PFAS = Bizarro World For Groundwater People?

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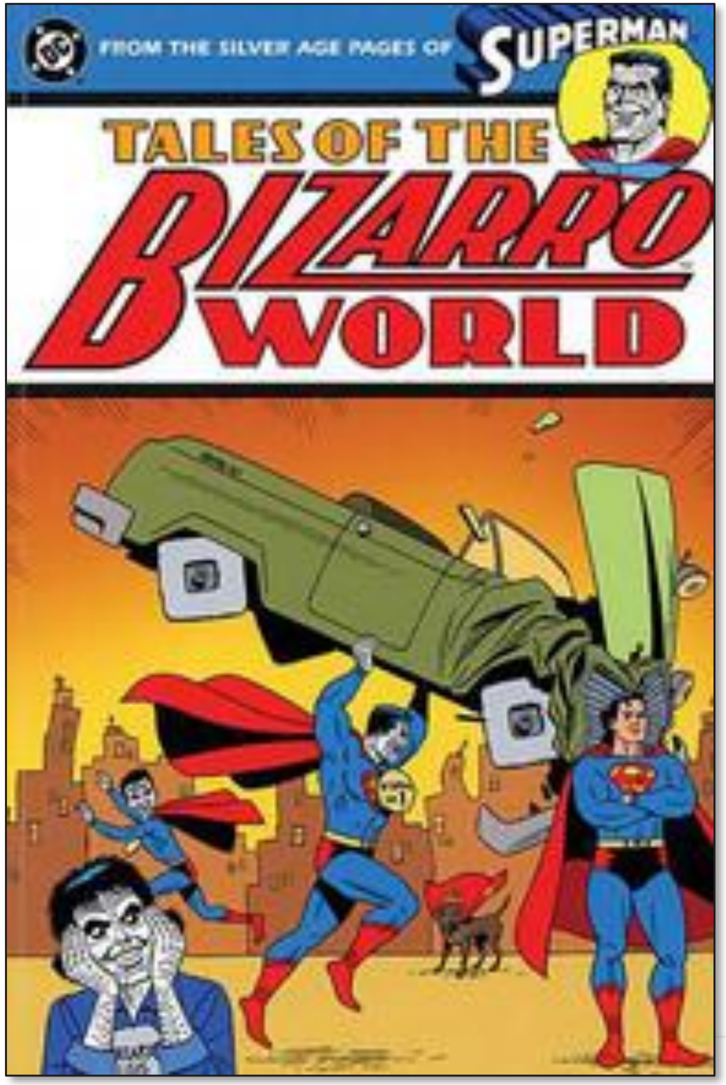
- "The Bizarro World (also known as Htrae, which is "Earth" spelled backwards) is a fictional planet appearing in American DC comic books.
- Htrae is a cube-shaped planet, home to Bizarro and companions, all of whom were initially Bizarro versions of Superman, Lois Lane, others
- In popular culture, "Bizarro World" has come to mean a situation or setting which is weirdly inverted or opposite to expectations."

Wikipedia, 2022



PFAS = Bizarro World For Groundwater People?

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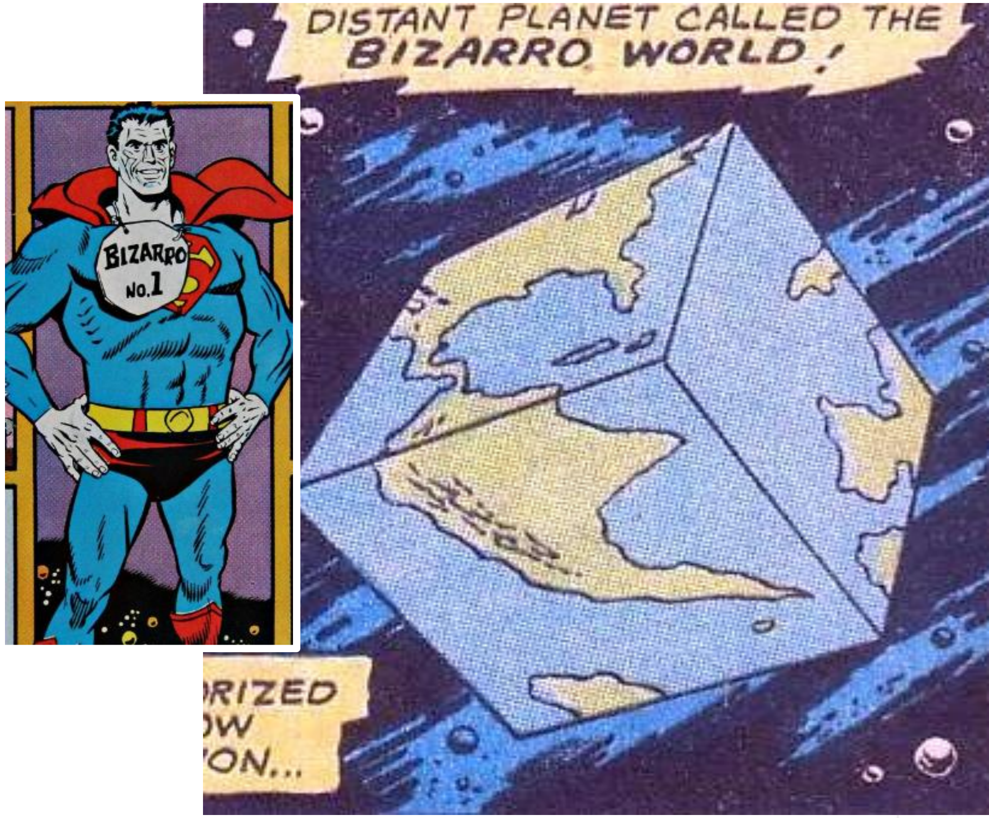
- No current evidence of in-situ degradation of regulated PFAAs!
- Biodegradation doesn’t help, it hurts!
- Front-line technology is Pump and Treat? Are we back in the 1980s?
- Concentrations: single digit ~~Nanogram~~ Picogram per liter?
- Thousands of individual PFAS!
- ~60,000+ sites in US? (EBJ, 2022)(Salvatore et al., 2022)



