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Julie Roth
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Dear Julie:

At the June 14, 1999 RPM meeting, Weiss Associates presented information that purports to show that there is no need for remediation or development of institutional controls on land use for the LEHR national Superfund site western dog pen soils. As I indicated at this meeting, as well as at previous RPM meetings, the approach that has been used by Weiss Associates in developing this conclusion is fundamentally flawed, in that it does not properly evaluate the potential for constituents in the surface soils in the western dog pens to be a significant public health and environmental threat. Attached is a write-up that I have prepared on this topic. This write-up is the initial phase of what will become a paper that I plan to publish on this issue which demonstrates the current unreliable approaches that are being conducted by PRPs and their consultants in evaluating the public health and environmental threat of chemical constituents in surface soils, and that are being allowed by the US EPA and the California EPA DTSC in making this evaluation. I am circulating this draft paper among the regulatory agencies to determine whether the situation that we are seeing at the LEHR site is representative of what the US EPA and DTSC typically follows, where they ignore the aquatic life bioaccumulation route for assessing the threats to public health and the environment of chemical constituents in surface soils.

I suggest you pass this material on to the LEHR national Superfund site RPMs and PRPs, asking for their comment on any problems that they have with my assessment of this situation. It is my intent to finalize this writeup by July 15, 1999.

As far as I have been able to determine, current US EPA Superfund and Cal EPA DTSC "Superfund" public health and environmental assessments do not include the bioaccumulation route of exposure. If my assessment is incorrect, then I would appreciate having the US EPA and DTSC representatives provide me with copies of any specific guidance that the agencies have developed on this topic. I also wish to see that this guidance is in fact incorporated into LEHR site western dog pen public health and environmental hazard/risk assessment.

I also will be bringing this material to the attention of US EPA national and DTSC Cal EPA management for their review and comment. I know that, at least with DTSC and their recent attempts to revise hazardous waste classification regulations, the DTSC staff did include bioaccumulation as a route of exposure. However, associated with the change in state administration, I understand that the DTSC waste reclassification effort has been terminated.

If there are questions or comments on these comments, please contact me.

Fred

DRAFT

Unreliable Assessment of the Potential Water Quality Significance of Chemical Constituents in the Surface Soils at the LEHR National Superfund Site: Importance of Bioaccumulation

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Abstract

The current approach for evaluating the potential public health and environmental impacts of chemical constituents in surface soils at Superfund sites and other areas where hazardous chemicals are present in the surface soils typically fails to consider the potential for constituents in the surface soils to be transported in stormwater runoff to nearby watercourses, where the constituents can bioaccumulate to excessive levels in edible aquatic organism tissue. The critical concentrations of many bioaccumulatable chemicals such as mercury, chlorinated hydrocarbon pesticides, PCBs, and dioxins, in waters are normally significantly less than the critical concentrations that are a direct threat to humans through ingestion, inhalation, and/or dermal contact with the contaminated soil. If it is not possible to measure concentrations of constituents in stormwater runoff and in the ambient waters for the runoff at potentially significant concentrations with respect to their possible excessive bioaccumulation in aquatic life tissue, it is necessary to conduct analyses of stormwater runoff receiving water organism tissue concentrations to assess whether the Superfund site, as well as all other sources, are potentially contributing to a water quality use impairment due to bioaccumulatable chemicals. Through forensic studies utilizing laboratory and field uptake experiments, it is possible to determine whether a contaminated soil is contributing hazardous chemicals in stormwater runoff that is leading to a water quality use impairment of the receiving waters due to excessive bioaccumulation.

