MISSION

NAVFAC Environmental Restoration delivers sustainable, innovative, cost effective remediation solutions with stakeholder engagement, to protect human health and the environment, maintain regulatory compliance, and maximize reuse of DON assets to support the warfighter.

VISION

NAVFAC Environmental Restoration is the recognized Federal leader for responsive, best value, and sustainable remediation solutions.

SiteWise™ Updates

Presentation Overview

- Introduction to SiteWise™
  - Why was it developed
  - What is it
- SiteWise™ Framework
  - Input Sheets
  - Output Tables and Graphics
- What is New for Version 2
  - New features and improvements
  - Status and Schedule
- What is Next
- Summary and Conclusions

Introduction to the SiteWise™ GSR Tool – Why was it Developed

- **Why was SiteWise™ developed**
  - **Need to be sustainable**
  - **Must consider sustainability metrics when making decisions**
    - What remedies to use
    - What methods/equipment to use
    - What footprint reduction techniques make sense
  - **Need information for basis of decisions**
    - Characterize metrics either quantitatively or qualitatively
  - **Need tools to provide this information in an efficient and consistent manner**
- **SiteWise™ facilitates calculation of several common GSR metrics**

Introduction to the SiteWise™ GSR Tool – What is it

- **Series of Excel spreadsheets to calculate the environmental footprint of remediation in terms of sustainability metrics**
- **User-friendly *streamlined life-cycle analysis (LCA)***
  - **Considers *life-cycle impacts* from remedial actions including emissions due to manufacturing of materials consumed during remedial action**
- **Originally developed by Battelle but further development performed jointly with the Navy and USACE in a collaborative effort**
- **Version 1 released to public in May 2010**
  - **Posted to the NAVFAC GSR Portal**
  - **GSR Portal received more hits than any other T2 portal or tool**
  - **SiteWise™ is being applied industry wide for Navy sites, Army, USACE, EPA, State regulators, and private industry**

Introduction to the SiteWise™ GSR Tool – Metrics Evaluated

Metrics calculated with tool:

- ***Energy Consumption***
  - –Expressed as BTUs
- ***Greenhouse Gases Emitted***
  - –Expressed as metric tons CO_2e
    - Includes CO_2, CH_4, and N_2O
- ***Criteria Air Pollutants Emitted***
  - –NOx, SOx, PM in metric tons
- ***Water Consumption***
  - –Expressed as gallons
- ***Worker Safety***
  - –Accidental injury and death

Metrics evaluated outside tool:

- ***Resource Consumption***
  - Includes land, top soil, surface water and aquifer impacts, landfill space
- ***Ecological Impacts***
- ***Community Impacts***
  - Includes noise, traffic, odors

SiteWise™ Framework

- **Remedial Action is broken down into phases (each with own spreadsheet)**
  - **Remedial Investigation**
  - **Remedial Action Construction**
  - **Remedial Action Operation**
  - **Long-Term Monitoring**
- **Each phase broken down into activities (each with tab in spreadsheet)**
  - **Material production**
  - **Transportation – personnel**
  - **Transportation – equipment**
  - **Equipment used – earthwork**
  - **Equipment used – pumps**
  - **Equipment used – other electric**
  - **Equipment used – other**
  - **Residual handling**

Input Sheets

- **Inputs required to run SiteWise™ are from activities undertaken during the entire remedial action**
- **Activities include:**
  - ***Materials*** **used / consumed during different phases of remedial action**
  - ***Transportation*** **of personnel and equipment**
    - Mode of travel, number of personnel, weight of material and equipment
  - **Energy consumption due to *equipment use***
    - Pumps, blowers, compressors, drilling and excavation equipment, etc.
  - ***Residual Management*** **and handling**
    - Waste recycling, incineration, etc.

