NAVFAC
Naval Facilities Engineering Command
EXWC Engineering & Expeditionary Warfare Center

Risk-Based Explosives Safety Siting and Munitions Risk Assessment System

Michael Oesterle, PhD, PE
Dave Bianchi
NAVFAC EXWC, Port Hueneme, CA

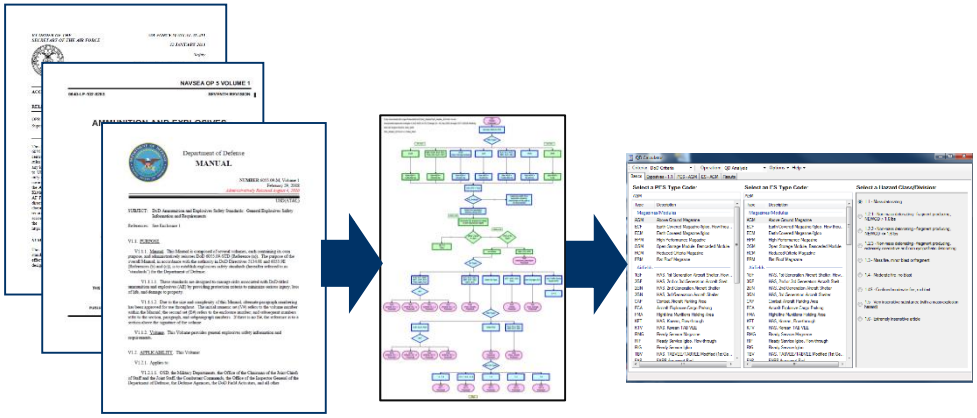
July 31, 2018

Overview

- Background on ESS
- Overview and Status
- Validation and Verification
- RBESS Demonstration
- MRAS Demonstration
- Summary

Background- What is ESS?

- DoD sponsored software developed for use by all DoD services.
- Software developed and maintained by NAVFAC EXWC on behalf of the DDESB
- Used for:
  - Automated calculation and display of explosives safety quantity distance (ESQD) arcs
  - Automated and standardized Site Plan Package development
  - Automated and standardized Potential Explosion Site (PES) data

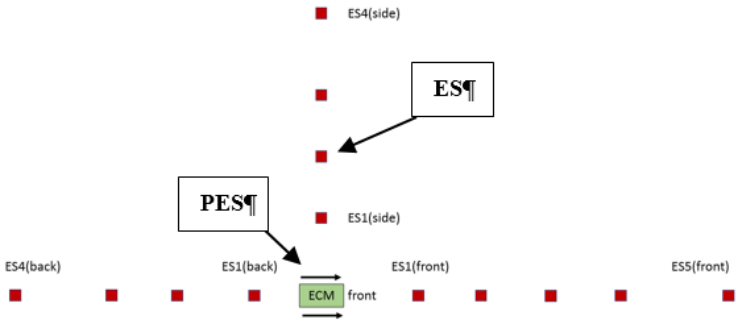


ESS Tools: ESQD Analysis, DQ Analysis, QD Calculator, Site Maps/Reports, RBESS, MRAS

RBESS Overview and Status

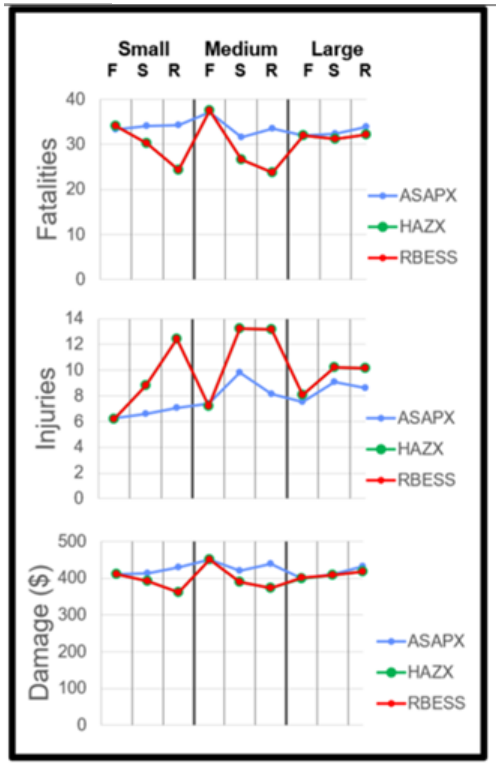
- **Hazard-consequence analysis tools have been added to ESS for risk acceptance of violations at Military Service Component level**
- **RBESS:**
  - **Tier 1- ASAP-X algorithms based on hazard zones and consequences described in DoD6055.09M released in 6.1.4**
  - **Tier 2a- HAZX with Technical Paper 14 Rev 5 algorithms released in 6.1.4**
- **Munition Risk Assessment System (MRAS):**
  - **ASAP-X algorithms**
  - **MRAS process has been implemented**
  - **Released in 6.1.4**
- **Status:**
  - **RBESS Tier 1 and 2a and MRAS into ESS near completion**
  - **Additional effort is for final issue resolution and general ESS testing**
  - **Validation and Verification effort is complete**
- **Future RBESS work:**
  - **Refinement of implementation to enhance usability**
  - ***Tier 2b- DDESB Approved Risk Based Explosives Safety SAFER TBD***

Phase I Verification Results

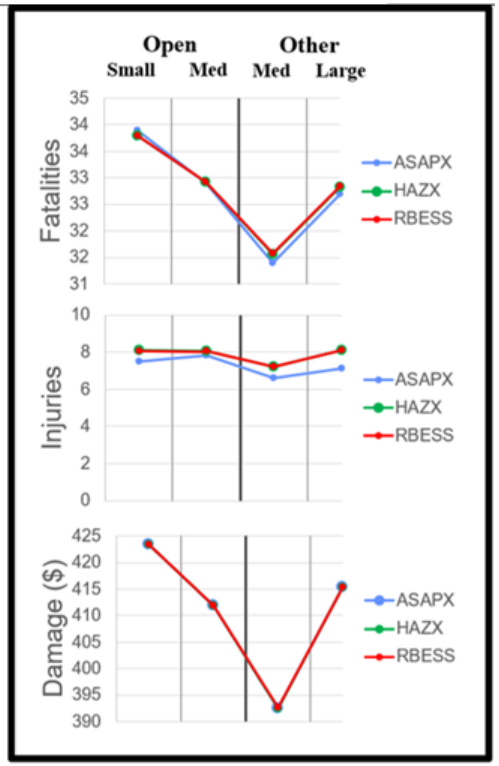


PES Type	Charge	ID	PES Orientation	IMD-B ES 1	ILD-B ES 2	IMD_U ES 3	ILD-U ES 4	PTR ES 5	IBD ES 6	> IBD ES 7
ECM	Small (1000 lb)	S1	Front	50	75	100	150	600	1000	1400
		S2	Side	40	65	95	140	500	1050	1300
		S3	Rear	30	70	105	115	400	850	1255
	Medium (70,000 lb)	S4	Front	200	300	400	500	800	1400	1600
		S5	Side	230	350	450	650	700	1300	1500
		S6	Rear	150	325	425	480	700	1000	1255
	Large (500,000 lb)	S7	Front	450	700	800	1300	2000	3800	4500
		S8	Side	400	600	750	1400	1600	3000	5000
		S9	Rear	475	500	870	1250	1500	2500	4000
Open	Small (500 lb)	S10	Front	40	60	80	120	400	900	1300
	Medium (30,000 lb)	S11	Front	150	250	300	500	650	1000	1400
Undefined	Medium (20,00 lb)	S12	Front	100	225	275	450	700	1200	1255
	Large (100,000 lb)	S13	Front	250	400	500	700	1000	1500	2000

- **Nearly full agreement between HAZX and RBESS**
  - **Common Library implement properly**
- **Disagreement between ASAP-X and RBESS/HAZX for ECMs**
  - **Hazard zone calculated with QDE in RBESS/HAZX**
  - **Hazard zone calculated with simplified QD engine in ASAP-X**
- **Disagreement between ASAP-X and RBESS/HAZX for Injuries**
  - **Interpolation scheme for ASAP-X is not consistent for all hazard zone due to different rounding rules**



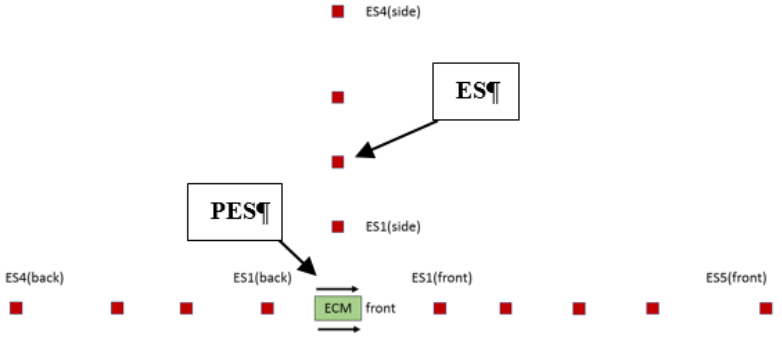
A. ECM-type PES Scenarios

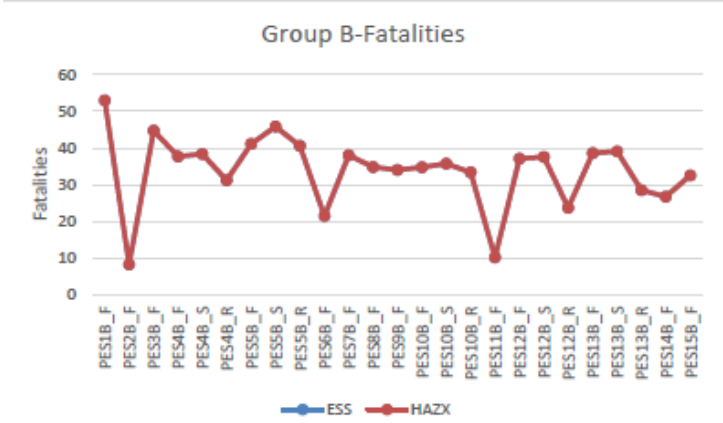


B. Open- and Other-type PES Scenarios

Phase II Verification Results

- Similar analysis performed for Tier 2a
- Complete agreement between RBESS and HAZX
- RBESS calculated a higher expected value loss than HAZX by a factor of 10 for all roads, but issue was corrected
- RBESS functioned as expected





PES/NEW Parameters

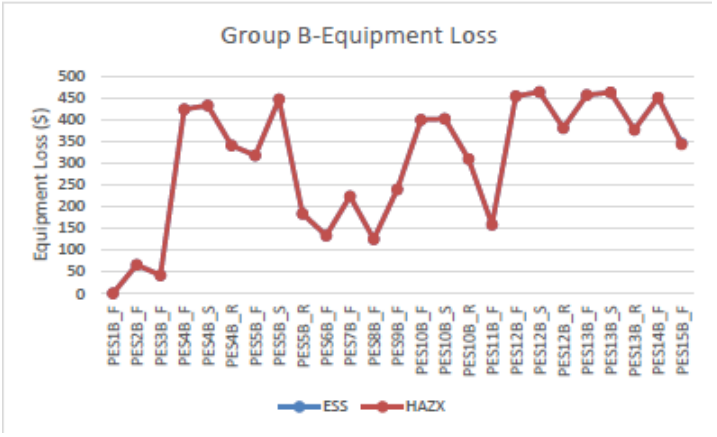
PES Category	PES Type	Soil Type	Activity Type	NEW	Hazard Division	Weapon Type
Aboveground Structure (AGS)	Small	Concrete	Destruction	S (< 1000 lb)	1.1	AIM-7 Missile
	Med	Loose Soil	Maint/Assembly	M (> 1000 lb)	1.2.1	Bulk/Lt Case
	Large	None (Ships)	Operations	L (> 100,000 lb)	1.2.2	M107
Earth Covered Magazine (ECM)	Small Steel Arch	Rock/Hard Clay	Storage		1.2.3	MK-82
	Small RC Arch		Testing		1.3	MK-83
	Med Steel Arch		Transportation		1.4	MK-84
	Med RC Arch				1.5	Unknown
	Large Steel Arch				1.6	MK1 (1.2.1)
	Large RC Arch					
Hardened AC Structure (HAS)	HAC					
Hollow Clay Tile	Hollow Clay Tile					
ISO Container	ISO Container					
Open	Open					
Operating Building (Concrete)	Small					
	Medium					
Steel PEMB	Steel PEMB					
Ship	Small					
	Medium					
	Large					

KEY
- Considered in Phase 1
- Recommended to be included
- Not likely to be included

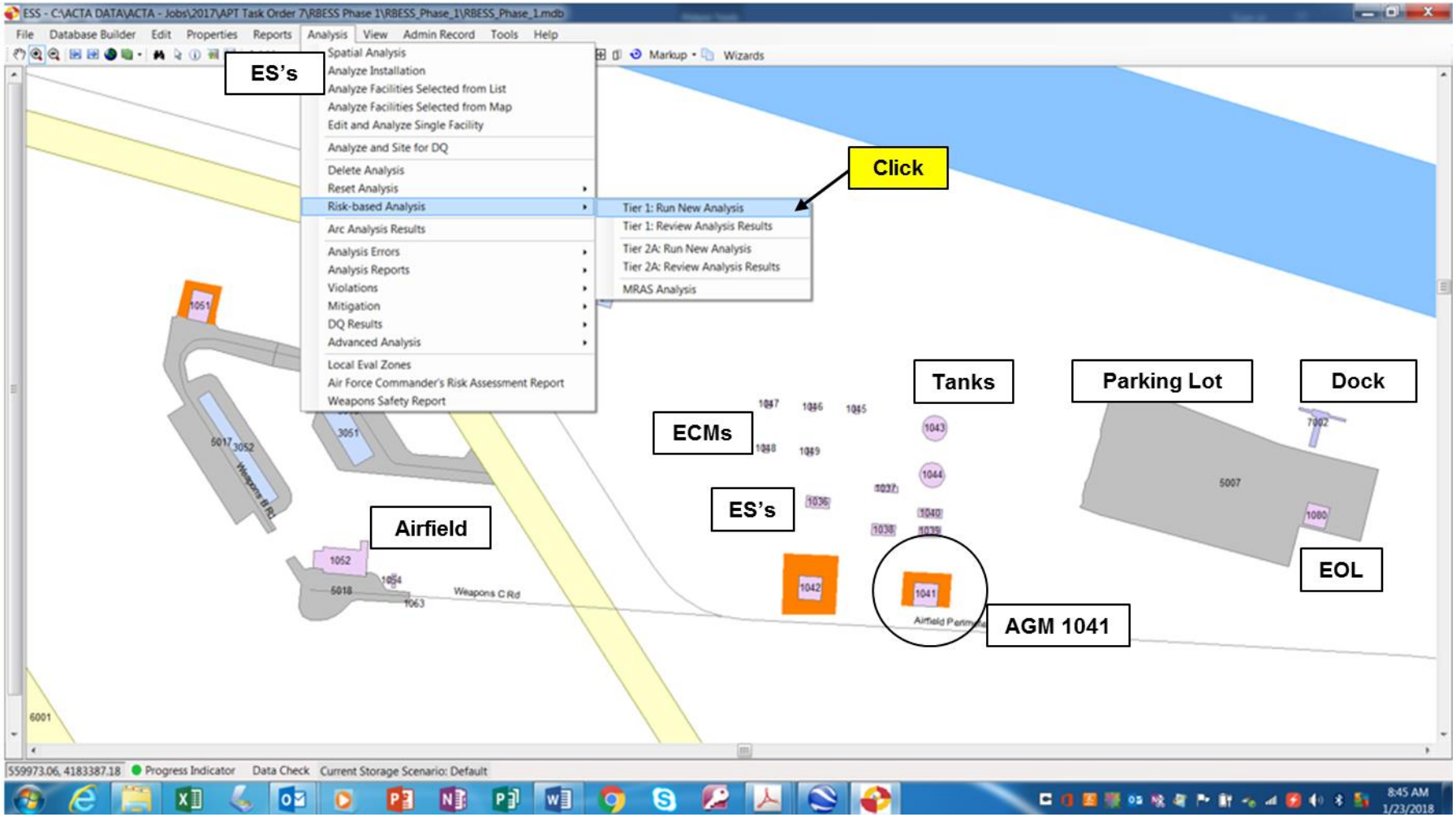
ES Parameters

ES Category	ES Building Type	ES Roof Type	Exposure Type	Glass	% Glass
Mod Build/Trailer	Mod Build/Trailer	14" Reinforced Concrete	None	Annealed	Low (0-10%)
Open	Open	4" Reinforced Concrete	IBD	Tempered	Med (11-25%)
Vehicle	Vehicle	5/8" Gypsum Board	PTRD	Dual Pane	High (25-40%)
Reinforced Concrete	Small (Office/Comm)	3/8" Plywood + 2x10 joists	ILD		
	Medium (Office/Comm)	Light Steel Panel (22 gauge)	IMD		
	Large Tilt Up (Comm)	Lightweight Con and Steel Deck	On Base Rd		
Reinforced Masonry	Small (Office/Comm)	Medium Steel Panel (18 gauge)	Asset Presrv		
	Medium (Office/Comm)	Steel (Automobile)			
Steel PEMB	Small (Office/Storage)	Unknown			
	Medium (Office/Comm)	Wood Panelized (1/2" Plywd)			
	Large (Office/Storage/Hanger)				
Stud Wall (Wood Frame)	Small Wood Frame (Residence)				
	Med Wood Frame (Residence)				
	Medium Steel Stud				
Unreinforced Masonry	Small (Office)				
	Medium (Office)				
	Large (Office)				

