OB/OD Closure Project

CH2MHILL

Vadose Zone Monitoring to Meet RCRA Closure/Post Closure Groundwater Monitoring Requirements

Camp Navajo, AZ

Introduction

- Objectives
- Camp Navajo history
- Regulatory history (CERCLA/RCRA)
- Data collection and analysis issues
- Alternatives to typical post-closure monitoring well network
- Vadose zone (VZ) monitoring results

Objectives

- Present the site and regulatory history
- Establish the regulatory requirements and corresponding issues
- Discuss process and resolution

Camp Navajo History

- Activated July 1, 1942
- Assigned Defense Supply Agency Depot mission February 13, 1967
- Placed under reserve status March 1, 1971
- Reassigned to Tooele Army Depot command 1975
- AZARNG assumed operational control June 1982
- Transferred under BRAC I to AZARNG September 1993
- OB/OD operations ended September 1994
- Environmental cleanup program began 1995
- Classified as a Maneuver Training Center-Light (MTC-L)

Regulatory History

- 1982-1988 – AZARNG submitted Part A and Part B RCRA permit applications, operated under Interim Status until 1994
- 2004 – ARNG/ADEQ agreed to address HTRW and MEC separately, designated NAADs and MRWAs
- 2004 – ARNG/ADEQ agreed that sites would be closed using CERCLA, but any post-closure care would be conducted under a RCRA Permit
- 2007 – NAAD 02 RI
- 2008 – MRWA 02/03 MEC characterization
- 2011 – MRWA 02 EE/CA

CERCLA to RCRA

- CERCLA work plans act as RCRA Closure Plans
- CERCLA Decision Documents act as RCRA Closure Reports
- Closed sites transfer from CERCLA to RCRA
- RCRA Interim Status is closed and RCRA Post-Closure Permit is issued

Why RCRA?

- This was an operational Treatment Storage and Disposal Facility (TSD) operating under Interim Status
- Military Munitions were sent to Camp Navajo for disposal through Open Burn and Open Detonation, under Hazardous Waste Manifests once the Permit application was requested
- Therefore, since the MEC remaining were intended for disposal, they are classified as a "waste left in place"

Problem Statement

- 40 CFR Subpart F-Groundwater Monitoring – …must implement a groundwater monitoring program capable of determining the facility's impact on the quality of groundwater
- The final groundwater monitoring program will be included in the RCRA Post-Closure Permit Application and associated Post-Closure Plan as required by 40 CFR 270.14(c).
- 40 CFR 270.28, the rule specifying which information is required for post-closure applications, specifically includes 40 CFR 270.14(c).

Problem Statement (cont)

- First aquifer is ~1,400 feet bgs
- Vadose zone is 6-30 feet of soil over fractured and faulted limestone and sandstone bedrock
- Pathway from source to receptor unknown
- Groundwater monitoring may not detect a release no matter how many wells
- Detection of a release in the groundwater could be too late to remediate
- ROM cost of $1.2M per monitoring well