Input Sheet – Material Production

WELL MATERIALS	Well Type 1	Well Type 2	Well Type 3	Well Type 4	Well Type 5
Input number of wells					
Input depth of wells (ft)					
Choose well diameter (in) from drop down menu	1/2	1/2	1/2	1/2	1/2
Choose material type from drop down menu	Steel	Steel	PVC	PVC	PVC
Choose specific material schedule from drop down menu	Schedule 40 Steel	Schedule 40 Steel	Schedule 40 PVC	Schedule 40 PVC	Schedule 40 PVC

TREATMENT CHEMICALS	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5
Input number of injection points					
Choose material type from drop down menu	ISCO Chemical	Sodium Hypochlorite	Urea	EZVI	Sodium Hypochlorite
Input amount of material injected at each point (lbs)					
Input number of injections per injection point					

GAC	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5
Input weight of GAC used (lbs)					
Choose material type from drop down menu	GAC	GAC	GAC	GAC	GAC

CONSTRUCTION MATERIALS	Material 1	Material 2	Material 3	Material 4	Material 5
Choose material type from drop down menu	HDPE	HDPE	HDPE	HDPE	HDPE
Input area of material (ft^2)					
Input depth of material (ft)					

WELL DECOMMISSIONING	Well Type 1	Well Type 2	Well Type 3	Well Type 4	Well Type 5
Input number of wells					
Input depth of wells (ft)					
Choose well diameter (in) from drop down menu	1/2	1/2	1/2	1/2	1/2
Choose material from drop down menu	Soil	Soil	Soil	Soil	Soil

Look-Up Tables

Table 2c: Air travel lifecycle impact

kg CO_2 / passenger mile[a]	0.277
g CH_4 / passenger mile[a]	0.0104
g N_2O / passenger mile[a]	0.0085
mg SO_2 / passenger mile[b]	140
mg NO_x / passenger mile[b]	670
mg PM_{10} / passenger mile[b]	32
MPG[c]	2.65
BTU / passenger mile[d]	3261

[a] Values obtained from EPA Climate Leaders "Commuting, Business Travel and Product Transport" Guidance, pg 7 Table 4 (May 2008)

[b] Values obtained from Chester, Mikhail, & Horvath, Arpad. (2008). Environmental Life-cycle Assessment of Passenger Transportation: A Detailed Methodology for Energy, Greenhouse Gas and Criteria Pollutant Inventories of Automobiles, Buses, Light Rail, Heav

[c] Values obtained from EPA Climate Leaders "Direct Emissions from Mobile Combustion Sources" Guidance, pg 12 Table 4 (May 2008)

[d] Values obtained from "Transportation Energy Data Book". U.S. Department of Energy (June 2008)

Table 2d: Air cargo transportation lifecycle impact

kg CO_2/ ton mile[a]	1.527
g N_2O / ton mile[a]	0.0479
g CH_4 / ton mile[a]	0.0417
g NO_x / ton mile[b]	6.1800
g SO_x / ton mile[b]	2.2100
g PM_{10} / ton mile[b]	0.8100
BTU / ton mile[c]	9,600

[a] Values obtained from EPA Climate Leaders "Commuting, Business Travel and Product Transport" Guidance, pg 12 Table 8 (May 2008)

[b] Values obtained from Facanha, Cristiano and Arpad Horvath. Evaluation of Life-Cycle Air Emission Factors of Freight Transportation. Environ. Sci. Technol. 2007, 41, 7138-7144