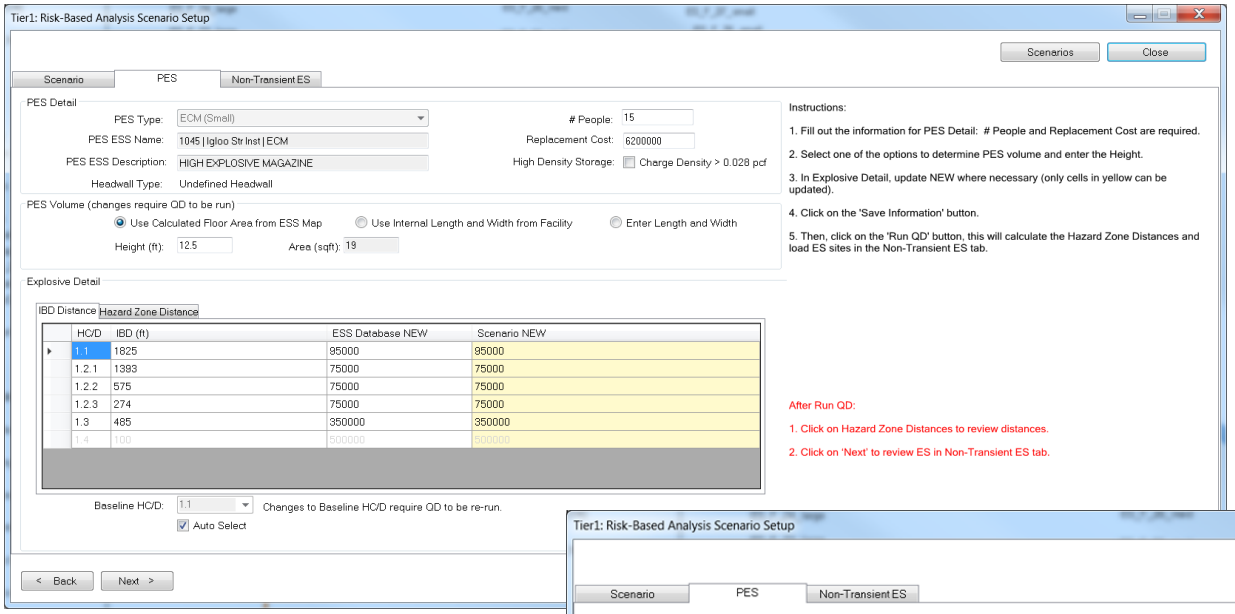
KEY
- Considered in Phase 1
- Recommended to be included
- Not likely to be included



RBESS Project

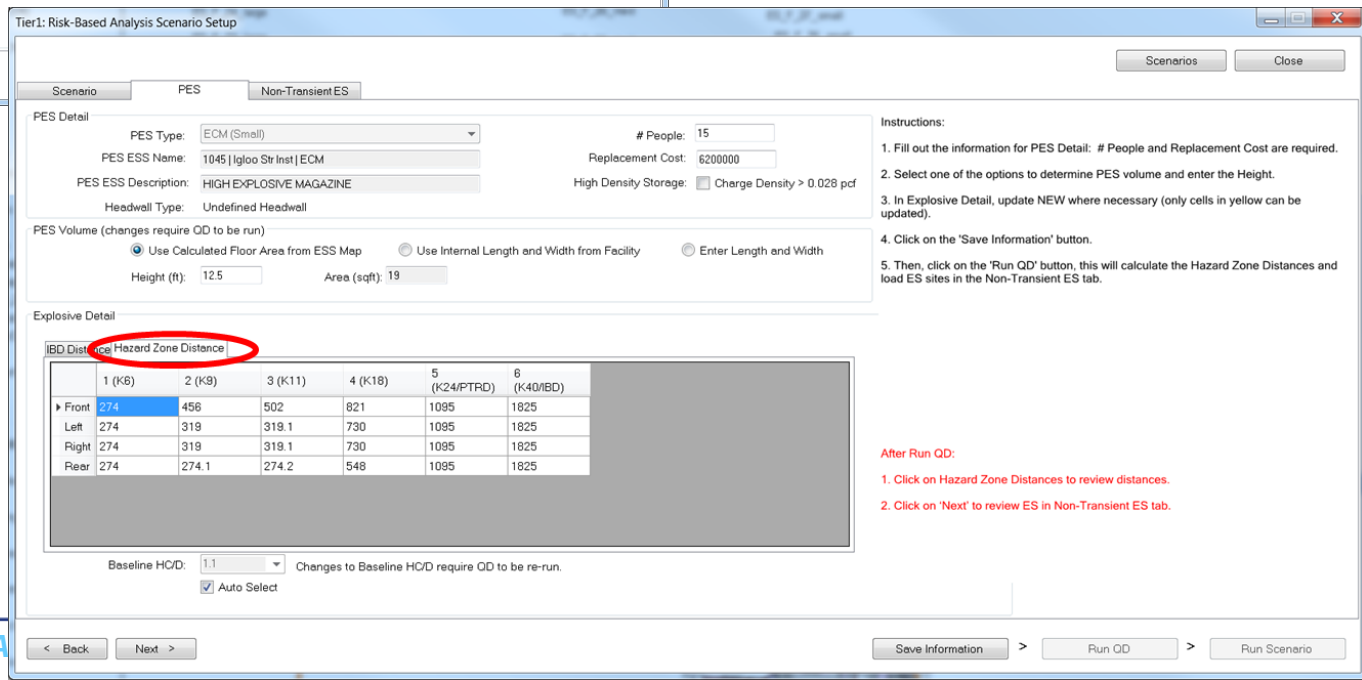


RBESS Tier 1 Input



PES Input Requirements:

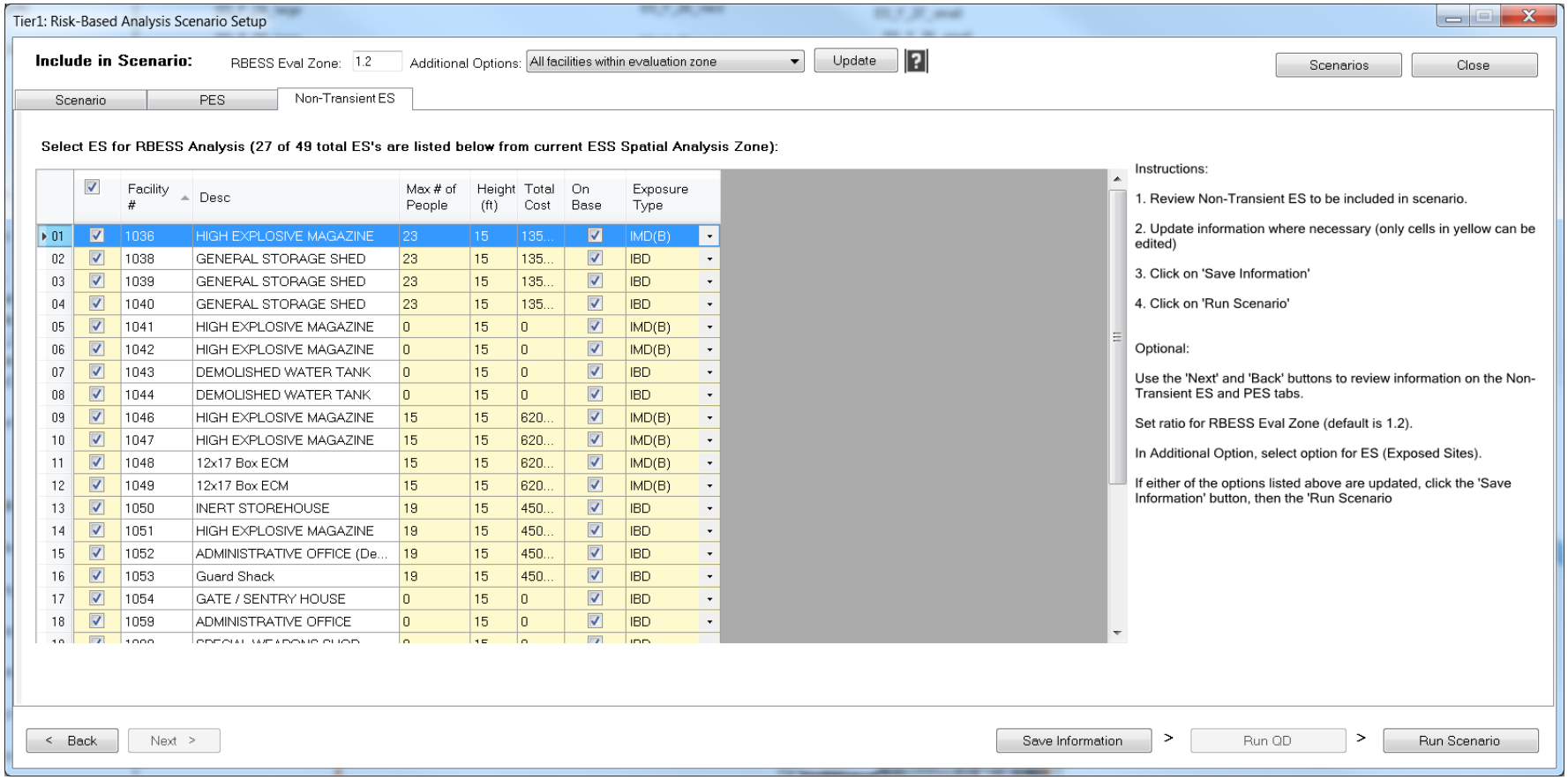
- Replacement Cost
- Occupants



RBESS Tier 1 Input

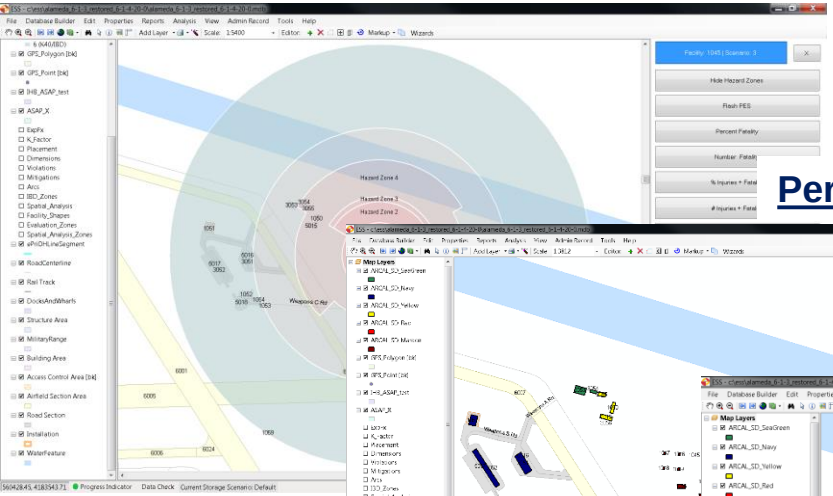
ES Input Requirements:

- Replacement Cost
- Occupants

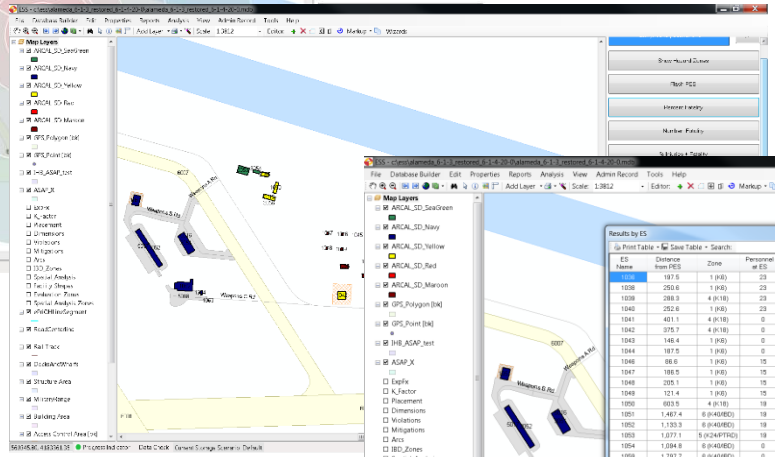


RBESS Tier 1 Output

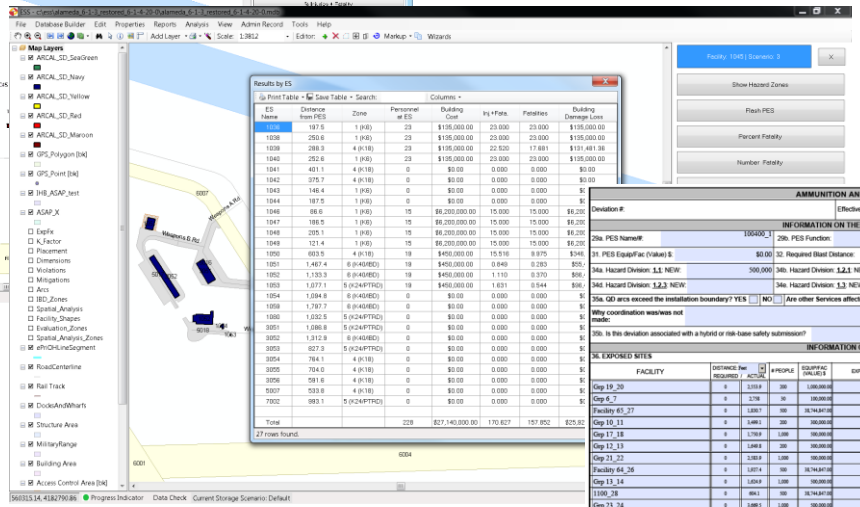
Hazard Zones



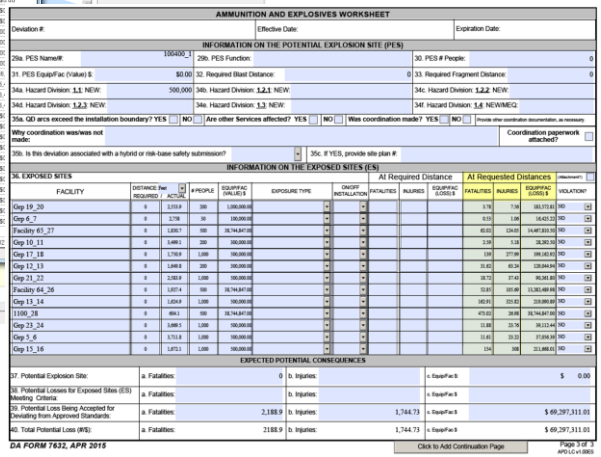
Percent Fatalities



ES Results



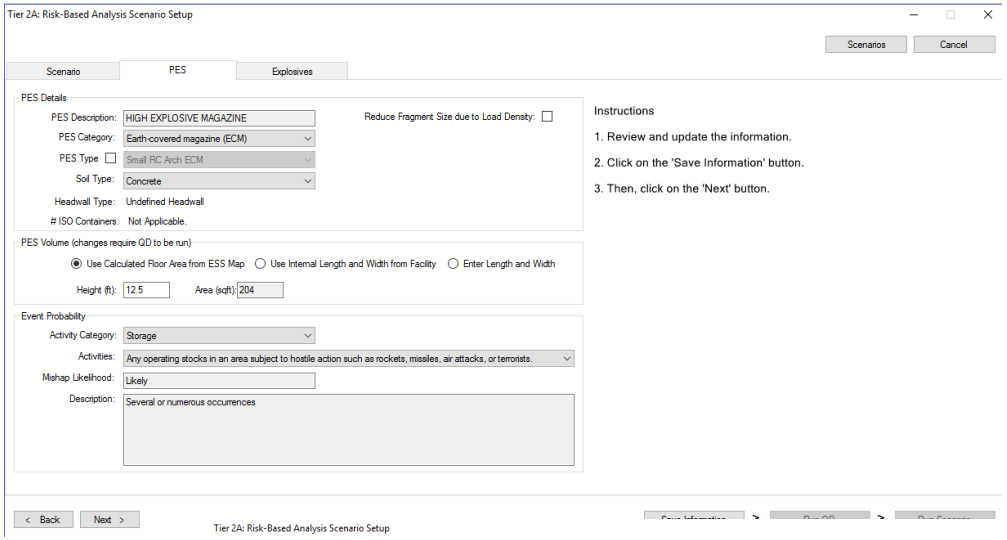
DARAD

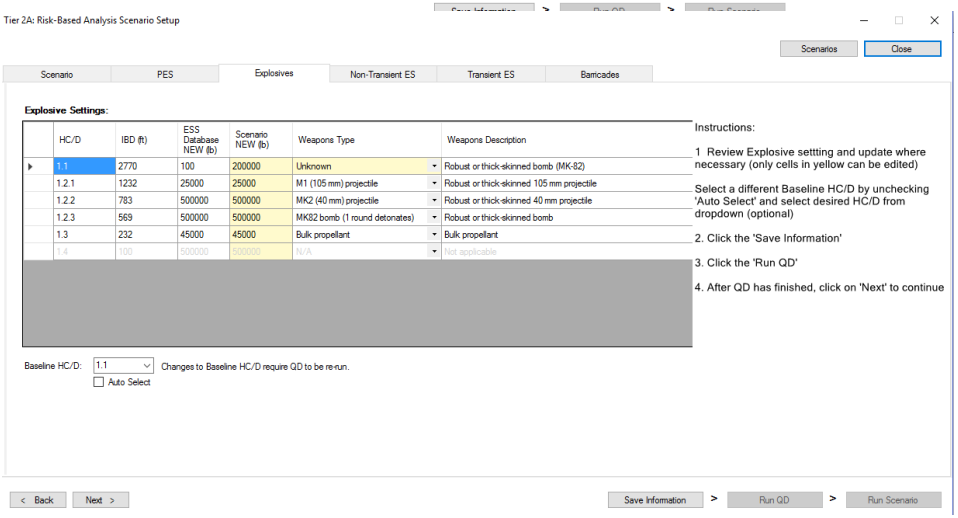


RBESS Tier 2a PES Input

PES Input Requirements:

- Facility Information
  - Height
  - Structure Type
- Replacement Cost
- Occupants
- PES Activity