Introduction

Recently, Weiss Associates, on behalf of the Department of Energy (DOE), has presented information concluding that the chemical constituents in the surface soils of the western dog pens at the University of California, Davis (UCD) DOE LEHR national Superfund site are present at concentrations that do not represent hazards to public health and/or the environment. However, a critical review of the methodology used to develop this conclusion shows that it is fundamentally flawed for several constituents that tend to bioaccumulate in aquatic life to excessive levels, causing health threats to those who use the aquatic life as food. This is a generic problem that occurs at many Superfund and hazardous chemical sites. The basic problem is that neither the US EPA nor the California EPA Department of Toxic Substances Control methodologies for assessing the public health and/or water quality significance of chemical constituents in surface soils include the evaluation of the potential for bioaccumulation in receiving water

aquatic life. This route of exposure can be one of the most important pathways for off-site human, aquatic life and wildlife exposure to excessive concentrations of hazardous chemicals.

Unreliable Assessment of Potential Public Health and Environmental Impacts

While the approach used by Weiss is a conventional approach typically used at Superfund sites, of evaluating exposure to humans through dermal contact with the contaminated soils, ingestion of these soils, and inhalation of dust/vapors associated with the soils, this methodology ignores the waterborne/airborne transport of potentially hazardous chemicals to nearby watercourses in stormwater runoff or dust transport that could lead to excessive bioaccumulation of these chemicals in aquatic life tissue causing the aquatic organisms to be a health threat to those who consume the organisms as food. Bioaccumulation of hazardous chemicals has been recognized since the late 1960s as one of the most important pathways by which low levels of potentially hazardous chemicals such as chlorinated hydrocarbon pesticides, PCBs, and mercury can cause health impacts in humans who use aquatic life as food, as well as higher trophic-level wildlife such as fish-eating birds and animals. While ignored in the LEHR site investigations by UCD/DOE and their contractors, it has been well-documented since the early 1970s through the National Academies of Science and Engineering Blue Book (NAS/NAE 1973)of water quality criteria, and subsequent water quality criteria promulgated by the US EPA in the Red Book (1977), US EPA (1980) and in the Gold Book (1987), US EPA (1996) that concentrations of chemical constituents in stormwater runoff from contaminated surface soils well below those that are considered a direct threat to public health and wildlife through dermal contact, ingestion, or inhalation can bioaccumulate in stormwater runoff receiving water aquatic life to sufficient concentrations to be significant threats to humans and wildlife that use the aquatic life as food.

Inadequate Screening Criteria for Assessing Public Health Hazards

The Weiss Associates/DOE approach of comparing soil concentrations found in the western dog pens, based on a limited number of samples from the area, to nearby surface soils "background" concentrations, as well as the RBAS (Risk Based Action Standard) and the US EPA PRGs (Preliminary Remediation Goals) ignores several fundamental tenets of appropriate public health and environmental protection for those constituents in the surface soils of the site being investigated, such as the LEHR site, which represent a threat to public health and the environment through the bioaccumulation route. To use nearby site soils as a measure of background, when the whole area may have been contaminated by previous site activities or surface soil constituents derived from other activities, is inappropriate. The public health and environmental threat issue should not be restricted to considering whether the chemical constituents in the surface soils in a limited area are no greater a threat than the constituents in the nearby (background-reference area) surface soils. The evaluation should be based on whether the constituents in the soils at the site are a threat, independent of their origin, such as through previous site waste management activities or generalized contamination of the area in which the site and the "background" samples where collected.

There could be situations where an area that was at one time used as an orchard and sprayed with lead arsenate pesticide has been found to have lead and arsenic concentrations in the surface soils, so that the region of the Superfund site and the nearby background-reference areas all contain hazardous levels of lead and/or arsenic. A mechanical comparison of the type that Weiss Associates performed for the western dog pens, where concentrations of several constituents, including mercury, in the surface soils of the western dog pens were not found to be significantly different from nearby "background" surface soils, should not be interpreted to mean that the mercury in the surface soils is not a threat to public health and/or the environment. Rather than using a comparative assessment to a reference area, an absolute assessment of the public health and environmental threat must be performed as part of a proper evaluation of the public health and environmental threat that constituents in surface soils represent at Superfund and other sites.

