CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION

MEETING OF SEPTEMBER 10 AND 11, 2014
BARSTOW, CALIFORNIA

ITEM: **12**

SUBJECT: **WORKSHOP - MONITORED NATURAL ATTENUATION**

CHRONOLOGY: This is a new item.

ISSUE: Staff will present a discussion of the use of Monitored Natural Attenuation (MNA) as a remedy at cleanup sites in the Region. This is an information item only. The Board may provide direction to staff during the workshop.

DISCUSSION: Water Board staff review proposals for sites in the Region that request to use natural attenuation processes for the cleanup remedy. Staff must evaluate the adequacy of these proposals to determine whether MNA as a cleanup process is appropriate and the likelihood that it will achieve acceptable site cleanup. Staff will present the following:

- regulatory guidance and policy;
- the natural processes most often at work at sites using MNA;
- types of sites in the region that have or may propose MNA remedies; and
- recommendations for acceptable site conditions for use of MNA.

Description of MNA

MNA is a term used for a remediation option that relies on natural processes to achieve site cleanup. MNA can include processes that destroy contaminants or transform them to less toxic forms. MNA can also occur by only non-destructive processes such as dilution, diffusion and by adsorption on soil particles in the aquifer. MNA remedies may rely on all or some of these processes depending on site specific conditions. MNA remedies include a monitoring component to evaluate effectiveness and should also include contingencies with clear triggers to address changes in conditions or if the contaminants do not behave as expected.

MNA Remediation

MNA has been recognized as a remedial option for groundwater contamination since the 1990s. According to the USEPA[1], MNA is considered appropriate at sites where the contamination does not pose an immediate exposure threat to human health and the environment, there is a low potential for further contaminant migration (plume boundary is stable or decreasing), and where remedial goals will be achieved in a "reasonable time" relative to other remedial methods. Additionally, source control and complete site characterization is usually considered a prerequisite for the use of MNA.

Some of potential advantages of MNA include:

- Generation of smaller volumes of remediation wastes.
- Reduced potential for cross-media transfer of contaminants commonly associated with ex-situ treatment.
- Reduced risk of human exposure to contaminants, contaminated media, and other hazards.
- Reduced disturbances to ecological receptors.
- Some natural attenuation processes may result in in-situ destruction of contaminants.
- Few or no surface structures are required.
- Potential for application to all or part of a given site, depending on site conditions and remediation objectives.

Some potential disadvantages of MNA include:

- Longer time frames may be required to achieve remediation objectives, compared to active remediation measures at a given site.
- Site characterization is expected to be more complex and costly.
- Toxicity and/or mobility of transformation products may exceed that of the parent compound.
- Long-term performance monitoring will generally be more extensive and for a longer time.
- Institutional controls may be necessary to ensure long term protectiveness.
- Potential exists for continued contamination migration, and/or cross-media transfer of contaminants.
- Hydrologic and geochemical conditions amenable to natural attenuation may change over time and could result in renewed mobility of previously stabilized contaminants (or naturally occurring metals), adversely impacting remedial effectiveness.

[1] U.S. Environmental Protection Agency [USEPA] 1999 Directive, *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* [USEPA Directive]; http://www.epa.gov/oust/directiv/d9200417.pdf

The Application of MNA in the Lahontan Region and Other Regional Boards

MNA is being used as a cleanup remedy for sites in the Lahontan Region, although most sites do not rely on MNA as the sole cleanup remedy. Enclosure 1 provides general information about use of MNA for site cleanup in the Lahontan Region and at sites throughout the state.

State Regulation and Policy

State Water Resources Control Board's Resolution No. 92-49 specifies that the Regional Water Board shall concur with any cleanup proposal that the discharger adequately demonstrates and the Regional Water Board finds has "a substantial likelihood to achieve compliance, within a reasonable time frame, with cleanup goals and objectives..." The resolution also states that the Regional Water Board shall require the discharger to consider the effectiveness, feasibility, and relative costs of applicable alternative methods for investigation, and cleanup and abatements[2].

Based on these requirements and EPA guidances, MNA can be an acceptable remedial technology for groundwater contamination if the responsible party has demonstrated to the Board's satisfaction that:

- The site has been adequately **characterized** per MNA guidances (see references above);
- The plume boundary is **stable or decreasing**;
- **Source areas** are cleaned up or controlled;
- Existing contamination **does not pose a threat to human health or the environment**, e.g., there is no current use of groundwater and institutional controls will prevent use of the groundwater until water quality goals have been achieved;
- There is an adequate plan **for long-term monitoring** and appropriate **institutional controls**;
- There are adequate **triggers and contingencies** if the plume does not behave as expected; and,
- Water quality objectives will be achieved in a **reasonable timeframe**.