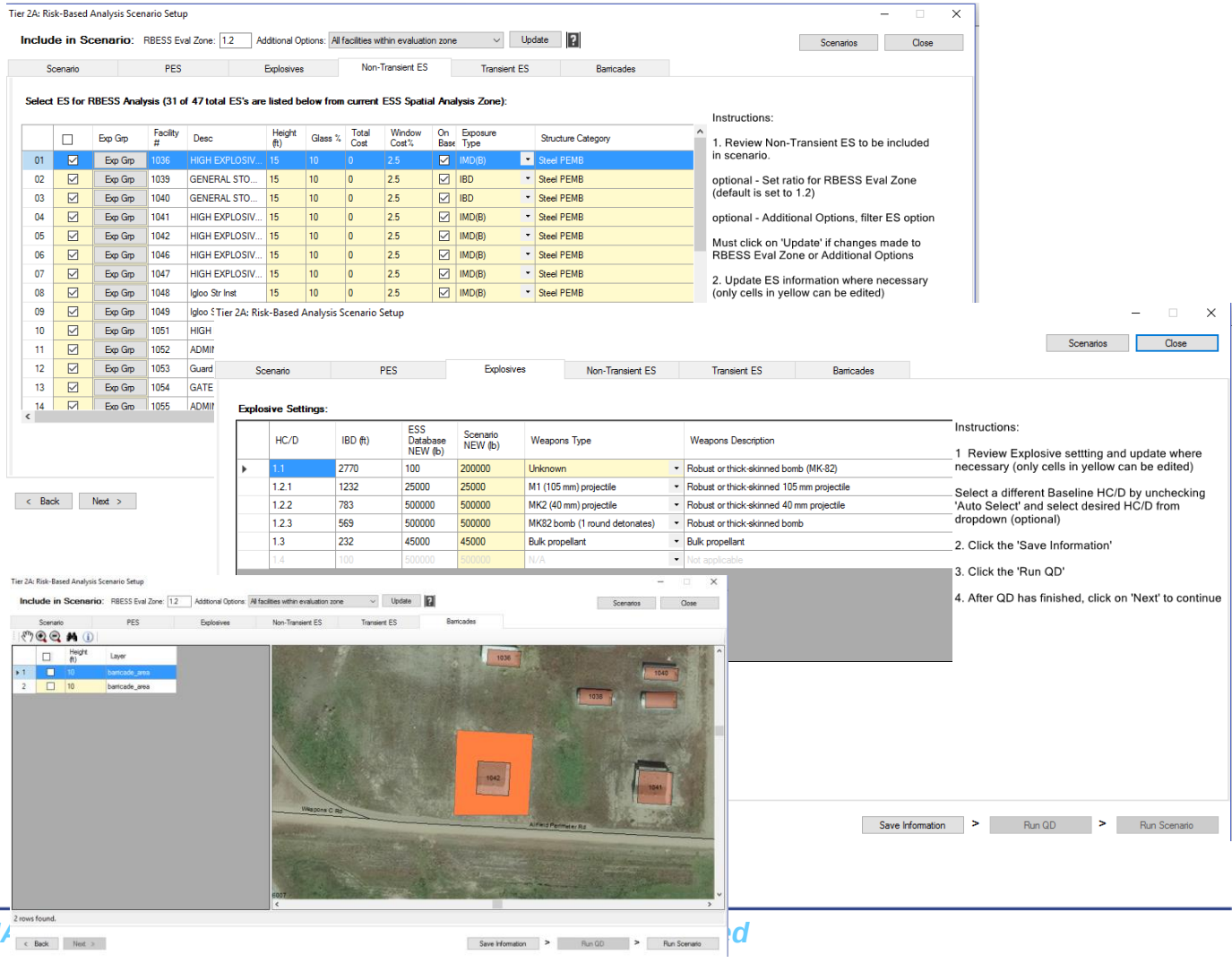




RBESS Tier 2a ES Input

ES Input Requirements:

- Facility Information
  - Height
  - Structure Type
  - Roof Type
  - Window
- Replacement Cost
  - Building
  - Windows
- Occupants
- Traffic Information
- Barricade Polygons

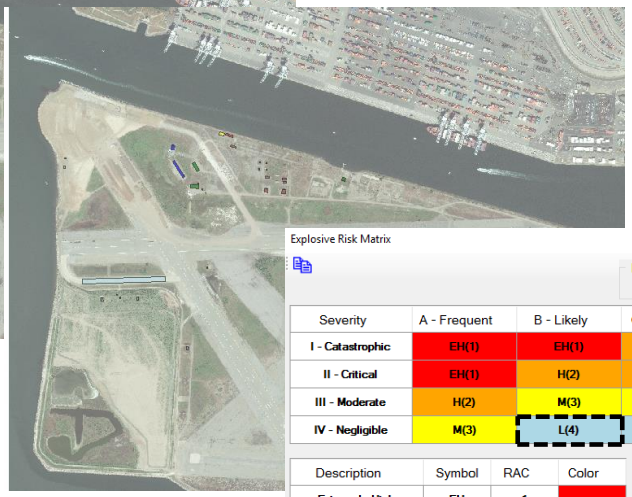


RBESS Tier 2a Output

Pressure Contours

Structural Damage

Percent Fatalities



Risk Matrix

Explosive Risk Matrix

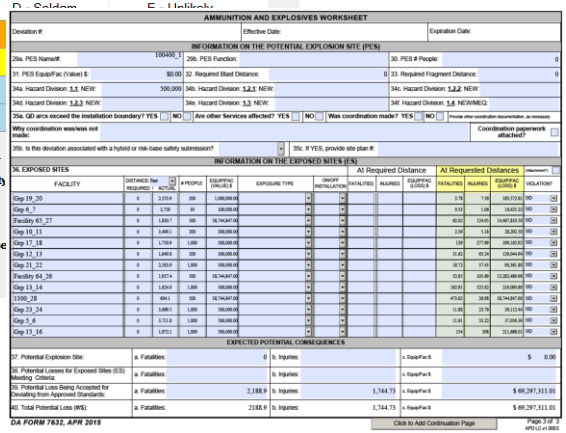
Risk Assessment Method
(•) Injuries and $ loss ( ) Injuries and % damage

Severity	A - Frequent	B - Likely	C - Occasional
I - Catastrophic	EH(1)	EH(1)	H(2)
II - Critical	EH(1)	H(2)	H(2)
III - Moderate	H(2)	M(3)	M(3)
IV - Negligible	M(3)	L(4)	L(4)

Description	Symbol	RAC	Color
Extremely High	EH	1	
High	H	2	
Moderate	M	3	
Low	L	4	

Matrix for Probability :
Severity :
RAC :
Note: base

DARAD



Summary

- RBESS Tier 1 and Tier 2a modes have been implemented in ESS.
- Output for both Tier 1 and Tier 2a RBESS include color-coded maps that display information on replacement cost, fatalities, and injuries.
- Output also displays consequence information for individual ES's as well as summary information for all the ES's affected by the PES.
- Both tiers of RBESS automatically populate the Department of Army (DA) Form 7632 which is known as the Deviation Approval and Risk Acceptance Document (DARAD).
- RBESS has been validated through comparisons with ASAP-X and HAZX for Tier 1 and 2a and has been shown to generate the expected results.
- RBESS is being released in ESS v6.1.4 and will be available to ESS users in the near future.

Questions

Michael Oesterle, PhD, PE
Naval Facilities Engineering Command
Engineering and Expeditionary Warfare Center (EXWC)

1100 23rd Ave.
Port Hueneme, CA 93043
805-982-3398 DSN: 551-3398
michael.oesterle@navy.mil

ESS Help Desk Support: ESS@navy.mil 805-982-3637

Naval Facilities Engineering Command
EXWC Engineering & Expeditionary Warfare Center

Overview
Munitions Risk Assessment System (MRAS)
in
Explosive Safety Siting Software (ESS 6.1.4)

July 31, 2018

David Bianchi & Ruby Domingo

MRAS - ESS

MRAS (Munitions Risk Assessment System):
Calculates and outputs risk assessment reports including consequence reports, injury reports, zone map report and base fact reports.

Explosives Safety Siting (ESS) Software

- **DoD sponsored software developed for use by all DoD services.**
- **Software developed and maintained by NAVFAC EXWC on behalf of the DDESB**
- **What does ESS do?**
  - Automates the calculation and display of explosives safety quantity distance (ESQD) arcs.
  - Automated and standardized Site Plan Package development.
  - Automated and standardized Potential Explosion Site (PES) data.

MRAS STEPS IN ESS

1. PREPARE ESS DATABASE

2. FIELD ASSESSMENT

3. MERGE TEAM DATA

4. REVIEW DATA & UPDATES

5. MRAS ASSESSMENT

MRAS STEPS IN ESS

1. PREPARE ESS DATABASE
2. FIELD ASSESSMENT
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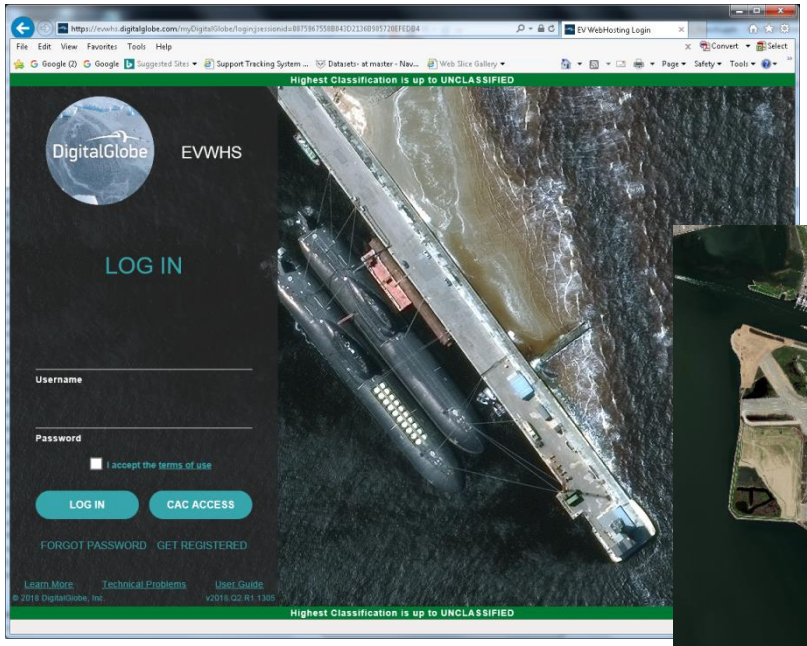
Prepare ESS Database:

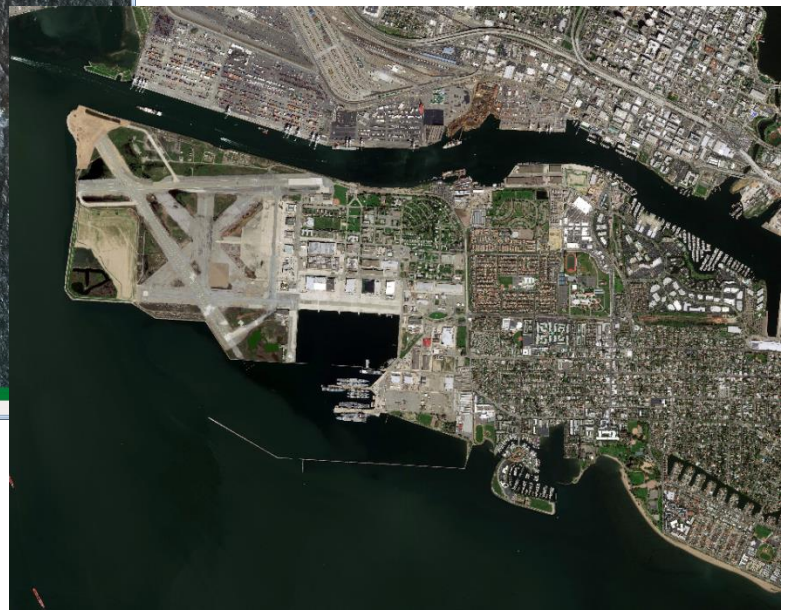
1. Create a New ESS Project with the Database Wizard
2. Add Map Layers and Imagery
3. Draw PES
4. Run QD Analysis
5. Display Arcs
6. Draw Land Use Areas
7. Prep MRAS Assessment
8. Create ESS Archive file for transfer to field computers

Prepare ESS Database – Imagery

Obtain imagery from Digital Globe or other source.

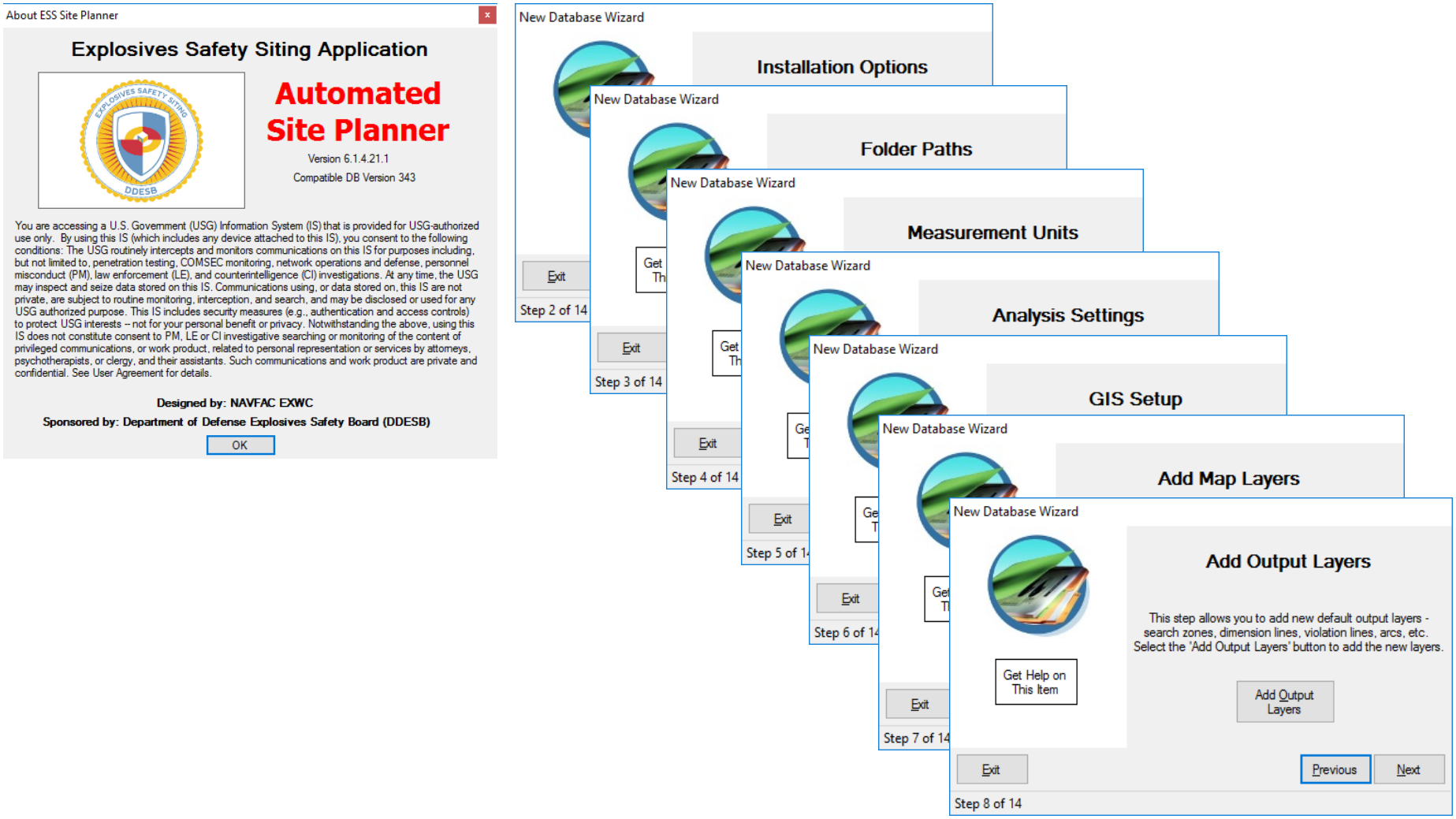
- https://evwhs.digitalglobe.com/myDigitalGlobe
- Recommend saving in UTM coordinate system in SID or TIF format.





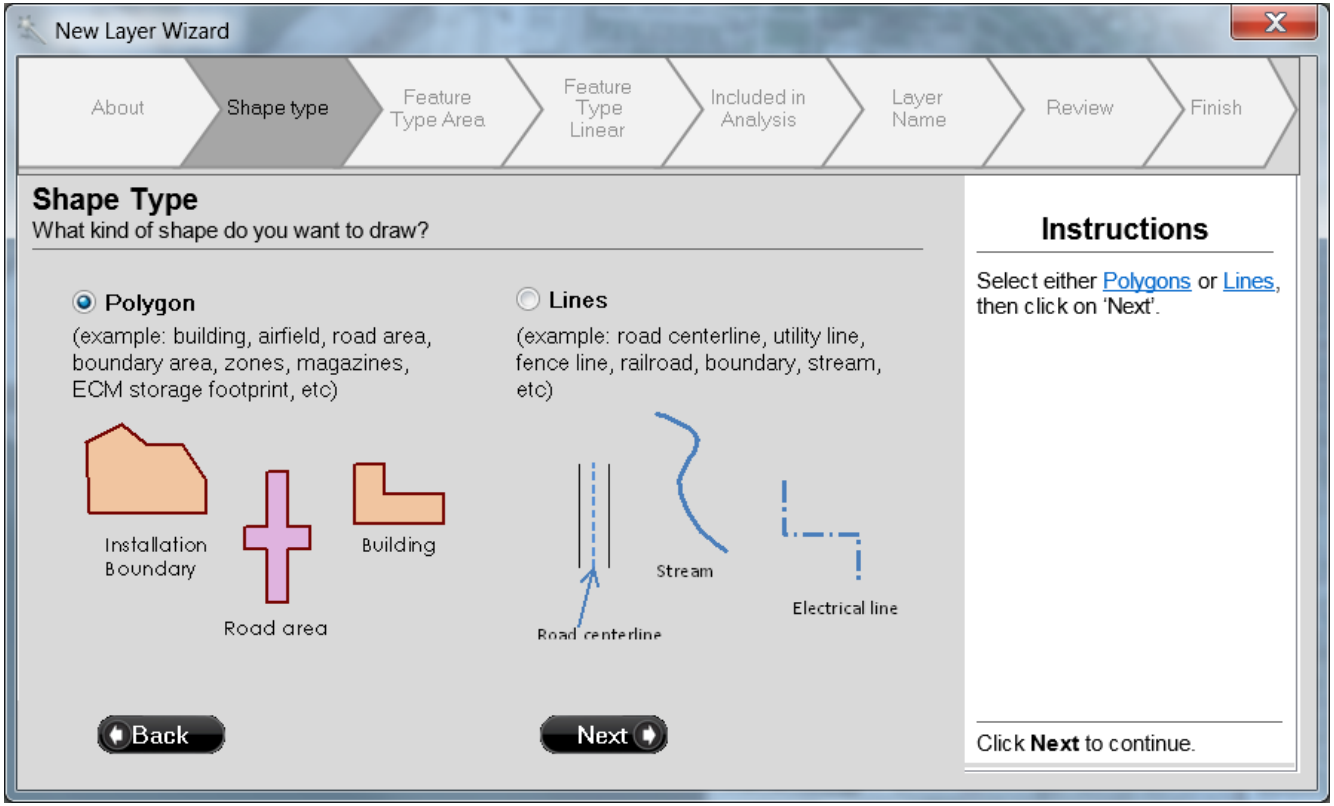
Prepare ESS Database – Create ESS Project

Start the ESS software and create a new ESS project using the New Database wizard.



