

# ***Air Force Center for Engineering and the Environment***

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*Integrity - Service - Excellence*



## **Green Remediation within the US Air Force**

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## ***Sustainability in AF Remediation: Past and Future***

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**Present ER programs focus on cost, risk reduction, compliance with existing laws, and other metrics**

**By including sustainability in an ER program, several new metrics may become part of remediation process:**

- **Carbon emissions**
- **Energy consumption**
- **Worker safety**
- **Resource service for land and/or groundwater**

**However, introducing sustainability metrics not new endeavor; for years investigated and promoted such sustainable approaches**



*Sustainability in AF Remediation:*

## ***“Green” Remediation Technologies***

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**Some past and current treatment technologies, although not originally targeted for sustainability, inherently sustainable and generally considered “green” remediation technologies**

**Incorporation into ER program can often reduce environmental impact of remediation activity itself.**

**Sustainable remediation technology examples:**

- **Phytoremediation – 4**
- **LNAPL recovery – 16**
- **Passive in situ treatment**
- **Wetlands**
- **Enhanced bioremediation – 101**
- **MNA – 105**
- **Biowalls – 11**





## *Sustainability in AF Remediation:* **“Green” Remediation Approaches**

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**In addition to some remediation technologies inherently sustainable, various approaches applied to restoration programs:**

- **ERP-O**
- **LTMO**
- **Groundwater modeling**
- **PBM**



**These optimize existing remediation and monitoring systems, and provide holistic and systematic results-based assessment of restoration programs to expedite site closure**



## *Sustainability in AF Remediation: Implementation*

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**Many beginning to purposefully and intentionally analyze sustainability factors as part of selection criteria for new remediation systems as well as for evaluation and optimization of existing systems**

- **FE Warren, WY – Wind turbines for on-site power generation**
- **MMR, MA –**
  - **Wind turbine to power groundwater cleanup**
  - **Transition from green bullets to green ranges**
- **Nellis AFB, NV – Completely on wind energy**





## *Sustainability in AF Remediation: Implementation*

- **Altus AFB, OK –**
  - **In situ bioreactor with solar-powered pump for groundwater circulation**
  - **Biowall replaces pump-and-treat**
- **Travis AFB, CA – Installed solar-powered pumps where electricity not readily available for pump-and-treat system and in situ bioreactor**
- **Hickam AB, HI – In situ bioreactor with solar-powered pump for groundwater circulation**
- **Sustainable Remediation Tool**





*Sustainability in AF Remediation:  
**For Further Information***

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**AFCEE ERP-O Website:**

[www.afcee.af.mil/resources/restoration/rpo/index.asp](http://www.afcee.af.mil/resources/restoration/rpo/index.asp)

**AFCEE Sustainable Remediation Web Site:**

[www.afcee.af.mil/resources/technologytransfer/programsand  
initiatives/sustainableremediation](http://www.afcee.af.mil/resources/technologytransfer/programsandinitiatives/sustainableremediation)

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