Possible Alternatives

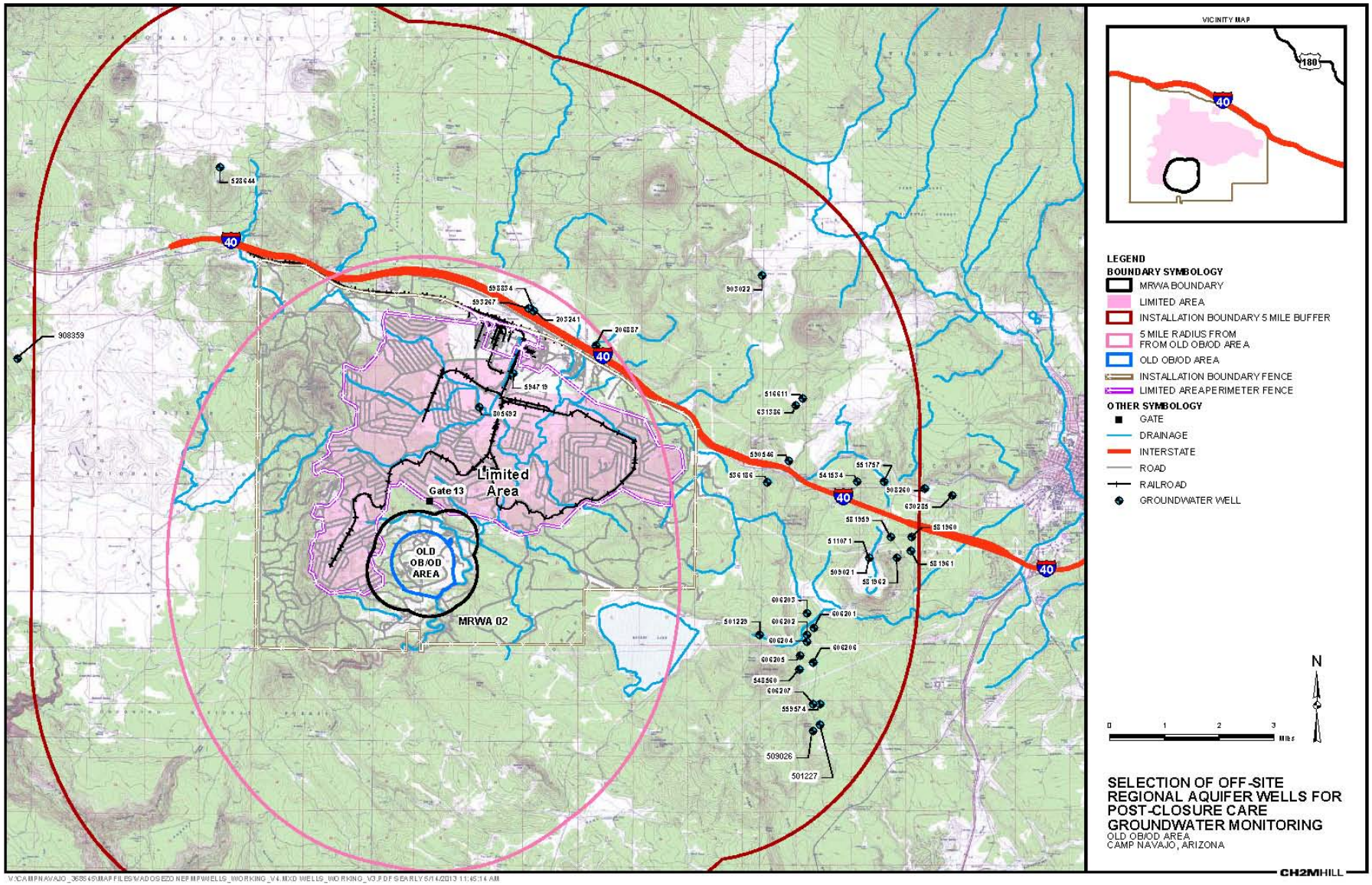
- Mass transfer model of remaining MC available to leach to groundwater
- Lysimeters to capture soil pore water
- Intermediate bedrock drywells with a sump
- VZ wells straddling soil/bedrock interface to monitor source area
- Existing down-gradient water-supply wells to monitor receptors

ADEQ Concerns

- Solution could not be a 100% model, too many variables
- MEC were dispersed, so solution had to have a "capture zone"
- Solution had to have "expandability"
- Solution had to both establish base line conditions and be able to detect releases
- Combined source/receptor monitoring

Agreed Upon Alternative

- VZ wells were determined to most closely meet the intent of RCRA
- VZ wells were located to maximize the probability of capturing infiltration
- VZ wells were located in areas with the highest suspected density of remaining MEC, and MC contained in remaining MEC


VICINITY MAP
180
40
LEGEND
BOUNDARY SYMBOLOGY
MRWA BOUNDARY
LIMITED AREA
INSTALLATION BOUNDARY 5 MILE BUFFER
5 MILE RADIUS FROM FROM OLD OB/OD AREA
OLD OB/OD AREA
INSTALLATION BOUNDARY FENCE
LIMITED AREA PERIMETER FENCE
OTHER SYMBOLOGY
GATE
DRAINAGE
INTERSTATE
ROAD
RAILROAD
GROUNDWATER WELL
Limited Area
Gate 13
OLD OB/OD AREA
MRWA 02
528644
908359
593834
593267
205241
206837
903022
594719
805692
516611
631386
590546
536126
541534
551757
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Miles
SELECTION OF OFF-SITE REGIONAL AQUIFER WELLS FOR POST-CLOSURE CARE GROUNDWATER MONITORING
OLD OB/OD AREA
CAMP NAVAJO, ARIZONA
CH2MHILL
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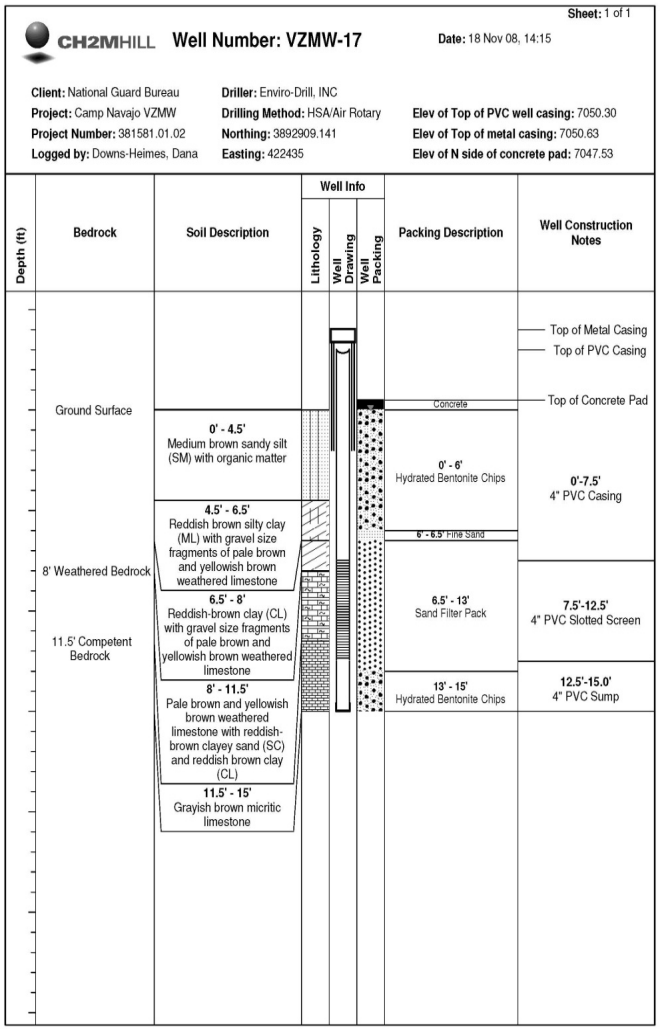
Rationale for selecting locations of vadose zone wells