Prepare ESS Database - Create GIS layers with ESS Wizards

Use the New Layer Wizard to create GIS layers:

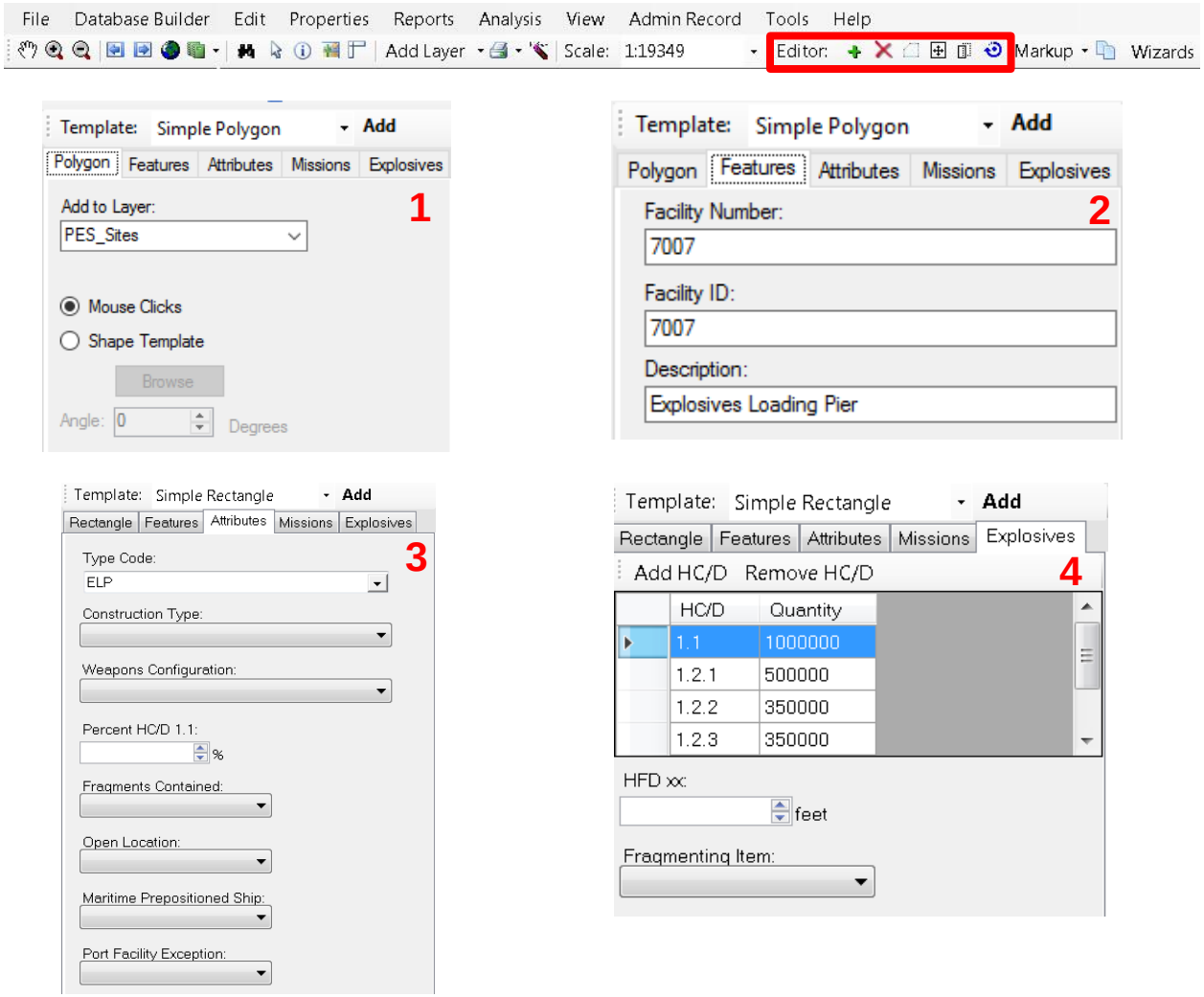


1. PES Sites
2. Group Areas
3. Group Sites
4. Singe ES
5. NFA ES
6. Other features such as Roads, Parking, Piers, Airfields, etc.

Prepare ESS Database - Draw PES Site

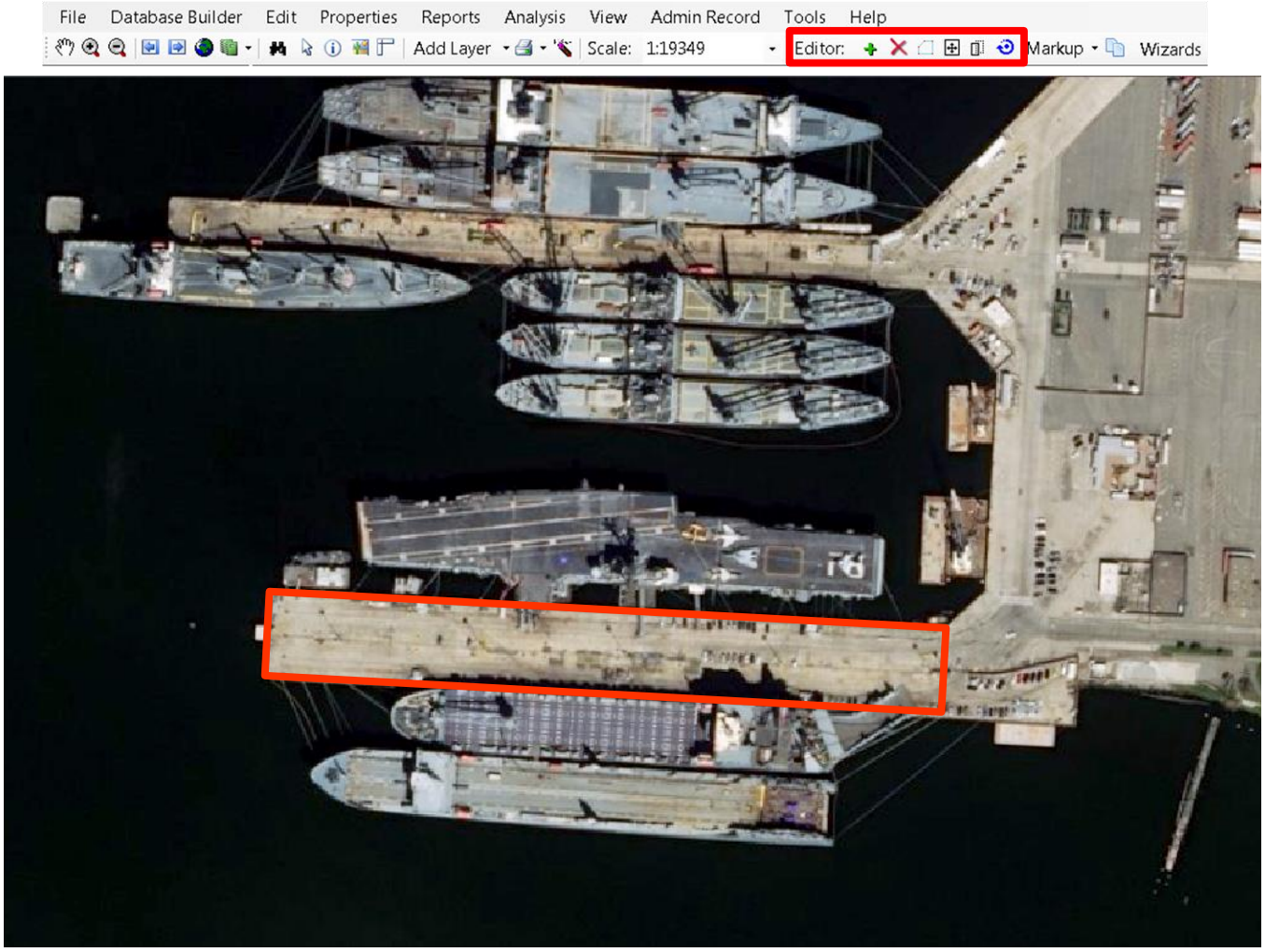
Enter information about the PES:

1. **Polygon Tab:** Simple Polygon on the PES_Sites layer using Mouse Clicks to draw.
2. **Features Tab:** Enter Facility Number and Description
3. **Attributes Tab:** Enter the type of facility (Type Code) ELP, AGM, ECM, EOL, etc. and other properties.
4. **Explosives Tab:** Enter the Hazard Class and NEW
5. Use the **Editor** tools to size and position the polygon.



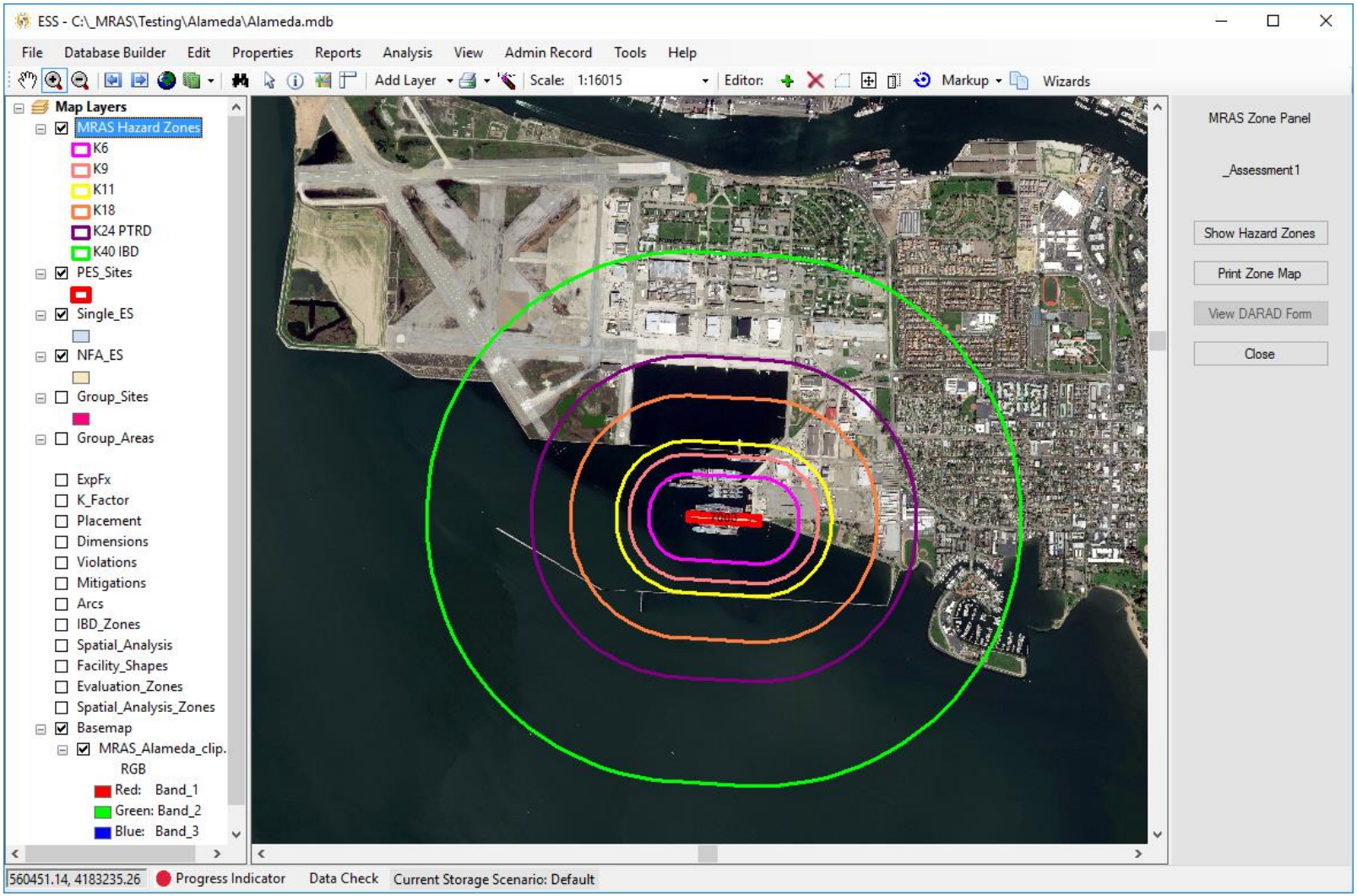
Prepare ESS Database - Draw PES Site

Draw the PES Site using the Editor Toolbar.



Prepare ESS Database - ESS Analysis

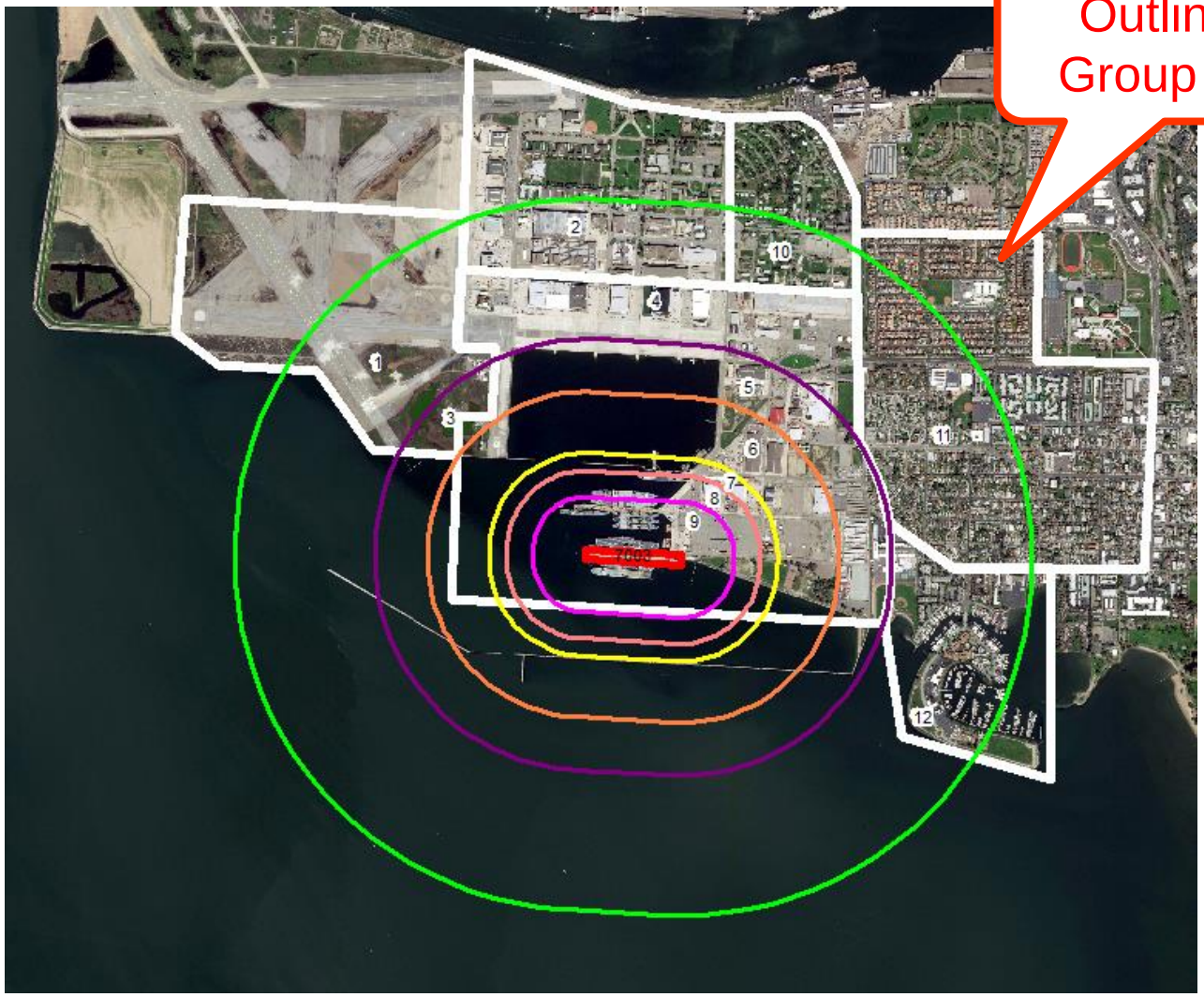
Run the ESS Analysis and display MRAS Hazard Zones



Prepare ESS Database - Draw GIS Features

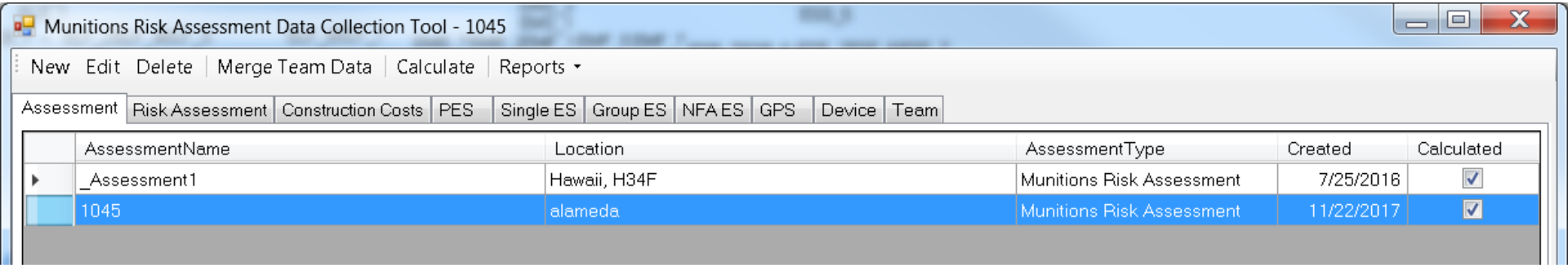
Draw ES Group Areas:

- Agricultural
- Commercial
- Industrial
- Institutional
- Residential

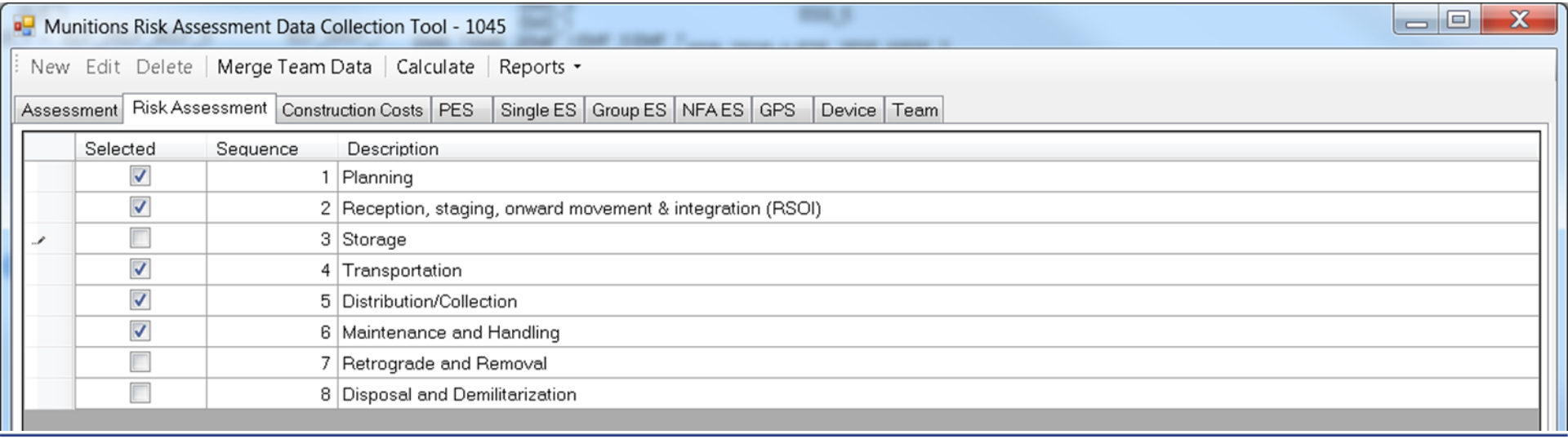


Prepare ESS Database - MRAS Assessment

Create New Assessment

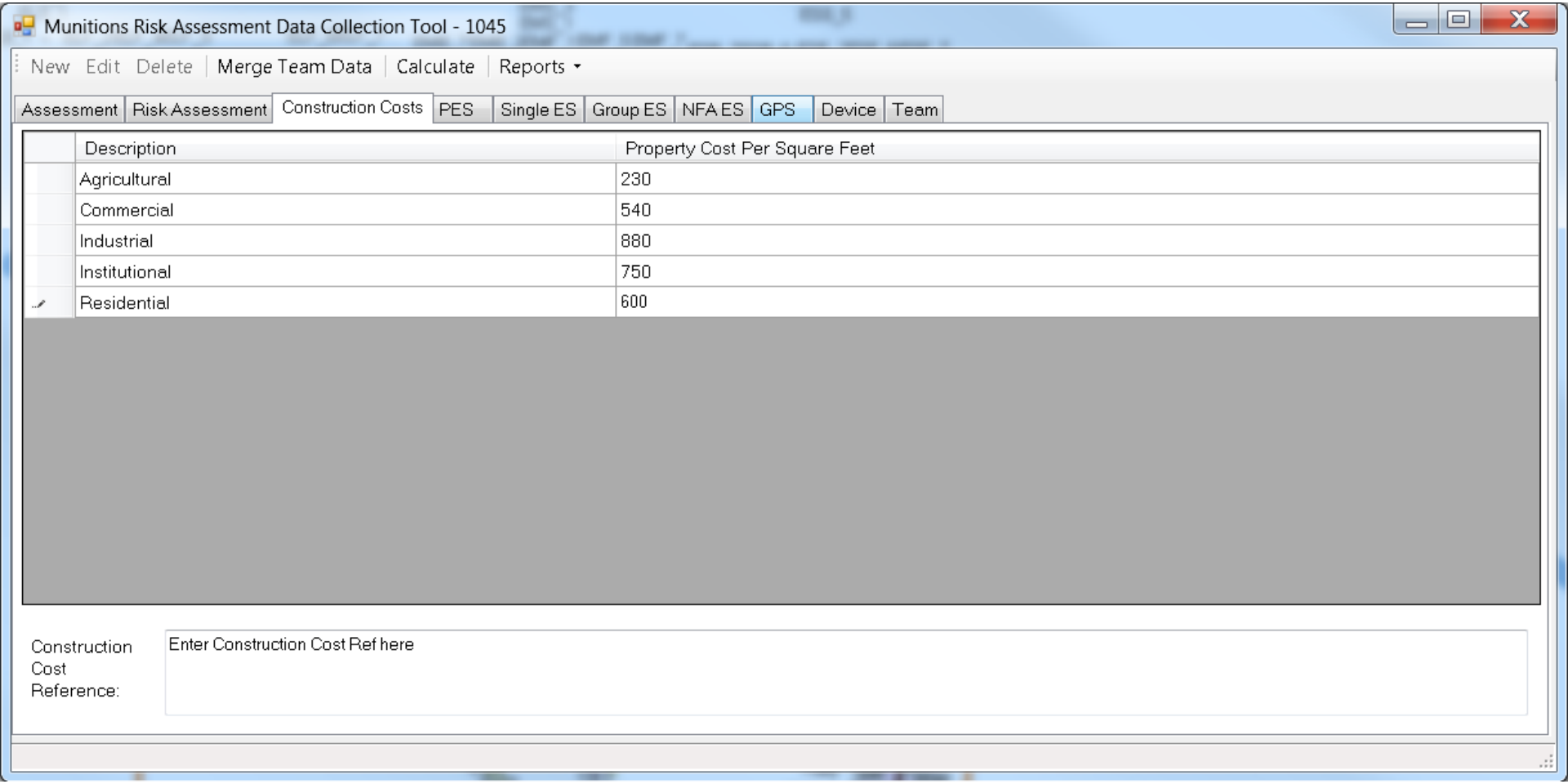


Risk Assessment - Types associated with assessment



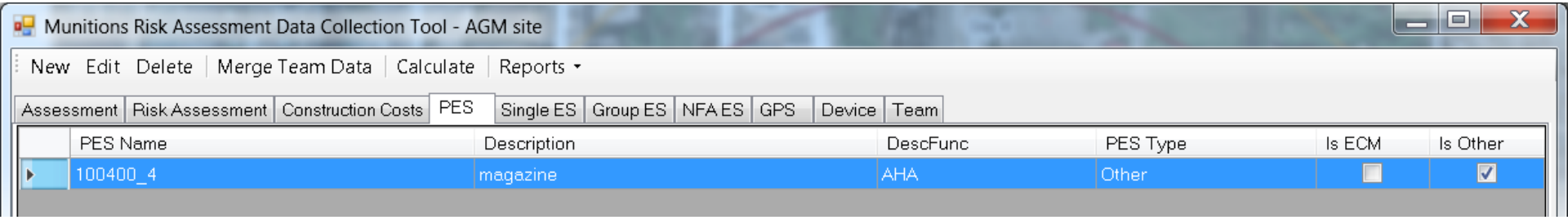
Prepare ESS Database - MRAS Assessment

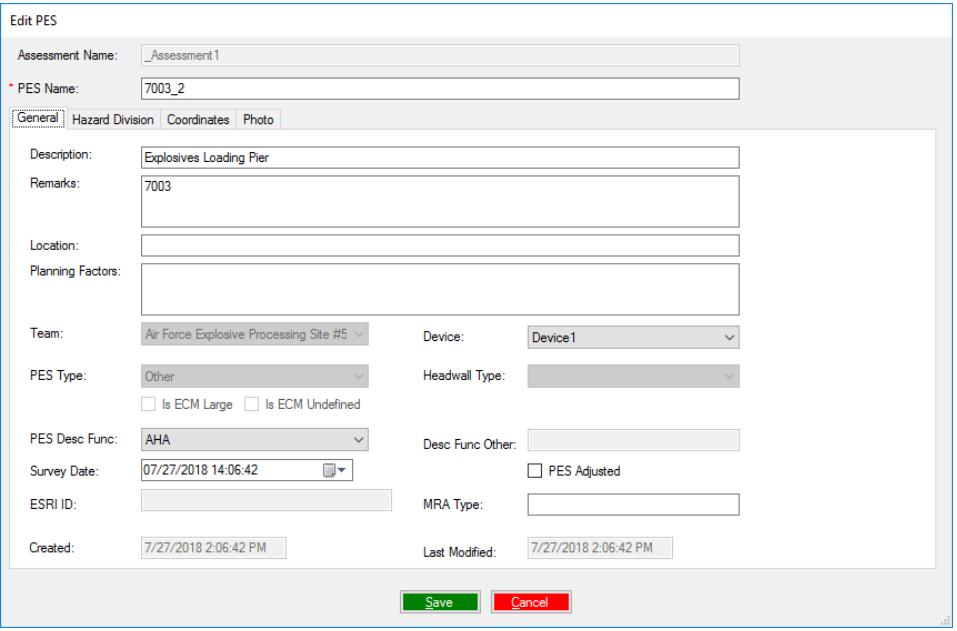
Construction Costs

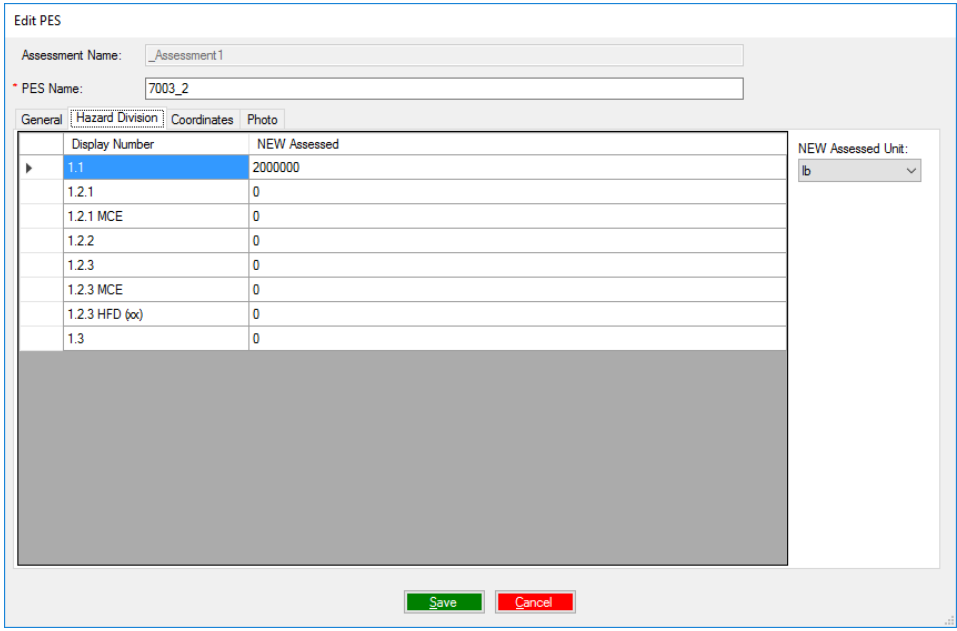


Prepare ESS Database - MRAS Assessment

PES Information

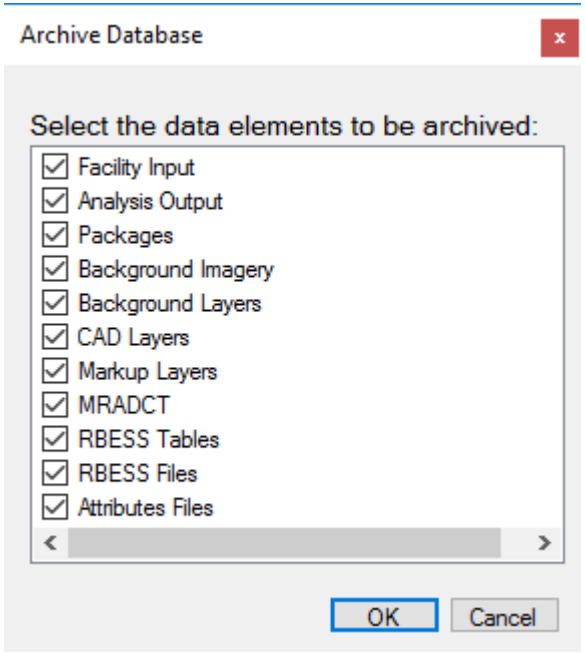






Prepare ESS Database – Transfer to Field Computers

Create an ESS Archive file to distribute to field computers



MRAS STEPS IN ESS

1. PREPARE ESS DATABASE

2. FIELD ASSESSMENT

3. MERGE TEAM DATA

4. REVIEW DATA & UPDATES

5. MRAS ASSESSMENT

Field Assessment:

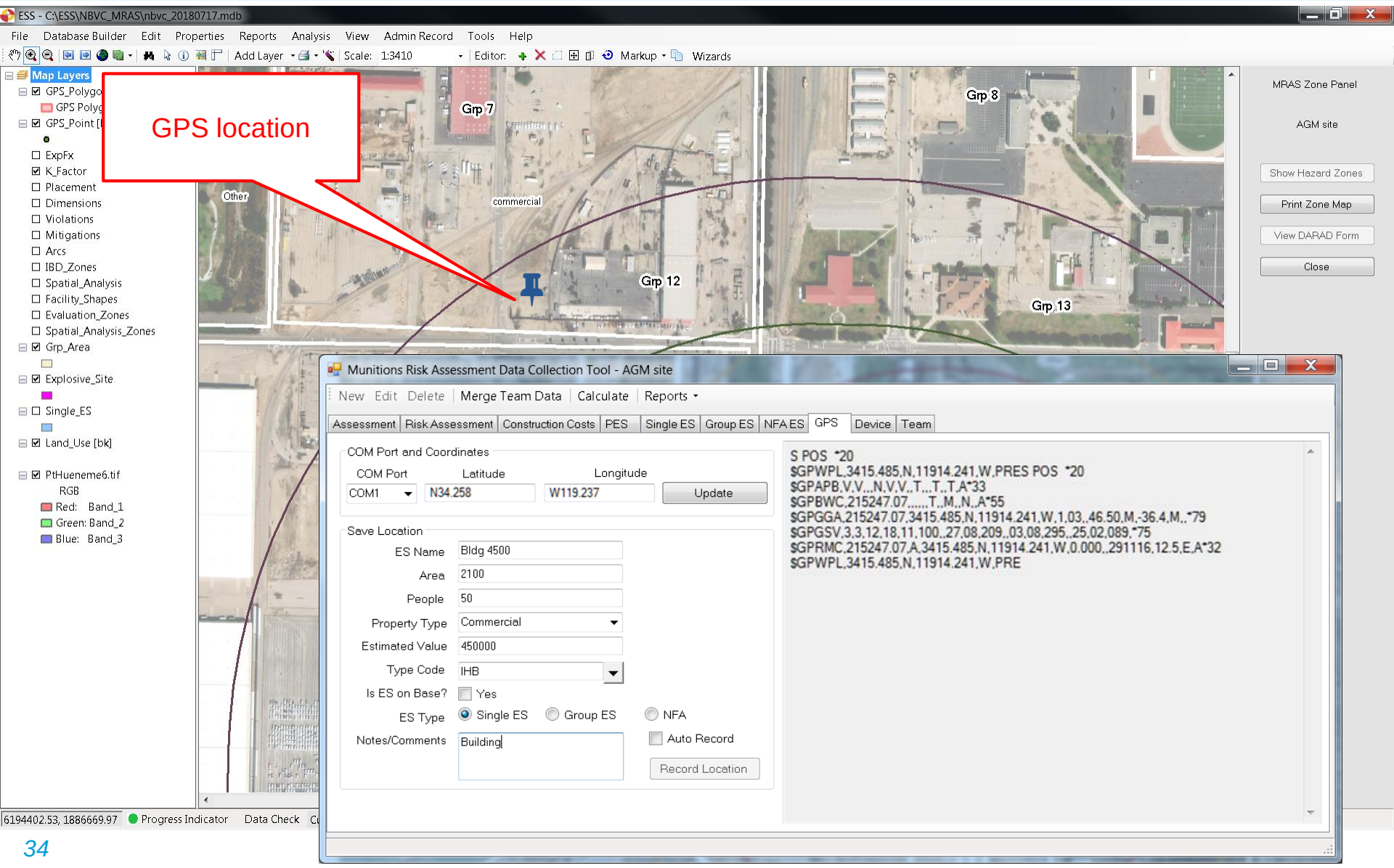
1. Restore Archive
2. Survey
    1. Single ES
    2. Group ES
    3. NFA ES
    4. Collect GPS points

