

# Transitioning: from RAOs to Solutions

By Lisa Alexander

This month we'll discuss the transition of various Response Action Outcome Statements (RAOs) to Permanent and Temporary Solutions. We'll briefly review all RAO types then focus mainly on those that have ongoing obligations under the Massachusetts Contingency Plan (MCP) and how they will be treated under the revised MCP.

## **Background:**

Since 1993, several types of Response Action Outcome Statements (RAOs) have evolved. Three Classes – A, B and C – each with multiple numeric subcategories, create nine possible endpoints for sites after notification: A-1, A-2, A-3, A-4, B-1, B-2, B-3, C-1 and C-2. If one adds a Downgradient Property Status (DPS) determination to the mix, this makes the ten most common endpoints for sites after notification.

The natural inclination is to assume that there is some order to these RAO categories, that an “A-1” RAO is somehow better or more protective than an “A-4.” Given the potential complexity of site-specific conditions, particularly in older urban industrial areas of Massachusetts, it is possible to have a Class A-1 or B-1 site “at background” with higher concentrations of Oil and Hazardous Materials (OHM) than a Class A-2 site remediated to No Significant Risk with all site related contaminants below Method 1 standards. More problematic is the fact that the RAO categories are not intuitive, and the subtleties and complexities and nuances are often lost on the residents, neighbors and potential buyers who need to be aware of what the RAO means. Clearly there had to be a simpler way of communicating conditions of sites at closure.

## **Types of RAOs:**

Taking a step back from the ten categories, we see that the vast majority of closed sites (almost 90% of all RAOs) are Class A-1, A-2 and B-1 and are able to be reused without restrictions. Another 7% of closed sites are Class A-3, A-4, B-2 and B-3 RAOs with Activity and Use Limitations (conditions to be maintained to reduce or eliminate exposures) and are also generally good candidates for re-use or re-development. Finally there are about 3% of RAOs in Class C, which may or may not also have AULs. Originally, there was only one “category” of Class C RAO but starting in 2006, the original Class C RAOs were transitioned to Class C-1 RAOs and a second category, Class C-2 RAOs were created. The Class C-2 sites are those at which Remedial Action has been initiated and the actions are expected to result in a permanent solution... eventually. The Class C-2 RAO is similar to, and also confused with, Phase V Status and Remedy Operation Status (ROS). Class C-1 RAOs are now considered those sites where there is no path to a Permanent Solution, given site conditions, technology availability or cost at the time of closure, but where “Substantial Hazards” have been eliminated. Class C-1 RAOs are required to conduct periodic evaluations of new technology or other possible developments that might allow them to proceed to a Permanent Solution.

For a quick look at some of our site statistics on our redesigned website, see:

<http://www.mass.gov/eea/agencies/massdep/cleanup/reports/statistics-on-cleaning-up-oil-and-hazardous-waste-sites.html>

and:

<http://www.mass.gov/eea/agencies/massdep/cleanup/reports/response-action-outcomes-table.html>

### **Class A and B RAOs without AULs:**

Class A RAOs apply at sites where remediation work has been done and Class B RAOs apply at sites where only assessment has been conducted. At sites with Class A-1 RAOs, contamination has been cleaned up to background. At sites with Class A-2 RAOs, contamination may be above background but below Method 1 cleanup standards or otherwise at No Significant Risk. Similarly, sites with Class B-1 RAOs may have contaminant levels at “background” or may be below Method 1 Standards and/or otherwise at No Significant Risk. Practitioners of the MCP know these categories are not necessarily “pristine.” It means that there is no additional risk from the *site* over and above what is there in the absence of the site. As documented in our files, historic fill, large fires, atmospheric fallout of nuclear testing and leaded gasoline, naturally occurring arsenic and coal-fired power plants in upwind states have all made for some interesting reading in Method 3 risk assessments. These types of RAOs make up about 90% of all site closures.

*The conditions that constitute Class A-1, A-2 and B-1 RAOs will become “Permanent Solutions” with no Conditions under the proposed revisions to the MCP.*

### **Class A and B RAO Sites with AULs:**

To paraphrase the MCP, the purpose of an AUL is to narrow the scope of exposure assumptions used to characterize risks to human health from a release by specifying the activities and uses that are both prohibited and allowed at the disposal site in the future. Class A-3, A-4, B-2 and B-3 RAOs are sites that are closed with AULs (as are some Class C sites). One of the most common specifications is to maintain paved surfaces or other barriers that restrict access to contaminated soil. Approximately 7% of closed sites have AULs.

Key elements of a Class A-3 RAOs are:

- the concentrations of OHM in soil and/or groundwater have *not* been reduced to background *but* they do not exceed an applicable Upper Concentration Limit (UCL); and
- one or more AULs has been implemented.

Class A-4 RAOs include the same elements, plus:

- a Phase III feasibility evaluation indicates that it is not feasible to reduce concentrations of OHM in soil located at depths greater than 15 feet from the ground surface or beneath an engineered barrier to the applicable UCLs in Soil (or less).