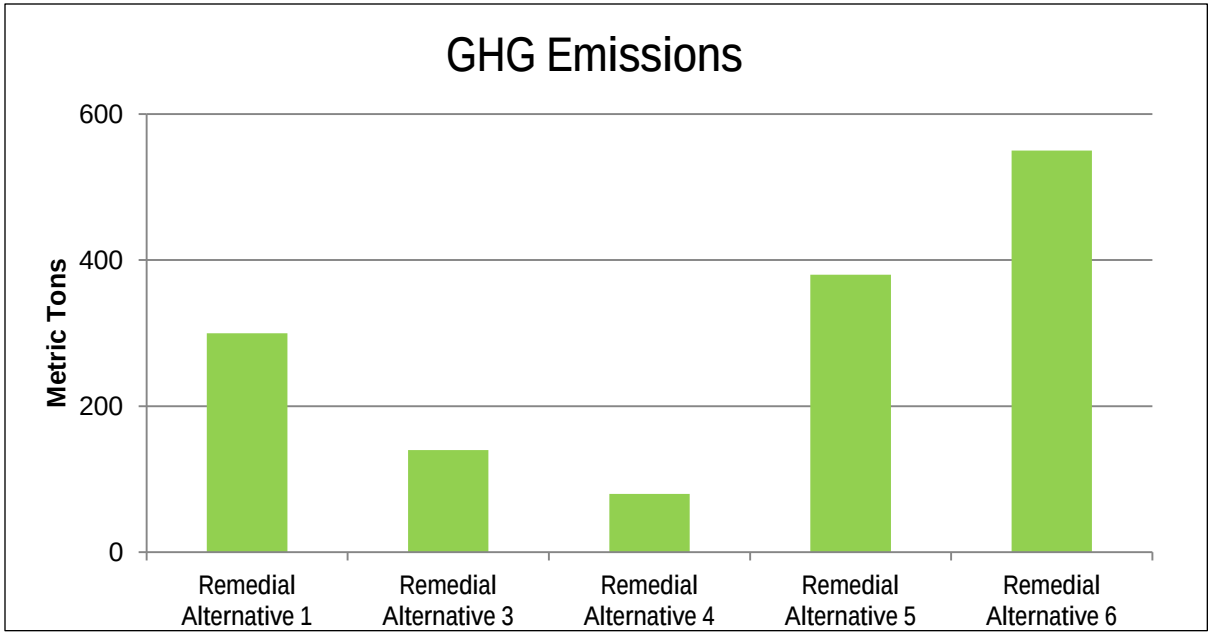
[c] Values for fuel consumption obtained from "Transportation Energy Data Book". U.S. Department of Energy (June 2008)

Example inventories include fuel consumption rates and emissions factors for vehicle and rail travel

- Includes CO_2, CH_4, and N_2O emissions factors

Different Graphical Outputs for Comparing Metrics and Remedial Alternatives

Remedial Alternatives	GHG Emissions	Total Energy Used	Water Consumption	NO_x emissions	SO_x Emissions	PM_{10} Emissions	Accident Risk Fatality	Accident Risk Injury
	metric ton	MMBTU	gallons	metric ton	metric ton	metric ton		
Remedial Alternative 1	300.00	3.05E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Remedial Alternative 3	140.00	3.05E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Remedial Alternative 4	80.00	3.05E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Remedial Alternative 5	380.00	2.20E-01	0.00E+00	6.00E-05	1.00E-06	1.00E-06	1.51E-08	3.14E-06
Remedial Alternative 6	550.00	2.20E-01	0.00E+00	6.00E-05	1.00E-06	1.00E-06	1.51E-08	3.14E-06



- Comparative graphic shown for GHG emissions
- Similar graph is generated for each metric