Field Assessment - Draw Exposed Sites

Draw GIS Features

1. ES Group Sites
2. Single ES
3. NFA ES

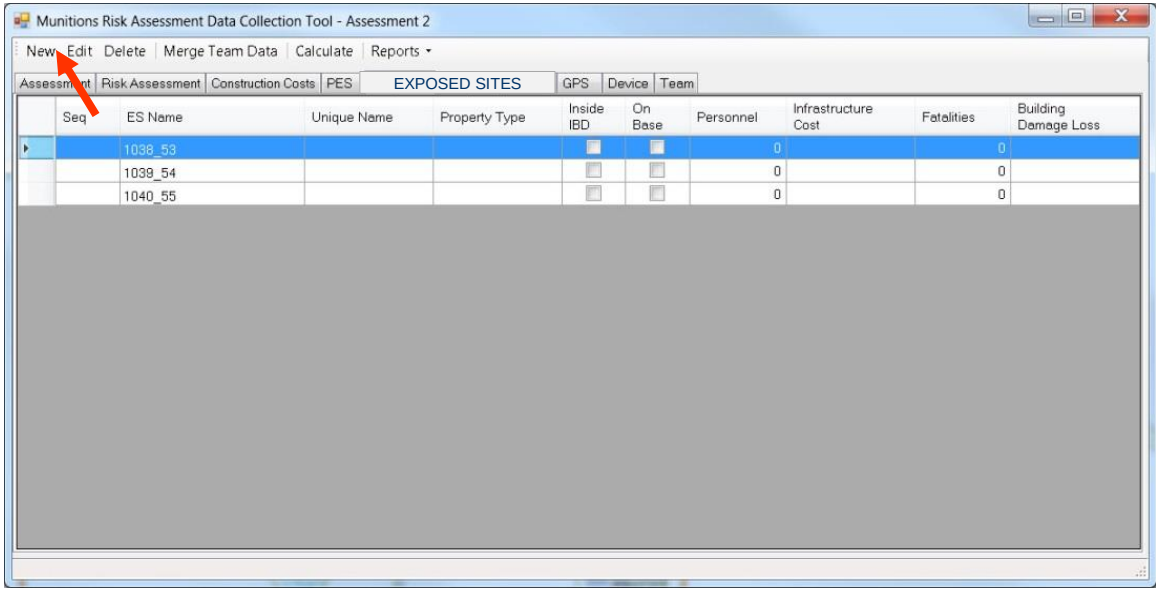
Field Assessment - GPS



Field Assessment - Creating an Exposed Site

Create an Exposed Site:

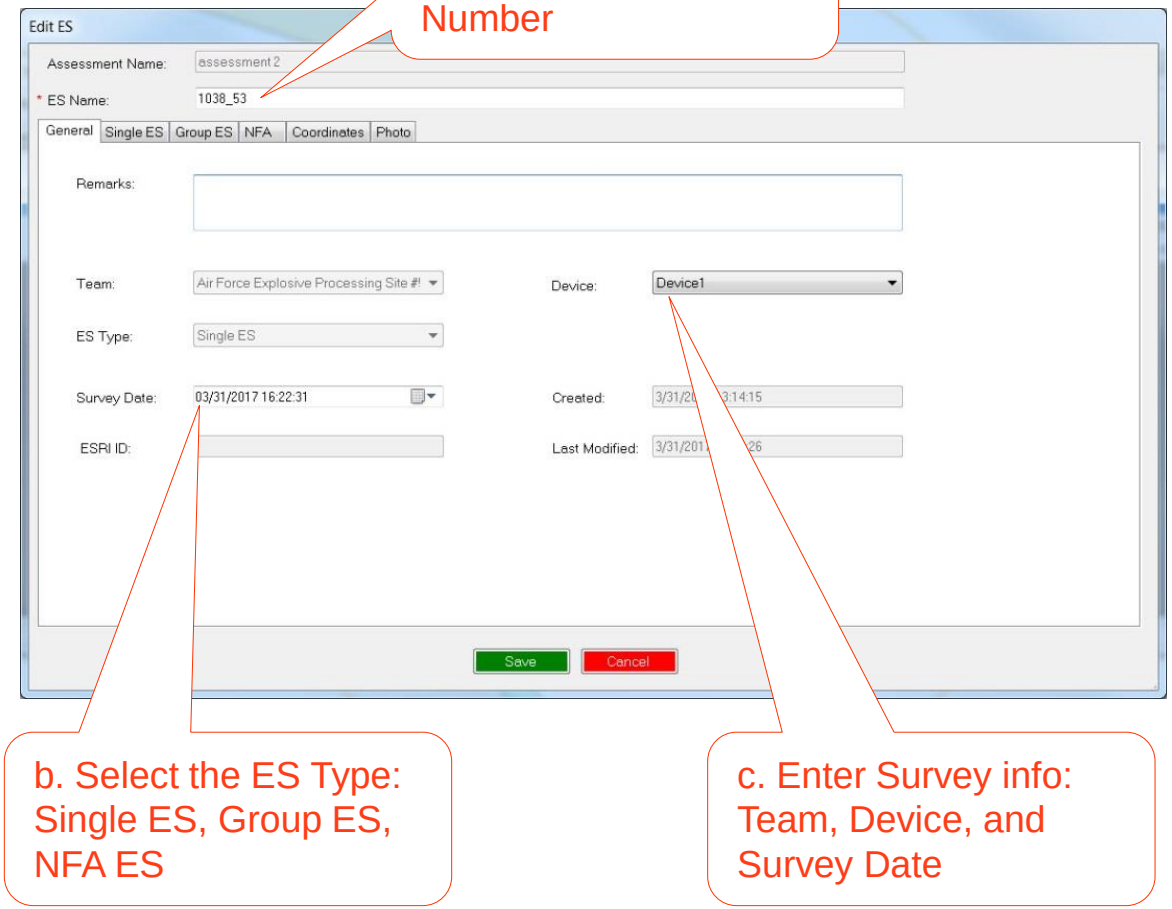
1. **Exposed Sites >** New
2. **General Tab** > Fill in Team, Device, Survey Date, Exposed Type (Single ES, Group ES, NFA ES
3. **Single/Group/NFA tab** > Fill in required number of people, cost, etc.
4. **Coordinate tab** > Copy coordinates from current GPS location or draw on map.
5. **Photo tab** > Add photo



Field Assessment - Creating an ES (Exposed Site)

Create an Exposed Site:

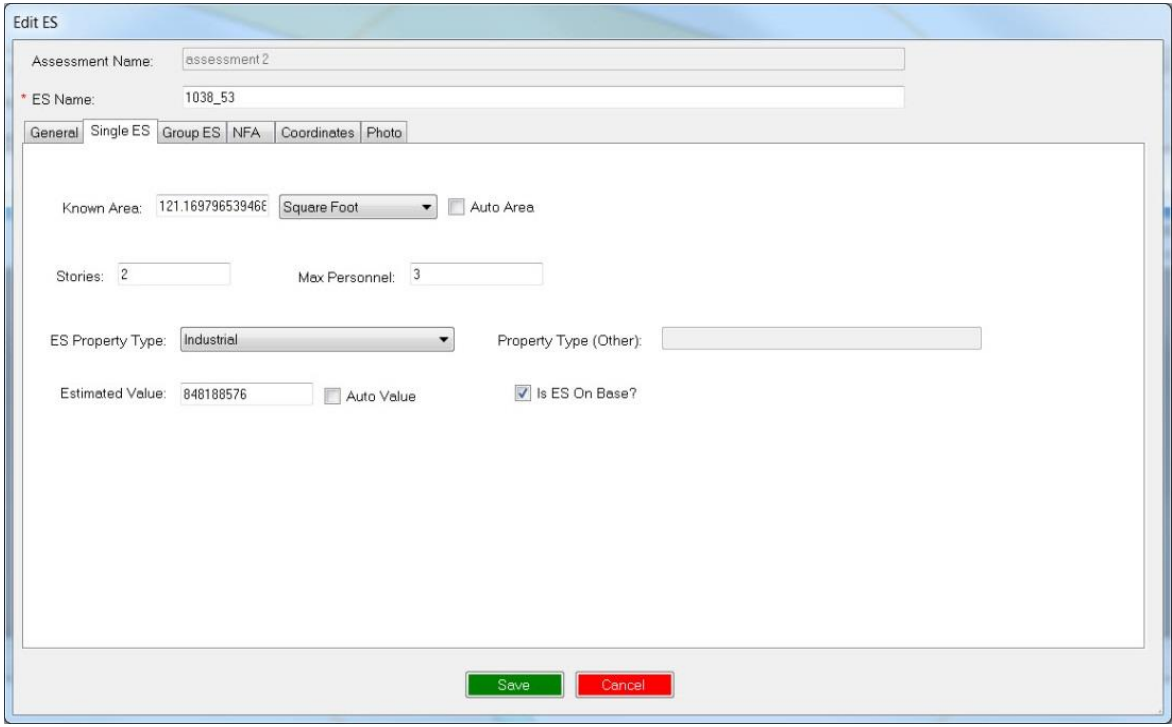
1. **Exposed Sites >** New
2. **General Tab** > Fill in Team, Device, Survey Date, Exposed Type (Single ES, Group ES, NFA ES
3. **Single/Group/NFA tab** > Fill in required number of people, cost, etc.
4. **Coordinate tab** > Copy coordinates from current GPS location or draw on map.
5. **Photo tab** > Add photo



Field Assessment - Creating an ES (Exposed Site)

Create an Exposed Site:

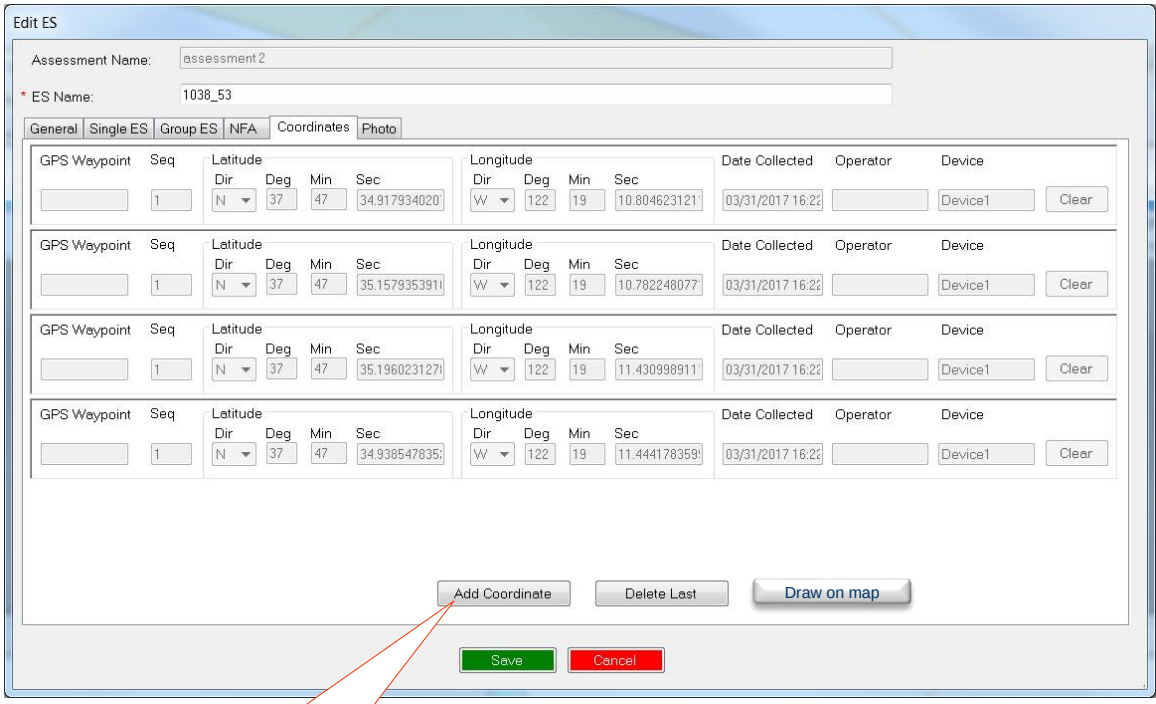
1. **Exposed Sites >** New
2. **General Tab** > Fill in Team, Device, Survey Date, Exposed Type (Single ES, Group ES, NFA ES
3. **Single/Group/NFA tab** > Fill in required number of people, cost, etc.
4. **Coordinate tab** > Copy coordinates from current GPS location or draw on map.
5. **Photo tab** > Add photo



Field Assessment - Creating an ES (Exposed Site)

Create an Exposed Site:

1. **Exposed Sites >** New
2. **General Tab** > Fill in Team, Device, Survey Date, Exposed Type (Single ES, Group ES, NFA ES
3. **Single/Group/NFA tab** > Fill in required number of people, cost, etc.
4. **Coordinate tab** > Copy coordinates from current GPS location or draw on map.
5. **Photo tab** > Add photo

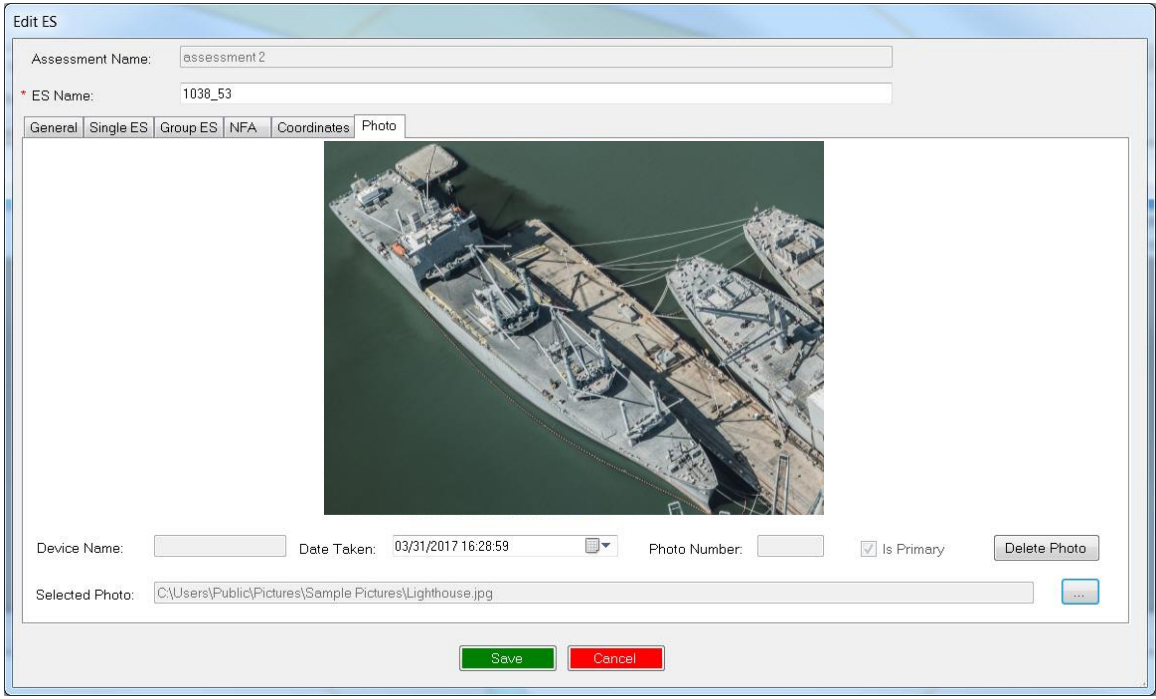


Add Coordinate: retrieves current GPS location.

Field Assessment - Creating an ES (Exposed Site)

Create an Exposed Site:

1. **Exposed Sites >** New
2. **General Tab** > Fill in Team, Device, Survey Date, Exposed Type (Single ES, Group ES, NFA ES
3. **Single/Group/NFA tab** > Fill in required number of people, cost, etc.
4. **Coordinate tab** > Copy coordinates from current GPS location or draw on map.
5. **Photo tab** > Add photo



MRAS STEPS IN ESS

1. PREPARE ESS DATABASE

2. FIELD ASSESSMENT

3. MERGE TEAM DATA

4. REVIEW DATA & UPDATES

5. MRAS ASSESSMENT

Merge Team Data:

1. Save the field data to the master database
2. Merge Team Data
   - Analysis > Risk-based Analysis > MRAS Analysis > Merge Team Data

MRAS STEPS IN ESS

1. PREPARE ESS DATABASE

2. FIELD ASSESSMENT

3. MERGE TEAM DATA

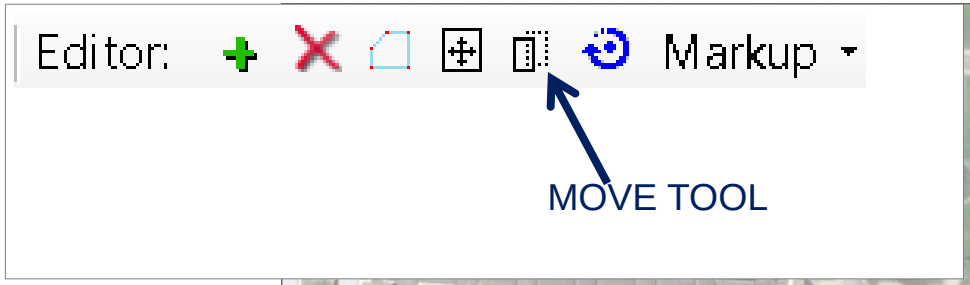
4. REVIEW DATA & UPDATES

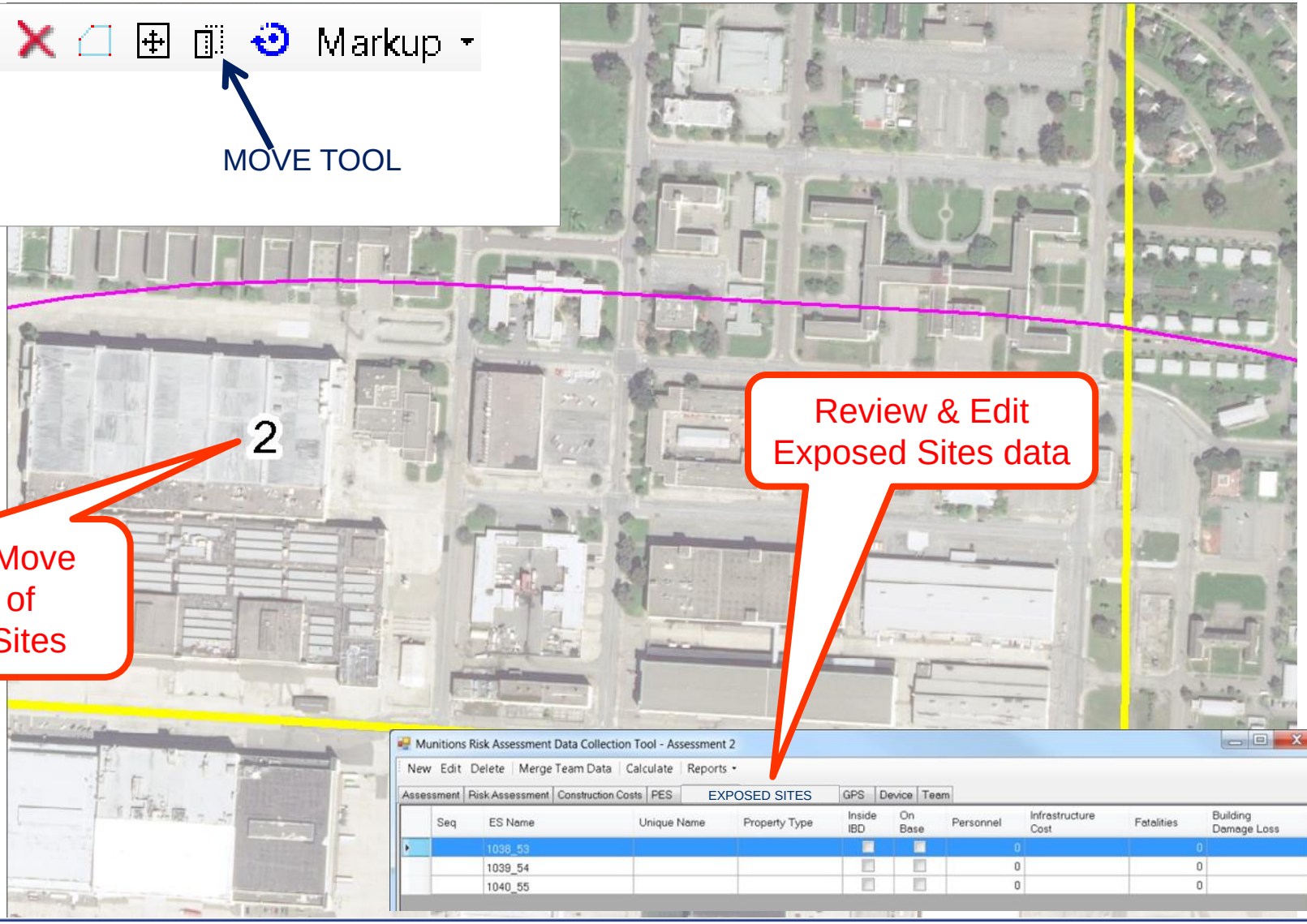
5. MRAS ASSESSMENT

Review Data & Updates:

1. Review and Update team data
2. Review GPS Points and add to MRAS ES
3. Edit and Update (reposition Group ES, type codes, add facilities, etc.)

