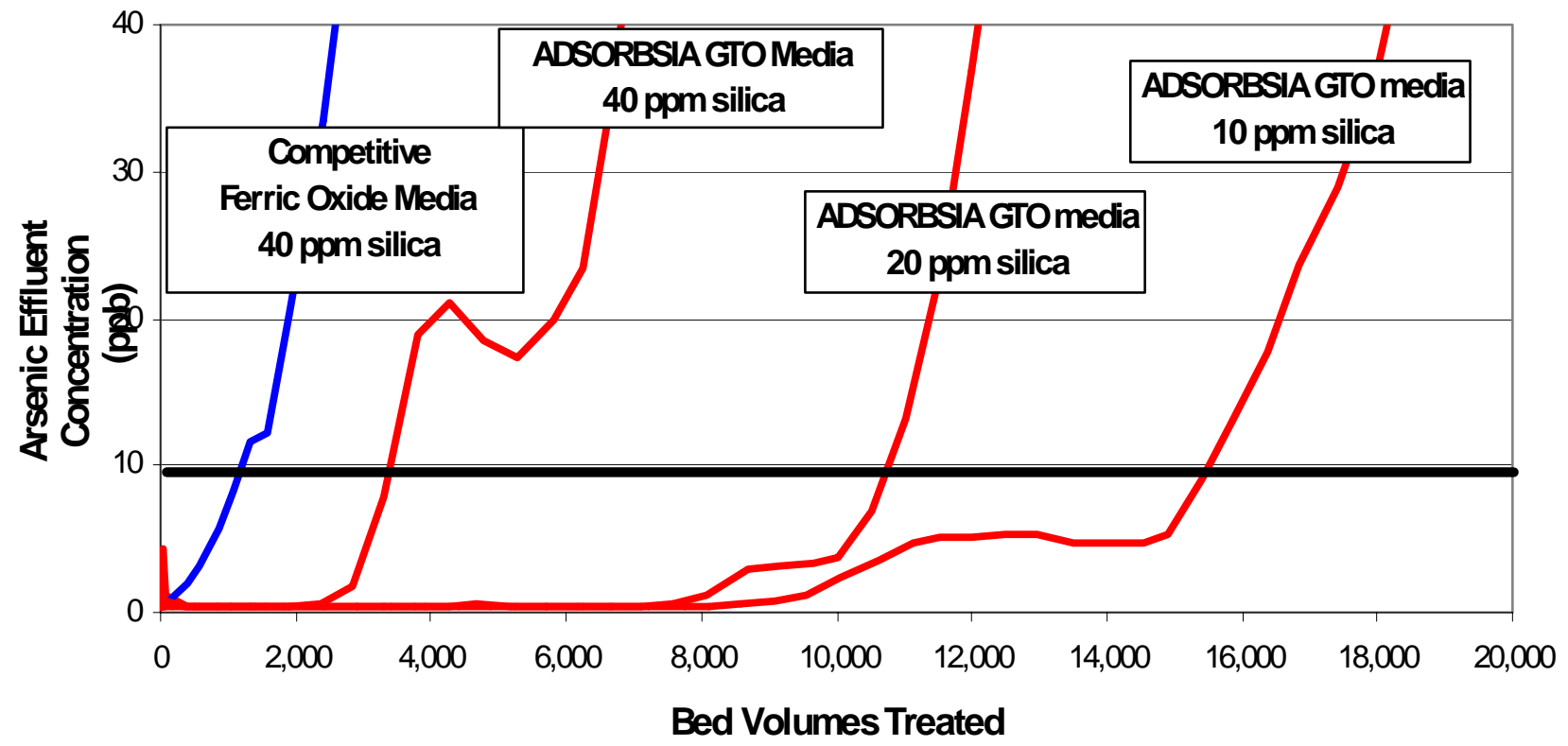




Best Over Wide Range of Water Conditions

Impact of Silica

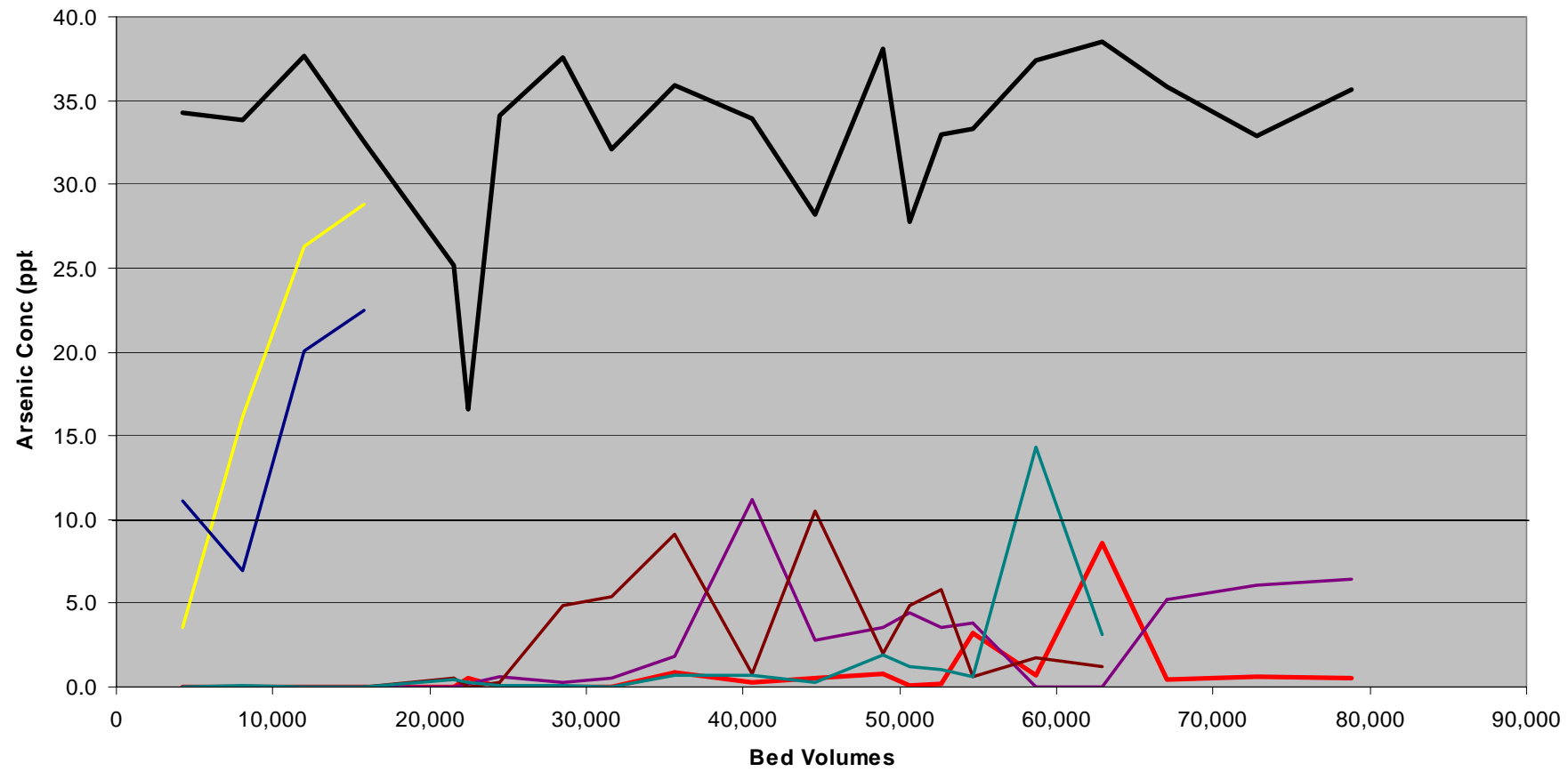
NSF Challenge Water (300 ppb As(V), pH=7.5, 180 sec EBCT)





EPA Licking River Data

EPA Licking River Study
Arsenic V removal





Competing Ion Effects

- Sulfate
 - No impact on performance
- Phosphate
 - Appears to have little or no impact on capacity
- Vanadium
 - High capacity for Vanadium
 - Low levels (<10ppb) do not appear to have a significant impact on capacity
 - Impact on higher levels yet to be determined
- Iron
 - Soluble iron has not been shown to impact performance
 - Non-Soluble iron is filtered by the bed (backwashing required)
 - Non-soluble iron will adsorb arsenic and can effectively increase capacity





- ADSORBSIA GTO arsenic removal media is available in several package sizes
 - Samples: 1L bottle
 - 1 cubic foot cardboard pack
 - 5 cubic foot fiber pack
- 30-60 day typical lead time for quantities $<200 \text{ ft}^3$
- 60-90 day typical lead time for quantities $>200 \text{ ft}^3$
- Dow standard terms and conditions