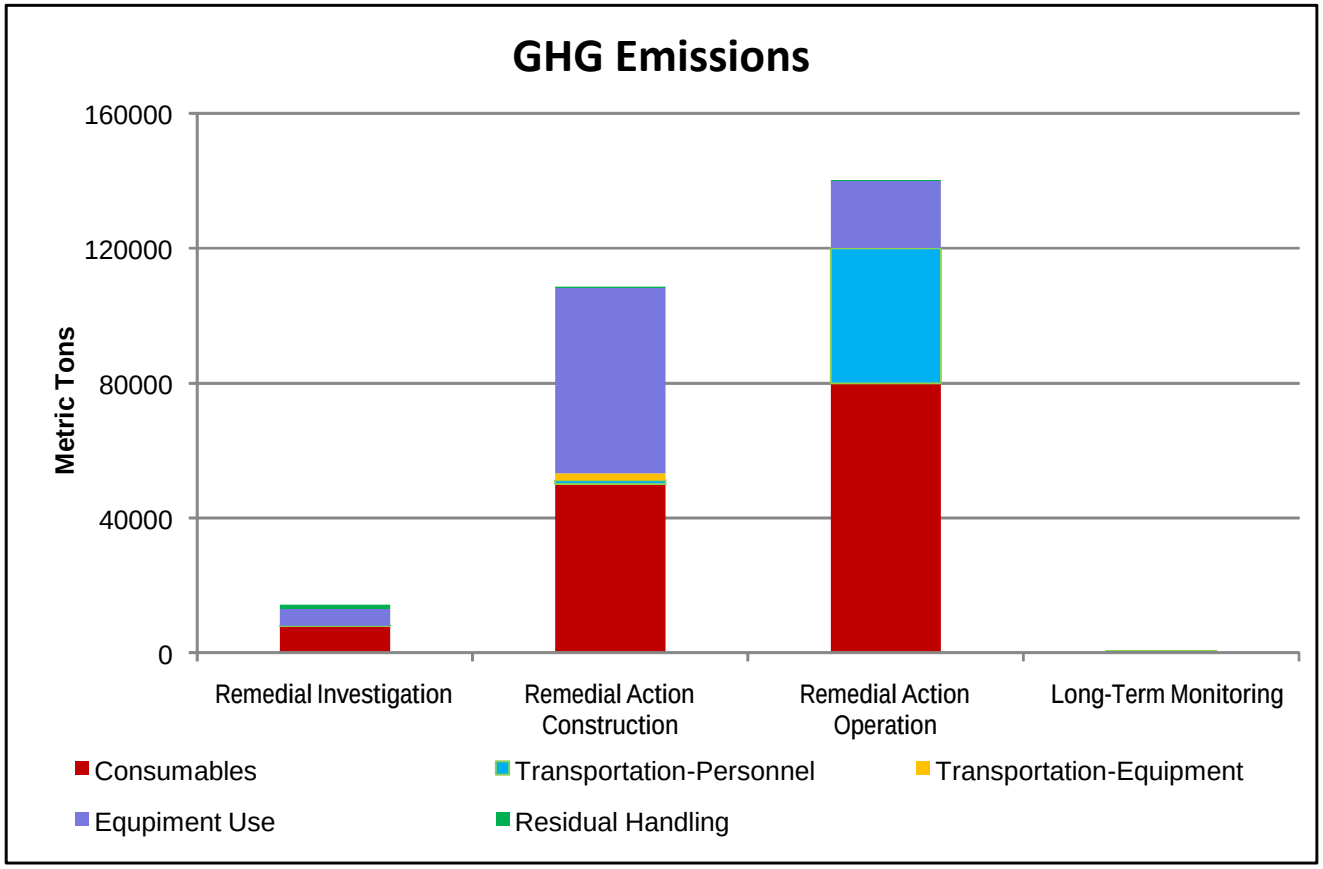
Output Broken Down to Individual Activity in a Particular Phase of Remedial Action

Sustainable Remediation - Environmental Footprint Summary

Alternative Enhanced Bioremediation — In situ Enhanced Bioremediation, MNA, Shallow Soil Excavation, and LUCs