Table 1: Vadose Zone Monitoring Well Location Rationale

Location	MEC Density	Rational for Location	Drainage Area Targeted
VZMW01	> 5 to > 50	Within central part of OD area Near shallow drainage that channels water to the principal drainages that drains the central part of the OB/OD Area Location surrounded by former OD pits.	Yes
VZMW02	> 10 to > 50	Within central part of OD area Located west of linear N-S trending ridge that channels water towards well location Steeply banked OD pits located up slope from well location	Yes
VZMW03	> 10 to > 50	Within central part of OD area Location positioned in low lying area which captures drainage from the north face of the E-W trending ridge that marks the southern boundary of the OD Area. Numerous OD pits on the north face of this ridge.	
VZMW04	> 10 to > 50	Within central part of OD area Characterized as a low, level area which collects water during precipitation or snow melt. Located down slope of many OD pits	
VZMW05	> 10 > 50	Within central part of OD area at the base of the E-W trending ridge that marks the southern boundary of the OD area. Receives drainage from pits located on the E-W trending ridge	
VZMW06	>2 to > 50	West side of OD area Receives drainage from pits along the western part of the E-W trending ridge that marks the southern boundary of the OD area	

Same mobilization – Welcome to Flagstaff

Well Construction - Example



CH2MHILL **Well Number: VZMW-17** **Sheet:** 1 of 1 **Date:** 18 Nov 08, 14:15

Client: National Guard Bureau
Project: Camp Navajo VZMW
Project Number: 381581.01.02
Logged by: Downs-Heimes, Dana
Driller: Enviro-Drill, INC
Drilling Method: HSA/Air Rotary
Northing: 3892909.141
Easting: 422435
Elev of Top of PVC well casing: 7050.30
Elev of Top of metal casing: 7050.63
Elev of N side of concrete pad: 7047.53