Class A-3 and A-4 RAOs do *not* apply to any disposal site where concentrations of OHM in soil or groundwater exceed UCLs *except* in those cases where the concentrations are shown to be consistent with background, *or* the soil is located at a depth greater than 15 feet from the ground surface or beneath

an engineered barrier. A Phase III evaluation must be performed to demonstrate that it is not feasible to further reduce the concentrations of OHM in soil to the applicable UCLs (or less). Class A-3 and A-4 RAOs also do *not* apply to any disposal site where the concentration of OHM in groundwater exceeds an applicable or suitably analogous standard in locations where the groundwater is categorized as GW-1.

Class B RAOs apply at disposal sites where remedial actions have *not* been conducted. For Class B-1 RAOs, the site already meets the criteria for No Significant Risk without an AUL.

Class B2 RAOs do apply to disposal sites where:

- OHM in soil is greater than background or above Method 1 standards or otherwise does not meet the criteria for No Significant Risk.
- remedial actions have *not* been conducted so an AUL is needed to restrict exposures to OHM to ensure a level of No Significant Risk at the disposal site; and
- no concentration of OHM at the disposal site may exceed an applicable UCL in Soil or Groundwater.

Class B-3 RAOs meet the above description, and also:

- OHM in soil located at a depth greater than 15 feet from the ground surface exceeds one or more applicable UCLs in Soil; and
- a Phase III evaluation has been performed to demonstrate that it is not feasible to reduce the concentrations of OHM in soil located at a depth greater than 15 feet from the ground surface to the applicable UCL in Soil (or less).

Class B RAOs do *not* apply if concentrations of OHM in soil or groundwater exceed UCLs *except* in those cases where:

- the OHM concentrations in soil are shown to be consistent with background;
- the contaminated soil is located at a depth greater than 15 feet from the ground surface and it is not feasible to reduce the concentrations of OHM to the applicable UCLs (or less); or
- concentrations of OHM in groundwater exceed an applicable or suitably analogous standard and the groundwater is categorized as GW-1.

***Class A and B RAOs with AULs will become Permanent Solutions with Conditions under the proposed changes to the MCP.***

### **Class C RAOs – Substantial Hazards must be eliminated:**

Prior to 2006, there were only “Class C” Temporary Solution RAOs. Starting in 2006, there were Class C-1 and Class C-2 RAOs. The original Class C RAOs transitioned in 2006 to Class C-1 RAOs. There are some overlapping requirements and some specific differences (covered below). The main requirement for a site to achieve a Class C RAO is to get to a condition of No Substantial Hazard. About 3% of sites are in Class C RAO.

A Substantial Hazard as defined by the MCP is a hazard that would pose a significant risk of harm to health, safety, public welfare, or the environment if it continued to be present for several years. The focus of a Substantial Hazard evaluation is on possible exposures to Human and Environmental

Receptors and considers the current use(s) of the disposal site and the surrounding environment and, where applicable, any AULs for the site.

There are some requirements that apply to all Class C RAOs as Temporary Solutions. Achievement of a Temporary Solution requires:

- the elimination of any Substantial Hazard at the disposal site; and
- the identification, characterization, and to the extent feasible, elimination, control or mitigation of any source of OHM.

Class C RAOs apply, without limitation, to sites where:

- concentrations of OHM exceed UCLs in soil and/or groundwater, but all Substantial Hazards have been eliminated; and/or
- disposal sites where concentrations of OHM exceed any applicable or suitably analogous standard identified but such OHM concentrations do not pose a Substantial Hazard.

Class C RAOs may be achieved whether or not remedial actions have been taken at a disposal site, but only after [either]:

- a Downgradient Property Status (DPS) Submittal has been provided to the Department: *or*
- a Phase II Comprehensive Site Assessment and a Phase III Identification, Evaluation and Selection of Comprehensive Remedial Action Alternatives have been completed.

Class C RAOs may also be reached:

- after implementation of a Phase IV comprehensive remedial action; or
- after implementation/installation of Phase V operation, maintenance and/or monitoring.

The differences between the two Class C RAOs are primarily whether there is or is not a potential to achieve a Permanent Solution.

- A Class C-1 RAO applies to a disposal site where, after completion of a Phase III evaluation, it is determined that a condition of No Substantial Hazard exists *and* it is not currently feasible that response actions will achieve a Permanent Solution. Periodic evaluations of these sites are required every five years, to assess whether new site conditions or new technologies have become available to make it possible to achieve a Permanent Solution.

***A Class C-1 RAO is the only true “Temporary Solution.”***

- A Class C-2 RAO applies to disposal sites where, after completion of a Phase III evaluation, it is determined that the milestone of reaching a condition of *No Substantial Hazard* has been met and that response actions to achieve a Permanent Solution *are* feasible. These additional response actions will be conducted under the phased process.

***A Class C-2 RAO is a site that has met the No Substantial Hazard milestone and is continuing work under the MCP with a Permanent Solution expected in the future.***