Review Data & Updates – ESS Editor Tools
EDIT SHAPE, RESIZE, MOVE, ROTATE, DELETE





MRAS STEPS IN ESS

1. PREPARE ESS DATABASE

2. FIELD ASSESSMENT

3. MERGE TEAM DATA

4. REVIEW DATA & UPDATES

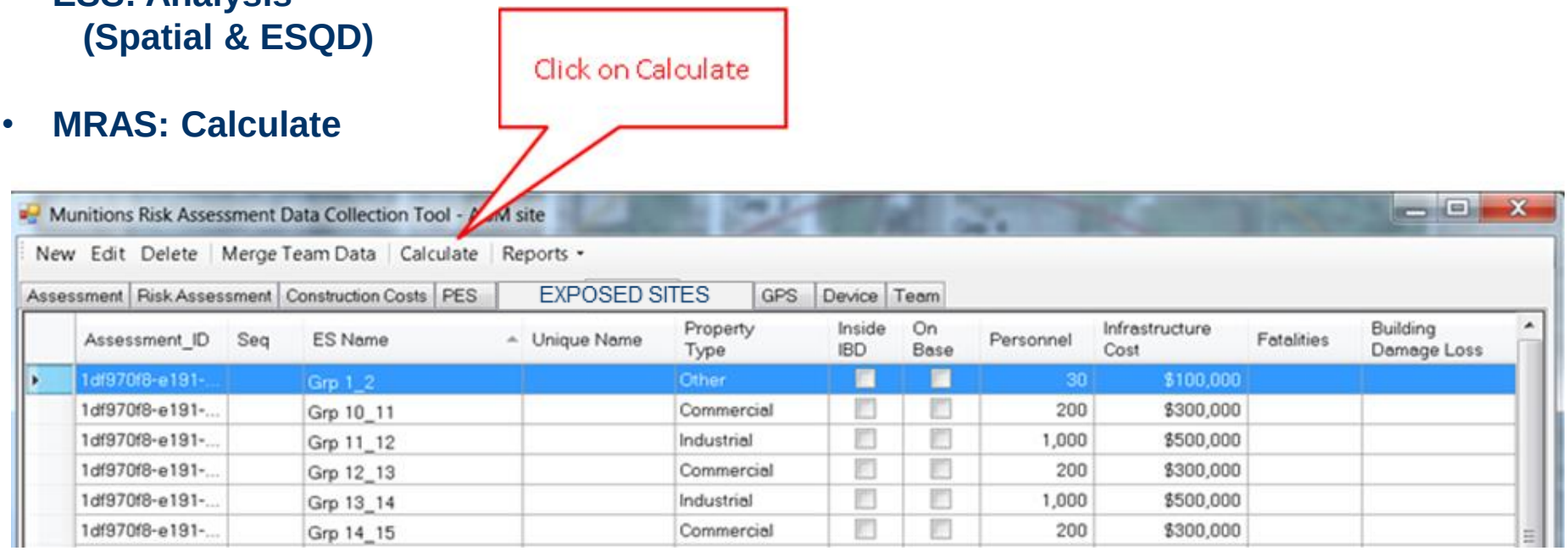
5. MRAS ASSESSMENT

MRAS Assessment:

1. Reset & Rerun QD Analysis
2. MRAS > Calculate
3. MRAS Reports
4. MRAS Zone Panel

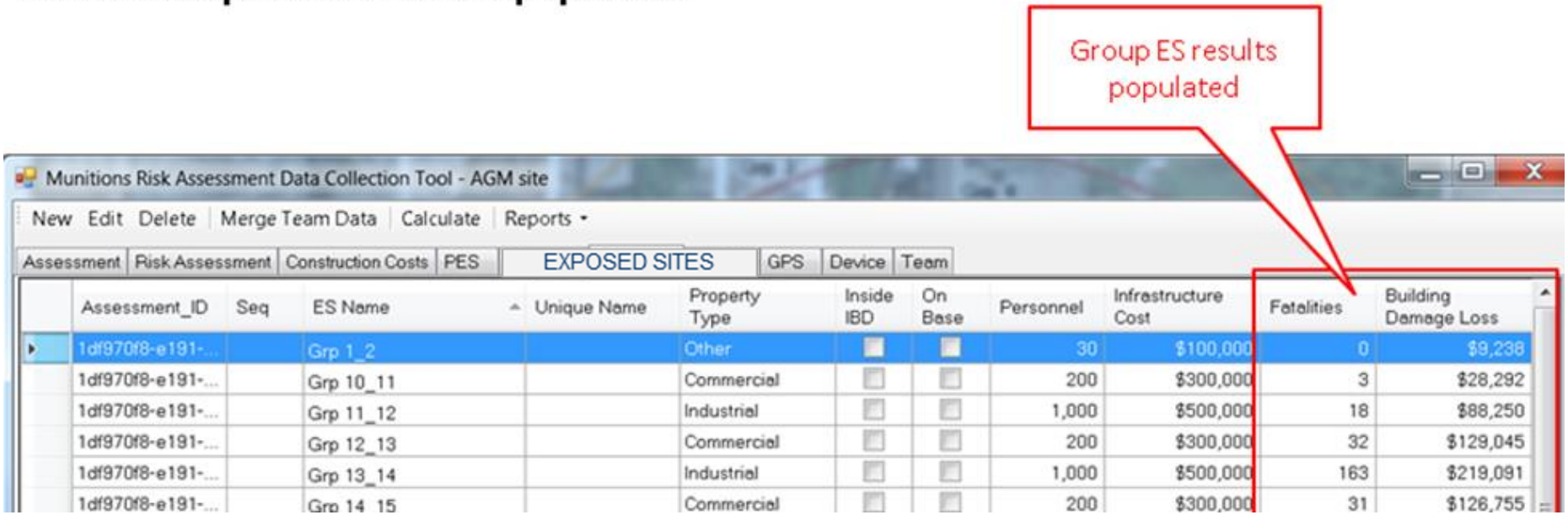
MRAS Assessment - Calculate

- **ESS: Analysis (Spatial & ESQD)**
- **MRAS: Calculate**

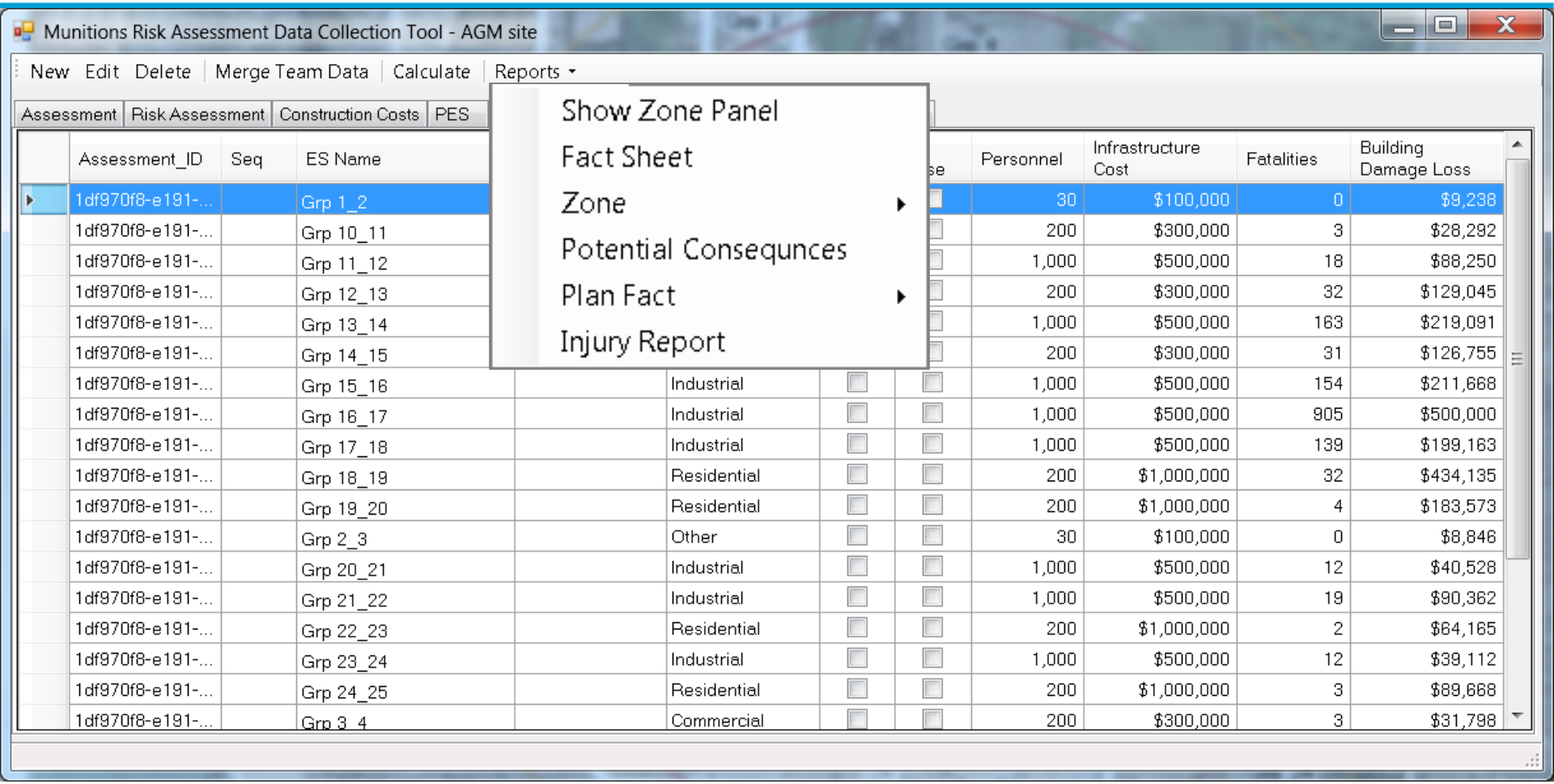


MRAS Assessment - Results

MRAS: Group ES tab > Results populated



MRAS Assessment - Reports Menu



AHA FACT SHEET: 100400_1

Hazard Division (HD)	Net Explosives Weight (NEW)	Inhabited Building Distance (IBD)	Exposures						Potential Consequences			
	Assessed	Assessed	No. of Personnel within IBD		No. of Facilities within IBD		Infrastructure Cost (USD)		Fatalities		Infrastructure Damage Loss (USD)	
1.1	500,000	3,969	On Base	Off Base	On Base	Off Base	On Base	Off Base	On Base	Off Base	On Base	Off Base
1.2.1			1,500	12,120	3	24	$116,234,541	$11,200,000	588	1,601	$66,495,147	$2,802,164
1.2.1 MCE												
1.2.2												
1.2.3												
1.2.3 MCE			Total No. of Personnel		Total No. of Facilities		Total Infrastructure Cost		Total Fatalities		Total Infrastructure Damage Loss	
1.2.3 HFD (xx)			13,620		27		$127,434,541		2,189		$69,297,311	
1.3												

Military Munitions Operations (planning, training exercises, or operation): planning

Location (city, country, port, railhead, NATO operating, training area, etc.): Port Hueneme, CA

Types of Exposed Site Facilities and Assets:

PES GPS Coordinates (Latitude, Longitude):
N34° 9' 53.403" W119° 12' 27.633"
N34° 9' 53.395" W119° 12' 25.848"
N34° 9' 50.625" W119° 12' 25.866"
N34° 9' 50.633" W119° 12' 27.651"

PES Dimension and Footprint	
Length (ft):	0
Width (ft):	0
Area (sq ft):	0

Munitions Risk Assessment Type:
- ☒ Planning
- ☐ Reception, staging, onward movement & integration (RSOI)
- ☐ Storage
- ☐ Transportation
- ☐ Distribution/Collection
- ☐ Maintenance and Handling
- ☐ Retrograde and Removal
- ☐ Disposal and Demilitarization

Site Description:

General Comments:

AHA FACT SHEET: 100400_1 MITIGATING CONTROL MEASURES

Instructions: **These control measures are provided for your use. Modify as needed for this specific site; use the blank space to add any site-specific measures.**

☐ Require the host nation to provide firefighting support.

☐ Generate a fire map that identifies the HD of all military munitions located at the site and provide it for first responders.

☐ Make available appropriate types and sufficient quantities of fire extinguishers throughout the military munitions storage and operating sites.

☐ Provide medical support by the training unit during all military munitions operations.

☐ Provide access to and maintain standard operating procedures and technical manuals for receipt, segregation, storage, and issue (RSS&I) during all military munitions operations.

☐ Provide the appropriate level of security required for the security risk codes of military munitions located at storage and operating sites.

☐ Arrange for explosive ordnance disposal support until all military munitions have been expended or retrograded.

☐ Require qualified/certified personnel and/or unit safety officers are present during all military munitions operations.

☐ Control and maintain vegetation at a maximum height of 18 inches. Maintain a fire break of 50 feet around storage and operating sites.

☐ Establish applicable emergency withdrawal distances based on the highest HD of military munitions being stored and brief all personnel working within storage and operating sites.

☐ Establish notification procedures for impending electrical storms within 15 miles of storage and operating sites. Evacuate personnel to a minimum public traffic route distance based on the highest HD of military munitions located at the storage or operating site.

☐ Require all vehicles and equipment offered for transporting military munitions are inspected by personnel who are AMMO-51 certified. On a case-by-case basis, the senior qualified inspector onsite will make a determination to use any vehicle or equipment that does not meet US safety standards identified on DD Form 626, "Motor Vehicle Inspection (Transporting Hazardous Materials)."

☐ Open military munitions-laden International Organization for Standardization (ISO) containers as needed for ventilation as long as adequate security is provided.

☐ Enforce hazards of electromagnetic radiation to ordnance restrictions to include radios, cell phones, and electronic devices.

☐ Ground military munitions-laden ISO containers. Bond military munitions-laden ISO containers to any other metal objects within 6 feet of the containers.

☐ Load test material handling equipment, ordnance handling equipment, and weight handling equipment in accordance with U.S. standards. Evaluate equipment that does not meet the U.S. standards by onsite qualified personnel and make a determination on a case-by-case basis before use.

☐ Place ISO containers with HD 1.1 military munitions at the most distant location from exposed sites.

☐ Place ISO containers with HD 1.4 military munitions between containers storing HD 1.1 military munitions.

☐ Properly package military munitions in storage; there should be no exposed explosives.

☐ Provide white phosphorus firefighting kits to all storage sites containing white phosphorus.

☐ Maintain intraline separation distance from munitions storage containers when conducting RSS&I operations.

☐ Maintain compatibility within the ISO containers.

☐ Maintain electrically sensitive items in proper packaging.

☐ Do not store inert material with live military munitions.

☐ Do not use or issue live and blank military munitions from the same building or range at the same time. Do not store live and blank military munitions in the same building or range at the same time.

☐ Require that only qualified/certified personnel store/handle military munitions in the ASP/FASP.

☐ Require that only qualified/certified personnel handle military munitions with the exception of host nation contracted crane operators and associated personnel who are responsible for on/offloading and staging military munitions-laden ISO containers within the ASP/FASP.

☐ Set up road access control points along all roads leading to the ASP/FASP, transfer point, and live fire training areas to restrict access to essential personnel only.

☐ Clear all local residents from the ASP/FASP, transfer point, and live fire training areas during the exercise.

☐ Establish force bed-down area to keep non-military munitions-related functions outside of the explosives safety quantity distance arc.