KEY POINT: “Business as Usual” won’t work for PFAS Groundwater Cleanup

Potential Futures for PFAS Management?

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- Scenario 1: Pump & Treat is the predominant approach for PFAS plumes (with some injected sorbents)?

→ 60,000 P&Ts is Too Many?

- Scenario 2: Researchers deliver a "silver bullet" that destroys PFAS in-situ & it is rapidly adopted?

→ Nothing Yet?

- **Scenario 3: Risk / Triage strategy used with variety approaches, including *retention-based MNA* at some sites.**

→ PFAS Expert Panel: Most likely outcome in near term

Newell et al., 2022 REMEDIATION

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GSI PFAS Dept. of Defense R&D Projects

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SERDP	Understanding the Spatial/Temporal Nature of AFFF PFAS Loadings in Stormwater to Develop Treatment Technologies (ER23-3741), 2023.
SERDP	Determining PFAS Transport Mechanisms Within AFFF-Impacted Construction (ER23-3713), 2023.
SERDP	Gas Sparging Directly in Aquifers to Remove or Sequester PFAS (SERDP Project ER22-3221), 2022.
SERDP	Principal Retention of PFAS Groundwater Plumes at Freshwater / Saltwater Interfaces (SERDP Project ER22-3275), 2022.
SERDP	Impact of Particulate Carbon Amendments on Pollutant Fate in Groundwater (SERDP ER-21-1130), 2021
ESTCP	Mobile App Tech Transfer for SERDP/ESTCP PFAS Projects, 2023.
ESTCP	Assessing Mass Discharge from PFAS Vadose vs. Saturated Zone vs. Matrix Diffusion to Improve Conceptual Models and DoD RI/FS (ER23-7754) 2023
ESTCP	Separating and Destroying Short-Chained PFAS from Waste Streams by Combining Colloidal Gas Aphrons (CGAs) with Plasma (ER23-7892) 2023
ESTCP	Rapid and Inexpensive Delivery of Particulate Carbon For In Situ PFAS Treatment in Groundwater (ER22-7363) 2022
ESTCP	Using Real-Time Remote Sensors at PFAS Vadose Source Zone (ESTCP Project ER22-7381), 2022.
ESTCP	Developing a Framework for Monitored Natural Attenuation at PFAS Sites, 2021.
ESTCP	Characterization of the PFAS in Environmental Media at DoD Sites for Informed Decision-Making (PFAS) (ESTCP ER-201633), 2016.
Navy	Innovative PFAS Destructive Technologies for Treatment of Soil and Other Media. 2022.
Navy	Improved Methodologies for Evaluating Risk During Remedial Investigations (RIs) at PFAS Sites, 2022.
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Air Force	Can the REMChlor-MD Model be Used to Evaluate Passive and Active PFAS Remediation Alternatives?, 2022.
Air Force	Applicability Comparison of Two Commonly Used Modeling Systems for Simulating PFAS Fate and Transport, 2022.

SERDP DOD · EPA · DOE

ESTCP

NAVFAC Naval Facilities Engineering Command ENGINEERING AND EXPEDITIONARY WARFARE CENTER

AIR FORCE CIVIL ENGINEER CENTER