[2] Note, Resolution 92-49 also addresses containment zone requirements. The Resolution defines a containment zone as a specific portion of a water bearing unit where the Regional Water Board finds that it is unreasonable to remediate to the level that achieves water quality objectives. Therefore, the primary difference between a containment zone and MNA is that water quality objectives will not be achieved in a containment zone, while MNA is a cleanup remedy implemented to achieve water quality objectives.

Summary and Recommendations

MNA can be effective in achieving remedial goals in a reasonable timeframe at some sites based on site conditions and the type of contaminant. Applicable MNA guidance should be followed in the site-specific evaluation supporting the selection of MNA and the responsible party must adequately demonstrate that MNA will meet the requirements contained in Resolution 92-49. The technical and economic feasibility of MNA as a cleanup method should be evaluated along with other more active cleanup technologies. MNA has been accepted for site cleanup in the Lahontan Region and by other regional water boards. MNA may be most useful in conjunction with some form of active site remediation. MNA is not appropriate as a cleanup remedy at sites that do not meet the conditions described above. Staff expects MNA will continue to be proposed for cleanup at Lahontan Water Board sites and recommends acceptance of remedies that follow the guidance described above.

RECOMMENDA-TION: This is an informational item. Water Board may provide direction and/or general support of staff's approach.

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ENCLOSURE	Item	Bates Number
1	Groundwater Cleanup Using Monitored Natural Attenuation, Survey Results from Regional Water Boards	12-7

ENCLOSURE 1

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ENCLOSURE 1

GROUNDWATER CLEANUP USING MONITORED NATURAL ATTENUATION
SURVEY RESULTS FROM REGIONAL WATER BOARDS

Region	Conditions where MNA is an acceptable remedy	Conditions that show MNA is working	Lessons Learned
2	Plume is stable or shrinking, no current impacts to receptors, cleanup timeframe is reasonable, conceptual site model must be complete, sources are controlled, no adverse effect to beneficial uses, and cleanup time is based on plume trend observations.	COC concentrations are decreasing, plume is shrinking or stable, evidence of biodegradation, and cleanup timeframe based on plume trend observations.	Robust monitoring is key and having graphical representation of data trends.
3	Defined rates and mechanisms of attenuation, a contingency plan, and feasibility study.	Source removal, decreasing COC concentrations, shrinking plume, and USEPA protocol.	View MNA as a cleanup method that requires monitoring, reporting, and a contingency plan; and not a do nothing approach. Have responsible parties evaluate cleanup timeframes regularly to confirm cleanup is on track.
4	No primary sources, minimal secondary sources, no NAPL, low COC concentrations, stable plume, minimal vapor intrusion risk, no production wells within 1-mile, and no other cleanup methods are feasible.	Stable to decreasing plume, reduced parent COCs, increased daughter COCs, monitoring of MNA physical and chemical parameters, and baseline microbial study.	Monitoring has shown the plume is continuing to migrate without shrinking significantly at one MNA site.
6	Plume is stable or shrinking, no current impacts to receptors, cleanup timeframe is reasonable, conceptual site model must be complete, sources are controlled, and no adverse effect to beneficial uses.	COC concentrations are decreasing, geochemical and/or hydrogeological data show natural attenuation processes are active, and field data demonstrates declining trends.	
7	No ongoing sources; no free product; site is completely characterized for source of mass, and electron acceptors.	Stable plume, acceptable risk level.	
8	Removal of sources, site characterized, timeframe for cleanup is reasonable, no access to areas of plume for active remediation, sensitive receptors identified and protected, and COC concentrations just over regulatory limits.	COC concentrations are decreasing, geochemical and/or hydrogeological data show natural attenuation processes are active, and field data demonstrates declining trends.	MNA is proposed at sites with insufficient funding for active remediation methods or consultants do not fully understand the requirements of implementing MNA.
9	Receptors identified and protected, contamination well defined, other factors associated with groundwater characteristics.	USEPA performance monitoring.	Regulators must be comfortable with accepting long cleanup times and uncertainty of data.

Groundwater Cleanup Using Monitored Natural Attenuation
Survey Results from Regional Water Boards (continued)

Region	Remedies using MNA alone (%)[1]	Remedies using MNA as a component (%)	Any remedy >100 years	Guidance	How to evaluate appropriate time
2	10	90	Possibly	USEPA/LTCP	Aquifer use
3	15	60	Yes, 2 SCP	USEPA	Tech./Econ. Feasibility/Time
4	8	80	No	RAOs	Tech/Econ. Feasibility
6	10	80	No[2]	USEPA/LTCP	Tech./Econ. Feasibility/Aquifer Use
7	0	30	No	USEPA	15 years/Tech./Time
8	0	5	No	USEPA	10-20 years
9	NA	12	Yes	USEPA/Res. 92-49	Aquifer Use

[1] Percentages are approximate.
[2] Two containment zones have been approved, allowing contaminants to remain in place for about 200 years.