

Remedial Alternatives Analysis (RAA)

**Site # – INSERT PROJECT NAME, SITE #, SWMU, ETC. HERE
BASE NAME, CITY, STATE**

Indicate which remedy evaluation document this RAA supports.
Check one: FS EE/CA CMS CAP (LUST)

Conceptual Site Model (CSM)	CSM - General	<p>Describe the CSM as indicated in the blocks below using a combination of narrative and related CSM figures as appropriate. Complexity of the information and graphics to be provided is dependent on the site complexity. 3-D CSM diagram is preferred but not necessary for less complex sites where 2-D cross section and plan view can communicate the CSM adequately.</p> <p><i>Use Guidance for Optimizing Remedy Evaluation, Selection, and Design (NAVFAC 2010) and the NAVFAC CSM Web Tool (http://www.ert2.org/csm) when developing conceptual site models and related remedial action objectives, remedial alternatives, technology performance objectives, and exit strategies.</i></p> <p><i>Use Guidance for Planning and Optimizing Monitoring Strategies (NAVFAC 2010) for developing and optimizing related monitoring plans.</i></p>
	Previous Site Use	Provide sufficient information on site use and site history to understand sources of contamination.
	Size	Describe dimensions of the site relevant to the remedial actions being evaluated. For example, list dimensions of source area, dissolved-phase plume, soil hot spot, etc. being evaluated as part of remedy selection (approximate area in XX,XXX square feet or XXX acres).
	Previous Investigations and Remedial Actions	Briefly describe or include in a table previous investigations and remedial actions.
	Current and Potential Future Land and Resource (e.g. Groundwater) Uses	Identify all current and potential future land and resource use. Include on-site and adjacent land/resource uses, including recreational use of adjacent surface waters and the groundwater current use and classification for potential future use, to ensure appropriate RAOs are identified for the potential receptors. If the groundwater classification is based on State criteria, indicate if the State has an approved Comprehensive Groundwater Protection Plan in place. Include specific descriptors for land use – industrial, residential, recreational, mixed use, other.
	Affected Media	Describe affected media (e.g. soil, groundwater, sediment, indoor air, surface water). For soil media, describe soil types, depths of soil contamination, and other relevant information. For groundwater media, include description of TDS, redox conditions, unusual geochemistry or characteristics that impact remedy selection. For sediment/surface water, include description of surface water/sediment environment (i.e. wetland, lake,

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		river/stream, harbor, etc.).
	Geology/Hydrogeology	Describe site geological and hydrogeological features that impact remedy selection and performance. Include cross-sectional figures depicting relevant soil/aquifer layers, depth to water, potentiometric head, and contaminant distribution if these features are relevant to remedy selection.
	Nature and Extent of Contamination	Describe the nature and extent of the release, including source area or plume, age of contamination; contaminant type (e.g. chlorinated solvents, petroleum hydrocarbons, munitions, heavy metals), fate and transport mechanisms, etc. If available, include figures depicting the relationship between the contamination, surface/subsurface features, hydrogeology, etc. (e.g. 3-D or 2-D plume maps, detailed cross-sections of contaminant distribution, site stratigraphy, etc.) depicting the relationship between the contaminant release, surface/subsurface features, hydrogeology, nature and extent, fate and transport mechanisms, current and potential future land/resource uses, and potential exposure pathways/receptors.
	Receptors/Exposure Pathway	Describe the course a chemical or physical agent takes from a source to a human or ecological receptor. Each exposure pathway includes a source or release from a source, an exposure point, and an exposure route. If the exposure point differs from the source, a transport/exposure medium (e.g., air, groundwater) or media (in cases of intermedia transfer) also is included.
	Other Site Constraints	Highlight site features (e.g. topography, accessibility, weather, presence of site utilities, disposal restrictions, on-site power limitations, infiltrating storm sewers or other preferential pathways influencing contaminant migration, etc.) that may impact remedy performance and selection.
Risk Summary	Human Health Risk	Identify the current and potential human receptors evaluated in the HHRA. Describe results of the HHRA and indicate, based on the various receptor scenarios what risks DO exist/DO NOT exist. Identify the COCs that drive risk. Quantify risk for each COC and any cumulative risk from multiple COCs and exposure pathways. Use tables to summarize potential unacceptable risk results. Some states may have more stringent criteria for specific environmental media. For example, if more stringent state criteria apply at this site, please identify these requirements. State whether a screening or baseline HHRA was performed and whether the background policy was followed. Describe any unusual exposure parameters that were used or anything else that may cause more than usual level of uncertainty in risk estimation.
	Ecological Risk	Describe results of the ERA and/or phased eco-risk screening, and indicate, based on spatial coverage and hazard quotients, what risks DO exist/DO NOT exist to

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		<p>plants, invertebrates, and wildlife or if they are expected to be minimal at the site.</p> <p>Quantify risk for each COC and exposure pathways. Use tables to summarize potential unacceptable risk results.</p> <p>State whether a screening or baseline ERA was performed and whether the background policy was followed. Describe any unusual exposure parameters that were used or anything else that may cause more than usual level of uncertainty in risk estimation.</p>
COCs	Surface Soil	Define depth interval considered to represent surface soil zone of concern. List or include all COCs in a table (average and maximum concentrations)
	Subsurface Soil	Define depth interval considered to represent subsurface soil. List or include all COCs in a table (average and maximum concentrations).
	Groundwater	List or include all COCs in a table (average and maximum concentrations).
	Sediment	Define depth interval considered to represent sediment zone of concern (e.g. bioturbation layer, dredge depth, etc.). List or include all COCs in a table (average and maximum concentrations).
	Surface Water	List or include all COCs in a table (average and maximum concentrations).
	Indoor Air	List or include all COCs in a table (average and maximum concentrations).
RAOs	Remedial Action Objectives	<p>Describe the RAOs for each affected medium. RAOs are medium-specific (e.g. soil or groundwater specific) goals for protecting human health and the environment.</p> <p>RAOs should provide a clear and concise description of what the remedial action should accomplish at a given site. Some sample RAOs for soil, sediment, groundwater, and landfill sites are as follows:</p> <ul style="list-style-type: none"> • Limit direct exposure to contaminants in surface soil by human and ecological receptors. • Remove contaminant mass in the vadose zone to the degree necessary to prevent further degradation of the underlying groundwater. • Limit human and ecological exposure to contaminated sediments. • Prevent COCs in groundwater from reaching points of compliance (POCs) at concentrations above the clean-up goal. • Protect future residential receptors from unacceptable risks associated with inhalation and ingestion of