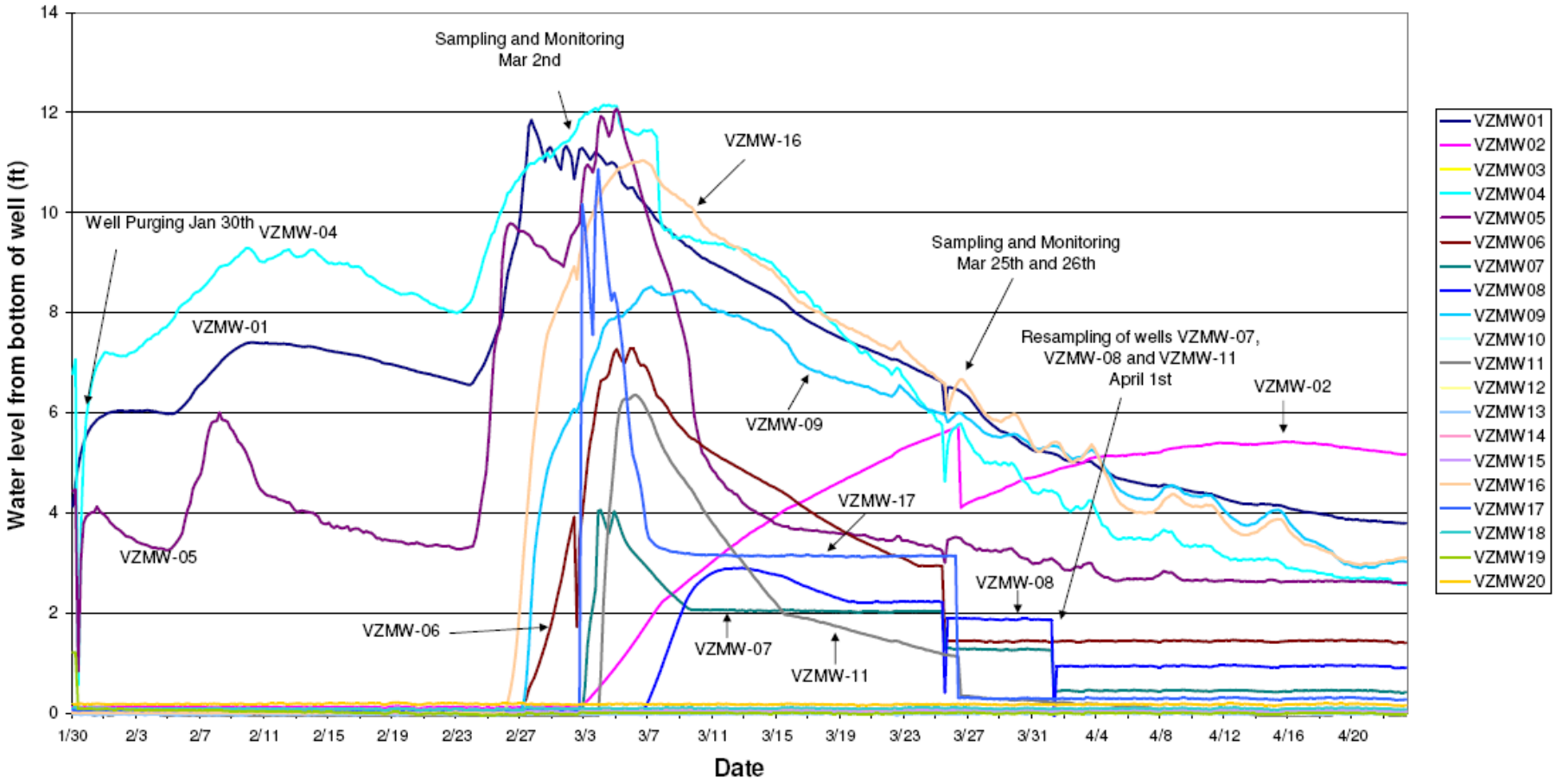
Depth (ft)	Bedrock	Soil Description	Well Info: Lithology / Well Drawing / Well Packing	Packing Description	Well Construction Notes
					Top of Metal Casing Top of PVC Casing
				Concrete	Top of Concrete Pad
	Ground Surface	**0' - 4.5'** Medium brown sandy silt (SM) with organic matter		**0' - 6'** Hydrated Bentonite Chips	**0'-7.5'** 4" PVC Casing
		4.5' - 6.5' Reddish brown silty clay (ML) with gravel size fragments of pale brown and yellowish brown weathered limestone		6' - 6.5' Fine Sand	
8'	Weathered Bedrock	**6.5' - 8'** Reddish-brown clay (CL) with gravel size fragments of pale brown and yellowish brown weathered limestone		**6.5' - 13'** Sand Filter Pack	**7.5'-12.5'** 4" PVC Slotted Screen
11.5'	Competent Bedrock	**8' - 11.5'** Pale brown and yellowish brown weathered limestone with reddish-brown clayey sand (SC) and reddish brown clay (CL)		**13' - 15'** Hydrated Bentonite Chips	**12.5'-15.0'** 4" PVC Sump
		11.5' - 15' Grayish brown micritic limestone			

Installation and Maintenance Issues Caused by the Locals

Concerns and Limitations

- The amount and duration of water moving through the soil vadose zone was unknown
- Remote area, difficult access, 7,300’ elevation
- Two infiltration events – spring snowmelt and summer monsoon
- Not known if results would be repeatable

VZMW Hydrographs



VZ Monitoring Results

- Four proof-of-concept baseline sampling periods were completed
- 3 to 17 VZ wells had sufficient water to sample
- RDX and perchlorate were detected at a number of locations
- Analytical results were repeatable
- A robust solution that meets the intent of the technical requirements for post-closure detection monitoring

Take Away

- RCRA closure/post-closure at MR sites can be tailored to address both regulatory requirements and site-specific challenges
- CERCLA closure at MR sites can satisfy RCRA closure requirements
- Engage stakeholders early to develop a closure strategy that meets everyone's expectations, the work as a team to achieve the common goal
- Site complexity does not negate the need to comply with regulatory requirements
- Look for other means to meet the intent of the requirements, hard data alternatives are better
- Do this as a collaborative method, use the TPP process

Questions?