Phase	Activities	GHG Emissions metric ton	Total Energy Used MMBTU	Water Impacts gallons	NO_x Emissions metric ton	SO_x Emissions metric ton	PM_{10} Emissions metric ton	Accident Risk Fatality	Accident Risk Injury
Remedial Investigation	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	0.00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Transportation-Equipment	0.00	0.0E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equpiment Use	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Residual Handling	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Remedial Action Construction	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	0.34	3.8E+00	NA	6.4E-04	9.4E-05	4.4E-05	2.1E-05	1.5E-03
	Transportation-Equipment	0.28	7.2E+00	NA	1.7E-03	2.2E-04	1.3E-04	7.2E-07	1.5E-04
	Equpiment Use	6.36	6.7E+01	0.0E+00	2.6E-02	7.4E-03	2.5E-03	4.8E-06	2.0E-03
	Residual Handling	130.06	1.3E+03	0.0E+00	3.5E-01	4.6E-02	2.7E-02	3.7E-06	7.8E-04
	Sub-Total	137.04	1.40E+03	0.00E+00	3.78E-01	5.33E-02	3.01E-02	3.05E-05	4.50E-03
Remedial Action Operations	Consumables	10.49	2.6E+02	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	0.26	2.8E+00	NA	4.9E-04	7.0E-05	3.3E-05	1.4E-05	1.0E-03
	Transportation-Equipment	0.24	5.2E+00	NA	1.1E-03	1.5E-04	8.8E-05	4.8E-07	1.0E-04
	Equpiment Use	0.68	8.9E+00	2.7E+01	3.9E-03	7.8E-04	2.9E-04	4.8E-06	2.1E-03
	Residual Handling	0.94	7.8E+00	2.2E+02	2.5E-03	3.3E-04	2.0E-04	3.4E-07	7.1E-05
	Sub-Total	12.61	2.81E+02	2.47E+02	8.05E-03	1.33E-03	6.13E-04	1.99E-05	3.28E-03
Long-Term Monitoring	Consumables	Activities	3.5E+00	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	1.21	1.6E+01	NA	2.3E-03	4.0E-04	1.8E-04	4.8E-05	3.5E-03
	Transportation-Equipment	0.21	1.8E+00	NA	5.6E-04	7.3E-05	4.4E-05	2.4E-07	5.0E-05
	Equpiment Use	0.93	1.3E+01	0.0E+00	5.5E-03	9.1E-04	4.2E-04	7.3E-07	3.1E-04
	Residual Handling	6.75	5.6E+01	0.0E+00	1.8E-02	2.4E-03	1.4E-03	6.8E-07	1.4E-04
	Sub-Total	9.10	9.01E+01	0.00E+00	2.65E-02	3.74E-03	2.07E-03	4.99E-05	3.97E-03
Total		**1.6E+02**	**1.8E+03**	**2.5E+02**	**4.1E-01**	**5.8E-02**	**3.3E-02**	**1.0E-04**	**1.2E-02**

Different Graphical Outputs for Comparing Metrics and Remedial Alternatives



- Graphic illustrates which phases of the project have large footprints and which specific elements in each phase have large footprints

What is New for Version 2

- **Additional metrics**
  - **Benefits and cost impacts of footprint reduction methods**
    - Wind
    - Solar
    - Microturbines for landfill gas
    - Variable frequency drives
    - Biofuels
  - **Consumption of landfill space**
  - **Lost hours for accidents**
- **Additional equipment and materials in the input menus**
  - **Additional chemicals, bentonite**
  - **More piping options (e.g. HDPE, Stainless steel, more sizes)**

What is New for Version 2 (Continued)

- **Additional features/equipment**
  - **Footprint factors for wastewater treatment**
  - **Footprint factors for landfill operations**
  - **Internal combustion engines**
  - **Small electric generators for well sampling**
  - **Trenching equipment**
- **Additional labor categories for accident risk**
  - **Construction laborers**
  - **Operating engineers**
  - **Waste management services**
  - **Scientific and technical services**
  - **Other option where user can input value into lookup table**

What is New for Version 2 (Continued)

Generation of remedy comparison table

Alternative	Impact Assessment	GHG Emissions	Energy Usage	Air Emissions	Collateral Risk	Community Impacts	Resources Lost	Water Usage
Enhanced Bioremediation	Relative Impact	Low	Low	Low	Low	Medium	Medium	Medium
	Impact Drivers	Biostiumulant Production and transportation & equip during shallow GW excavation	Biostiumulant Production and transportation and equip during shallow GW excavation	Biostiumulant Production and transportation and equip during shallow GW excavation	Transportation related to long term groundwater monitoring and transportation and equip during shallow GW excavation	Disturbance due to increased traffic during shallow excavation	Landfill space for shallow excavation	Biostiumulant Production
ISCO	Relative Impact	Low to Medium	Low to Medium	Low	Low	Medium	Medium	Medium
	Impact Drivers	Oxidant Prod,, transportation & equip during shallow GW excavation	Oxidant Prod., transportation & equip during shallow GW excavation	Oxidant Prod., transportation & equip during shallow GW excavation	Transportation & equip during shallow GW excavation	Disturbance due to increased traffic during shallow excavation	Landfill space for shallow excavation	Chemical Oxidant Production
ISCR	Relative Impact	Low to Medium	Low to Medium	Low	Low	Medium	Medium	Medium
	Impact Drivers	ZVI production, transportation & equip during shallow GW excavation	ZVI Production, transportation & equip during shallow GW excavation	ZVI Production, transportation & equip during shallow GW excavation	Transportation & equip during shallow GW excavation	Disturbance due to increased traffic during shallow excavation	Landfill space for shallow excavation	ZVI Production
ERH	Relative Impact	High	High	High	Medium	Low	Medium	High
	Impact Drivers	Electrical Usage	Electrical Usage	Electrical Usage	System Construction and Operation	Land Use Controls during the period of application	Lost groundwater	Electrical Production
Excavation	Relative Impact	Medium	Low to Medium	Medium	High	High	High	Low
	Impact Drivers	Transportation & Disposal	Transportation & Disposal	Transportation & Disposal	Excavation to 20 ft	Disturbance due to increased traffic	Landfill Space and lost groundwater	Production of PVC for wells and GAC for water treatment