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		<p>volatile organic compounds (VOCs) in groundwater.</p> <ul style="list-style-type: none"> Prevent infiltration of precipitation into landfill waste to minimize leachate. Prevent direct contact with landfill contents. <p>Use <i>Guidance for Optimizing Remedy Evaluation, Selection, and Design</i> (NAVFAC 2010) and the <i>Navy/Marine Corps Policy for Optimizing Performance and Sustainability of Remedial and Removal Actions</i> (CNO 2011) when developing RAOs.</p>
Remediation Goals	Preliminary/Final Remediation Goals	Describe the remediation goals proposed to meet each RAO for this site (and the risk scenario or ARAR driving the RG). Quantify site-specific cleanup levels for each medium based on unacceptable risk. Provide justification if remediation goals (cleanup standards) are based on non-promulgated screening levels (e.g., EPA RSLs, BTAG screening values, SSLs, or state screening levels).
TTZs	Target Treatment Zones	<p>A target treatment zone (TTZ) is the volume or area at which the remedial action (or treatment component in a treatment train) is determined to best apply. Describe the target treatment zone(s) (TTZ) for the site. A figure may also be used to depict the location of TTZ(s). A TTZ is defined by the CSM and RAOs, considering risk reduction, exposure routes, and the nature and extent of contamination. For soil or sediment sites, the target treatment zone may be limited to hot spots with elevated contaminant concentrations or may extend over the entire impacted area. For groundwater sites, the target treatment zone may encompass the source zone, the dissolved plume, localized areas with elevated concentrations within the plume, and/or the downgradient boundary or discharge point of the dissolved plume. A site may have multiple TTZs. Remediation goals are established for each TTZ.</p> <p>Use <i>Guidance for Optimizing Remedy Evaluation, Selection, and Design</i> (NAVFAC 2010) when developing TTZs.</p>
Remedy Status	Interim or Final Remedy	Indicate if this is the interim or final selected remedy for the site. If Interim, explain how the interim remedy will impact or compliment the final remedy or potentially result in no further action (NFA).
Unrestricted Land Use	Was an UU/UE Remedial Alternative Evaluated?	Indicate if a remedial alternative that would result in unrestricted future land use (unrestricted use/unrestricted exposure [UU/UE]) was evaluated.
Data Gaps	Identify Any Remaining Data Gaps	Describe any known data gaps that may impact risk management decisions, remedy selection, and/or remedial design. For example, indicate if additional site characterization, source zone delineation, etc. may be required to ensure proper remedy selection and/or design.

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Applicable Documents	<p>Reference applicable supporting documents, such as the Remedial Investigation Report, RCRA Facility Investigation Report, Site Assessment Report (LUST), etc. Make these documents available to reviewers upon request.</p> <p>Provide NIRIS web link for downloading the RI, RFI, or other relevant site investigation document. For documents not stored in NIRIS, provide FTP, RMFT, or other file transfer web link where the reviewer can download the document if needed for additional information.</p>
Additional Comments	<p>Provide additional comments relevant to the RAA and indicate if CSM figures, data tables, and plume maps are attached.</p>

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Description of Feasibility Study Alternatives

(Only include alternatives that have been screened and retained for detailed analysis in the remedy selection document.
Include alternatives for all impacted media – e.g. soil, groundwater, sediment)

Alternative Number	Alternative Description
Alternative #1 No Action	<ul style="list-style-type: none"> • No Action Alternative (include for FS only) • Does not include LUCs, monitoring, or cost.
Alternative #2	<ul style="list-style-type: none"> • Provide remedy information for Alternative #2. • Describe in sufficient detail so reviewer will understand proposed remedial alternative. • Describe all technologies or remedy components that may be included in treatment trains used in 1) a phased approach over time (e.g., in-situ chemical oxidation to reduce source area COC concentrations followed by MNA to remediate residual concentrations), and/or 2) to address multiple target treatment zones (e.g., enhanced bioremediation followed by MNA in the source area, MNA in the downgradient plume, and a permeable reactive barrier (PRB) in the interim to prevent COCs from discharging to surface water). • Describe the exit strategy for each technology or remedy component of the treatment train targeting a particular target treatment zone. • Describe any land use controls (LUCs). • Describe all long-term monitoring requirements associated with each alternative, including an estimate of the monitoring timeframe and exit strategy for optimizing and reducing the monitoring frequency, locations, etc over time. • Do not include cost information.
Alternative #3	<ul style="list-style-type: none"> • Describe each alternative considered as per Alternative #2 above.
Other Alternatives Considered	<ul style="list-style-type: none"> • Include a list of significant technologies considered during the initial screening of remedial alternatives and a brief explanation (1-3 sentences) of why these technologies were not retained for detailed analysis in the remedy selection document.

INCLUDE APPROPRIATE NOTES HERE.

FS = Feasibility Study

PRGs = Preliminary Remediation Goals (site specific goal as defined in the FS; similar to the CG in an FSA).

LUCs = Land Use Controls