Additional Measures:

Table J-4. Total Exposed Site Output Data: NBVC

Exposed Site (ES)	On-Base?	Distance from PES (Feet)	Affected Personnel at ES	Fatalities*	Injuries	Building Cost (USD)	Building Damage Loss (USD)
Zone 2 (K9)							
1100_28	Yes	604.101	500	473.021	26.979	$38,744,847.000	$38,744,847.000
Grp 16_17	No	702.896	1,000	904.665	95.335	$500,000.000	$500,000.000
ON-BASE – ZONE 2			500	473 / 94.6%	27 / 5.4%	$38,744,847	$38,744,847 / 100.0%
OFF-BASE – ZONE 2			1,000	905 / 90.5%	95 / 9.5%	$500,000	$500,000 / 100.0%
SUBTOTAL – ZONE 2			1,500	1,378 / 91.8%	122 / 8.2%	$39,244,847	$39,244,847 / 100.0%
Zone 5 (K24/PTRD)							
Facility 64_26	Yes	1,927.379	500	52.846	105.692	$38,744,847.000	$13,282,489.981
Facility 65_27	Yes	1,830.704	500	62.024	124.048	$38,744,847.000	$14,467,810.504
Grp 8_9	No	2,222.061	1,000	49.904	99.808	$500,000.000	$124,919.845
Grp 12_13	No	1,649.842	200	31.618	63.236	$300,000.000	$129,044.942
Grp 13_14	No	1,624.930	1,000	162.909	325.818	$500,000.000	$219,090.886
Grp 14_15	No	1,674.038	200	30.702	61.404	$300,000.000	$126,754.776
Grp 15_16	No	1,672.118	1,000	154.002	308.003	$500,000.000	$211,668.009
Grp 17_18	No	1,750.854	1,000	138.996	277.991	$500,000.000	$199,162.920
Grp 18_19	No	1,637.307	200	32.096	64.192	$1,000,000.000	$434,135.413
ON-BASE – ZONE 5			1,000	115 / 11.5%	230 / 23.0%	$77,489,694	$27,750,300 / 35.8%
OFF-BASE – ZONE 5			4,600	600 / 13.0%	1,200 / 26.1%	$3,600,000	$1,444,777 / 40.1%
SUBTOTAL – ZONE 5			5,600	715 / 12.8%	1,430 / 25.5%	$81,089,694	$29,195,077 / 36.0%
Zone 6 (K40/IBD)							
Grp 9_10	No	2,538.468	200	3.801	7.601	$300,000.000	$55,514.687
Grp 21_22	No	2,583.886	1,000	18.715	37.430	$500,000.000	$90,361.798
Grp 20_21	No	3,639.592	1,000	12.070	24.141	$500,000.000	$40,527.561
Grp 2_3	No	3,560.494	30	0.377	0.754	$100,000.000	$8,845.662
Grp 19_20	No	2,553.863	200	3.781	7.562	$1,000,000.000	$183,572.808
Grp 11_12	No	2,629.791	1,000	18.433	36.867	$500,000.000	$88,249.798
Grp 22_23	No	3,817.029	200	2.189	4.378	$1,000,000.000	$64,164.915

Table J-4. Total Exposed Site Output Data: NBVC Continued

Exposed Site (ES)	On-Base?	Distance from PES (Feet)	Affected Personnel at ES	Fatalities*	Injuries	Building Cost (USD)	Building Damage Loss (USD)
Grp 1_2	No	3,518.499	30	0.385	0.770	$100,000.000	$9,237.768
Grp 23_24	No	3,669.484	1,000	11.882	23.763	$500,000.000	$39,112.435
Grp 7_8	No	2,399.266	200	3.976	7.952	$300,000.000	$59,458.606
Grp 6_7	No	2,757.984	30	0.529	1.057	$100,000.000	$16,425.223
Grp 5_6	No	3,711.822	1,000	11.608	23.215	$500,000.000	$37,056.394
Grp 4_5	No	2,899.242	30	0.502	1.004	$100,000.000	$15,100.540
Grp 3_4	No	3,374.477	200	2.747	5.493	$300,000.000	$31,798.341
Grp 24_25	No	3,547.251	200	2.529	5.058	$1,000,000.000	$89,667.704
Grp 10_11	No	3,499.065	200	2.591	5.182	$300,000.000	$28,292.498
ON-BASE – ZONE 6			0	0 / 0.0%	0 / 0.0%	$0	$0 / 0.0%
OFF-BASE – ZONE 6			6,520	96 / 1.5%	192 / 2.9%	$7,100,000	$857,387 / 12.1%
SUBTOTAL – ZONE 6			6,520	96 / 1.5%	192 / 2.9%	$7,100,000	$857,387 / 12.1%
ON-BASE – ALL ZONES			1,500	588 / 39.2%	257 / 17.1%	$116,234,541	$66,495,147 / 57.2%
OFF-BASE – ALL ZONES			12,120	1,601 / 13.2%	1,488 / 12.3%	$11,200,000	$2,802,164 / 25.0%
GRAND TOTAL – ALL ZONES			**13,620**	**2,189 / 16.1%**	**1,745 / 12.8%**	**$127,434,541**	**$69,297,311 / 54.4%**

*Fatality subtotals are rounded up to the nearest whole number. Individual exposed site fatalities are not rounded

MRAS: Reports > Potential Consequences

Table ES-1. Potential Consequences of an Unplanned Explosives Event for NBVC

Potential Explosion Site	Exposure Location	Number of Exposed Sites	Exposures		Potential Consequences		
			Number of Personnel Within IBD	Infrastructure Cost (USD)	Fatalities*	Injuries*	Infrastructure Damage Loss (USD)*
100400_1	On-Base	3	1,500	$116,234,541	588	257	$66,495,147
	Off-Base	24	12,120	$11,200,000	1,601	1,488	$2,802,164
	Total	27	13,620	$127,434,541	2,189	1,745	$69,297,311
	On-Base						
	Off-Base						
	Total						
	On-Base						
	Off-Base						
	Total						
	On-Base						
	Off-Base						
	Total						
	On-Base						
	Off-Base						
	Total						
	On-Base						
	Off-Base						
	Total						

*The potential fatalities and infrastructure damage loss (which excludes the contents of the infrastructure) were determined using the C&RI Assessment Tool that analyzes an exposed site's estimated population and property (i.e., assets, facilities, and infrastructure within the IBD ESQD arc) based on the type of material, construction, functional use, size, and cost per square foot. This tool provides the estimated number of fatalities and property replacement value based on potential damages resulting from the exposed site's physical distance to the PES.

Source: Enter additional notes here

MRAS: Reports > Plan Fact > Base Plan Fact

Table 1. NBVC Planning Factors NEW

Potential Explosion Site (PES)	Net Explosives Weight (NEW), Hazard Division (HD)	Inhabited Building Distance (IBD) Explosive Safety Quantity Distance (ESQD) Arcs*	
		m	ft
100400_1	1.1: 500,000 lb	1,210	3,969

*The IBD ESQD arc distances were obtained from Volume 3 of DoD 6055.09-M.

MRAS: Reports > Plan Fact > Second Plan Fact

Table 3. NBVC Planning Factors, Potential Total Fatalities, and Potential Building Damage Loss by Site

Potential Explosion Site	NBVC Planning Factors[1]	Potential Total Fatalities[2]	Potential Total Building Damage Loss (USD)[2]
100400_1		2,189	$69,297,311

[1]The planning factor selected is based on historical or projected use for each port.
[2]The potential fatalities and building damage loss were determined using the C&RI Assessment Tool that analyzes an exposed site's area (i.e., infrastructure within the ESQD IBD arc), type of construction, and cost per square foot, and provides an estimated replacement value based on the amount of damage due to the physical distance from the PES. The total fatalities are based on the physical distance from the PES.

MRAS: Reports > Injury Report

OUTPUT DATA FOR

ZONE	DISTANCE	FATAL	BUILDING DAMAGE LOSS	% FATAL	% BLDG DAMAGE	Total # Personnel	INJURIES	
1	1 (K6)			0%	0%	0	0	All non-fatal are injuries
2	2 (K9)	1378	39,244,847	92%	100%	1,500	122	All non-fatal are injuries
3	3 (K11)			0%	0%	0	0	All non-fatal are injuries
4	4 (K18)			0%	0%	0	0	Sliding scale from "all non-fatal" to 2X fatalities
5	5 (K24/PTRD)	715	29,195,077	13%	36%	5,600	1,430	Twice the # of fatalities
6	6 (K40/IBD)	96	857,387	1%	12%	6,520	192	Twice the # of fatalities

Total Fatalities	2,189	Total # Personnel	13,620	1,744	Total Injuries

Note: Copy cells E39:H44 from the original ASAP-X file and paste in cells C6:F11 above.

DEVIATION APPROVAL AND RISK ACCEPTANCE DOCUMENT (DARAD)

For use of this form, see DA PAM 385-30; the proponent agency is DAS.

SITE INFORMATION

1a. Country: United States	1b. State: California	2. Service: N - Navy	3a. Installation Type: DEPOT
3b. Installation Name: Unknown Installation	3c. Type of Site: Unknown Site Type		

DEVIATION INFORMATION

4. Deviation #:	5a. Effective Date: *(Will auto populate from block 16.)*	5b. Expiration Date:	6. Deviation From:
7. Type of Deviation:	8a. Number/Title and Paragraph of Requirement:		
8b. What we need to do that deviates from 8a: *(Synopsis of block 24)*			
8c. Operational, Strategic or Compelling Reason for Violation:			
9. Potential Consequences of Deviation from Approved Standards:	9a. # Fatalities: 2,188.9	9b. # Injuries: 1,744.73	9c. Equip/Fac Loss $: $ 69,297,311.01
10. Date Deviation Initiated: 20180717			
11. Residual Severity:	12. Residual Probability:	13. Residual Level of Risk:	14a. Safety Professional/ Analyst (POC Info):
14b. Analyst Signature:	14c. Submitter (POC Info): *(If different from 14a.)*	14d. Submitter Signature: *(if different from 14a.)*	

14 e. REVIEWED BY:

DATE	CONCUR (YES/NO)	ORGANIZATION	PRINTED NAME/TITLE	Attachment	SIGNATURE
				Attachment? ☐	
				Attachment? ☐	
				Attachment? ☐	
				Attachment? ☐	
				Attachment? ☐	
				Attachment? ☐	

DEVIATION APPROVAL/RISK ACCEPTANCE

I have reviewed the risk assessment and understand the hazard and potential consequences. **I am approving this deviation and accepting the additional potential consequences and residual risk based on current operational necessity.**

15. Army HQ:	15b. Unit/Comm:	16a. DATE:	16b. Expiration Date:	17. RANK/TITLE:
17a. PRINTED NAME:	17b. SIGNATURE:			
17c. Comment:				Attachment? ☐

RISK ASSESSMENT WORKSHEET

Deviation #:	Effective Date:	Expiration Date:	

RISK ANALYSIS INFORMATION

18. Current Situation: "Provide a description of the situation that necessitates this deviation." Attachment? ☐

18

19. Hazard Category: | 20. Specific Hazard:

21. Duration of Deviation *(Choose one of the following)*	21a. 1 month or less: *(select the duration (in days))*	0	21b. 1 month to 1 year: *(select the duration (in months))*	0	21c. 1 year to 5 years: *(select the duration (in years))*	0	21d. Permanent or greater than 5 years: *(enter number of years or PERMANENT)*	

22. Deviation Approval Authority: *(or Equivalent)*

23. Mission Impact of Not Accepting Risk: Attachment? ☐

24. What we need to do that violates 8a: *(Provide a detailed description of the action that deviates from the standards.)* Attachment? ☐

25. Control Measures: "Measures taken, or will take, to reduce hazards of risk being accepted." Attachment? ☐

26. Permanent Corrective Actions (with Milestones): Include estimated cost, military construction project number, etc. Attachment? ☐

27. Alternatives Considered: "Things considered doing but didn't, and why." Attachment? ☐

Alternative 1:

Alternative 2:

Alternative 3:

28. Attach any supporting documents (i.e. Photos, MOU, ASAP-X, ESS, etc.) Attachment? ☐

AMMUNITION AND EXPLOSIVES WORKSHEET

Deviation #:	Effective Date:	Expiration Date:

INFORMATION ON THE POTENTIAL EXPLOSION SITE (PES)

29a. PES Name/#: 100400_1	29b. PES Function:	30. PES # People: 0
31. PES Equip/Fac (Value) $: $0.00	32. Required Blast Distance: 0	33. Required Fragment Distance: 0
34a. Hazard Division: 1.1: NEW: 500,000	34b. Hazard Division: 1.2.1: NEW:	34c. Hazard Division: 1.2.2: NEW:
34d. Hazard Division: 1.2.3: NEW:	34e. Hazard Division: 1.3: NEW:	34f. Hazard Division: 1.4: NEW/MEQ:

35a. QD arcs exceed the installation boundary? YES ☐ NO ☐ | Are other Services affected? YES ☐ NO ☐ | Was coordination made? YES ☐ NO ☐ | Provide other coordination documentation, as necessary.

Why coordination was/was not made:

Coordination paperwork attached? ☐

35b. Is this deviation associated with a hybrid or risk-base safety submission?

35c. If YES, provide site plan #:

INFORMATION ON THE EXPOSED SITES (ES)

36. EXPOSED SITES

FACILITY	DISTANCE: Feet REQUIRED	DISTANCE: Feet ACTUAL	# PEOPLE	EQUIP/FAC (VALUE) $	EXPOSURE TYPE	ON/OFF INSTALLATION	At Required Distance FATALITIES	At Required Distance INJURIES	At Required Distance EQUIP/FAC (LOSS) $	At Requested Distances FATALITIES	At Requested Distances INJURIES	At Requested Distances EQUIP/FAC (LOSS) $	(Attachment?) VIOLATION?
Grp 19_20	0	2,553.9	200	1,000,000.00						3.78	7.56	183,572.81	NO
Grp 6_7	0	2,758	30	100,000.00						0.53	1.06	16,425.22	NO
Facility 65_27	0	1,830.7	500	38,744,847.00						62.02	124.05	14,467,810.50	NO
Grp 10_11	0	3,499.1	200	300,000.00						2.59	5.18	28,292.50	NO
Grp 17_18	0	1,750.9	1,000	500,000.00						139	277.99	199,162.92	NO
Grp 12_13	0	1,649.8	200	300,000.00						31.62	63.24	129,044.94	NO
Grp 21_22	0	2,583.9	1,000	500,000.00						18.72	37.43	90,361.80	NO
Facility 64_26	0	1,927.4	500	38,744,847.00						52.85	105.69	13,282,489.98	NO
Grp 13_14	0	1,624.9	1,000	500,000.00						162.91	325.82	219,090.89	NO
1100_28	0	604.1	500	38,744,847.00						473.02	26.98	38,744,847.00	NO
Grp 23_24	0	3,669.5	1,000	500,000.00						11.88	23.76	39,112.44	NO
Grp 5_6	0	3,711.8	1,000	500,000.00						11.61	23.22	37,056.39	NO
Grp 15_16	0	1,672.1	1,000	500,000.00						154	308	211,668.01	NO

EXPECTED POTENTIAL CONSEQUENCES

37. Potential Explosion Site:	a. Fatalities: 0	b. Injuries:	c. Equip/Fac $:	$ 0.00
38. Potential Losses for Exposed Sites (ES) Meeting Criteria:	a. Fatalities:	b. Injuries:	c. Equip/Fac $	
39. Potential Loss Being Accepted for Deviating from Approved Standards:	a. Fatalities: 2,188.9	b. Injuries: 1,744.73	c. Equip/Fac $	$ 69,297,311.01
40. Total Potential Loss (#/$):	a. Fatalities: 2188.9	b. Injuries: 1,744.73	c. Equip/Fac $	$ 69,297,311.01

Deviation #: _____

INFORMATION ON THE EXPOSED SITES (ES) CONTINUATION WORKSHEET

Exposed Sites (continued from block 36)

FACILITY	DISTANCE: Feet REQUIRED	DISTANCE: Feet ACTUAL	# PEOPLE	EQUIP/FAC (VALUE) $	EXPOSURE TYPE	ON/OFF INSTALLATION	At Required Distance FATALITIES	At Required Distance INJURIES	At Required Distance EQUIP/FAC (LOSS) $	At Requested Distances FATALITIES	At Requested Distances INJURIES	At Requested Distances EQUIP/FAC (LOSS) $	VIOLATION?
Grp 22_23	0	3,817	200	1,000,000.00						2.19	4.38	64,164.92	NO
Grp 3_4	0	3,374.5	200	300,000.00						2.75	5.49	31,798.34	NO
Grp 16_17	0	702.9	1,000	500,000.00						904.67	95.34	500,000.00	NO
Grp 7_8	0	2,399.3	200	300,000.00						3.98	7.95	59,458.61	NO
Grp 4_5	0	2,899.2	30	100,000.00						0.5	1	15,100.54	NO
Grp 1_2	0	3,518.5	30	100,000.00						0.39	0.77	9,237.77	NO
Grp 11_12	0	2,629.8	1,000	500,000.00						18.43	36.87	88,249.80	NO
Grp 18_19	0	1,637.3	200	1,000,000.00						32.1	64.19	434,135.41	NO
Grp 2_3	0	3,560.5	30	100,000.00						0.38	0.75	8,845.66	NO
Grp 14_15	0	1,674	200	300,000.00						30.7	61.4	126,754.78	NO
Grp 24_25	0	3,547.3	200	1,000,000.00						2.53	5.06	89,667.70	NO
Grp 8_9	0	2,222.1	1,000	500,000.00						49.9	99.81	124,919.85	NO
Grp 20_21	0	3,639.6	1,000	500,000.00						12.07	24.14	40,527.56	NO
Grp 9_10	0	2,538.5	200	300,000.00						3.8	7.6	55,514.69	NO
													NO
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													NO

1a. Safety Professional/ Analyst *(POC Info)*:

1b. Analyst Signature:

2a. Submitter *(POC Info)*: *(If different from 14a.)*

2b. Submitter Signature: *(if different from 1a.)*

DA FORM 7632, APR 2015

Click to Add Continuation Page

Questions

David Bianchi, GISP
Naval Facilities Engineering Command
Engineering and Expeditionary Warfare Center (EXWC)

1100 23rd Ave.
Port Hueneme, CA 93043
805-982-1607 DSN: 551-1607
david.bianchi@navy.mil

ESS Help Desk Support: ESS@navy.mil 805-982-3637