What is New for Version 2 (Continued)

- **More energy options in addition to electricity**
  - **Fuel oil**
  - **Natural gas**
  - **Jet fuel**
- **A more detailed tutorial/guidance/module**
  - **What components to add when installing a well**
  - **What to consider if Variable Frequency Drives (VFDs) are used**
  - **How to use the tool for the following activities:**
    - Excavation equipment and when to use what type of equipment.
    - Passive and grab sampling techniques vs. conventional techniques (including low flow purge)
  - **Mapping of technologies into SiteWise™ indicating the necessary inputs required to represent each technology in SiteWise™.**

SiteWise™ Version 2 Status

- **Version 2 is currently in Beta testing phase (comments due on March 4th but later comments expected)**

- **Reviewers from the following organizations**
  - **Navy Optimization Workgroup**
  - **Other interested Navy personnel**
  - **USACE**
  - **Army**
  - **AFCEE**
  - **EPA**
  - **Various contractors**

- **Reviewers also represent the following groups**
  - **Sustainable Remediation Forum (including LCA team developing LCA guidance)***
  - **ITRC GSR team (developing technical regulatory guidance)***
  - **ASTM GSR Sub-committee (developing GSR standards)**
  - **FRTR Green Remediation Sub-group**

*** Indicates that SiteWise™ developers are part of that group**

SiteWise™ Version 2 Schedule

- **March 3rd**
  - **First hands on training class on Version 2 at NAVFAC ER Conference**
- **March 4th**
  - **Beta test comments are due**
- **March 9th**
  - **Training at AFCEE Remediation T2 Workshop (Combined with AFCEE SRT™ training in two rooms due to high demand**
- **April 29th**
  - **Target release date Version 2 with new manual**
- **June 27th**
  - **Training at the International Symposium on Bioremediation and Sustainable Environmental Technologies (Combined Navy, USACE, AFCEE effort on SiteWise™ and SRT™)**

What is Next for SiteWise™

- **NAVFAC ESC recently awarded ESTCP Project:**
  - *Quantifying Life-cycle Environmental Footprints of Soil and Groundwater Remedies*
- **ESTCP project includes following scope related to SiteWise™**
  - **Performing three GSR reviews using SiteWise™ (Version 2)**
  - **Compare results to LCA using Simapro; robust LCA software used for industrial applications**
  - **Determine comparability of the SiteWise™ streamlined LCA approach to robust LCA**
  - **Understand limitations and identify areas where SiteWise™ can be improved and make those improvements**
- **Completion date: Fourth quarter 2012 but tool update to be completed second quarter 2012**
- **Award by ESTCP demonstrates DoD support for SiteWise™**

How to Get the SiteWise™ Tool and Training Manual

GSR Web Portal Address

- **General GSR Portal**
  www.ert2.org/t2gsrportal
- **SiteWise™ page**
  www.ert2.org/t2gsrportal/tools.aspx
    - Tool download
    - Manual download
- **Currently above address is for Version 1 only but will be replaced with Version 2 once available**
- **To participate in Beta testing, contact the appropriate Navy Points of Contact (POCs)**