Inadequate Stormwater Runoff Monitoring Programs

One of the chronic problems that has persisted at the LEHR site, as well as other Superfund sites, where PRPs and their contractors are allowed by regulatory agencies to assess the potential threats of chemical constituents in the stormwater runoff from the site, is that this assessment does not include measurement of the constituents of concern at potentially critical levels. The measurements of constituents that are of concern because of the potential to bioaccumulate to excessive levels in receiving water fish, such as the chlorinated hydrocarbon pesticides, PCBs and mercury, must be done with sufficiently sensitive analytical procedures to assess whether the excessive bioaccumulation of these constituents could occur in the stormwater runoff receiving water aquatic life.

The US EPA, as part of promulgating the 1987 Gold Book of water quality criteria, continued the approach that had been adopted in the mid-1970s of developing, in accord with Clean Water Act implementation requirements set forth by Congress, worst-case-based water quality criteria that are designed to protect public health and the environment from the potential hazards that chemical constituents represent. The critical bioaccumulation concentrations of many of the chlorinated hydrocarbon pesticides, PCBs or mercury are well below the typical detection limits that are used in Superfund and other hazardous chemical site investigations. For example, in the University of California, Davis Dames and Moore (UCD 1998) water monitoring report, the statement is made that mercury and chlordane do not represent public health or environmental threats in stormwater runoff from the LEHR site, in which analytical methods with detection limits for mercury 0.1 ：g/L were used, and for chlordane 0.05 ：g/L were used. This conclusion is obviously inappropriate, since the US EPA (1987) Gold Book worst-case-based criterion for bioaccumulation of mercury is 12 ng/L, and it is projected to be decreased to 5ng/L in the near future. A similar situation exists for chlordane, where the US EPA Gold Book criterion is 0.0043 ：g/L.

This means that the approach that has been used repeatedly by UCD/DOE and their contractors, and that has been allowed by the regulatory agencies, of reporting that constituents in the stormwater runoff from the LEHR site do not represent a public health or environmental threat because they are present at less than detection limits for the analytical methods used, is obviously flawed. This approach does not

incorporate well-established worst-case-based Clean Water Act required assessments of public health and environmental threats of chemical constituents in aquatic systems.

The DOE/Weiss Associates evaluation of the lack of threat to public health and the environment caused by chemical constituents in the surface soils of the LEHR Superfund site western dog pens revealed that heptachlor epoxide was present in these soils at concentrations of potential concern for direct human health contact. Heptachlor epoxide is one of the chlorinated hydrocarbon pesticides that tends to bioaccumulate in fish to excessive levels. The DOE/Weiss Associates public health and environmental evaluation of the heptachlor epoxide, like the evaluation for mercury and chlordane, is unreliable since it does not include the potential for this chlorinated hydrocarbon pesticide to bioaccumulate in Putah Creek fish.

As discussed by Lee and Jones-Lee (1996, 1998), the reliable approach for assessing whether a constituent, such as the chlorinated hydrocarbon pesticides, PCBs and mercury present in stormwater runoff and/or ambient waters at concentrations less than the detection limit for the analytical methods used is to measure the concentrations of these constituents within edible aquatic life to determine whether the tissue concentrations exceed current public health or wildlife guideline values for certain rates of consumption of the aquatic life as food. It is important in making the assessment of hazardous levels of constituents, such as mercury in fish, to use appropriate local fish consumption rates, rather than the national average fish consumption rate of one meal of fish per month (6.5 grams per day). That level of consumption is far lower than what is often experienced by some populations of people who rely on local fish as an important constituent in their diet.

It is also important to consider that for certain constituents, certain types of fish tend to bioaccumulate more than others. In the case of mercury, the higher trophic-level game fish tend to have much higher tissue concentrations of mercury than smaller fish. Further, for the chlorinated hydrocarbons, the fish with the greater fat content tend to bioaccumulate higher concentrations than those with lower fat levels within the tissue. The sampling for fish and other aquatic life must properly incorporate information on the local fish that are being consumed by the exposed populations.

Recently, two compilations of critical concentrations of chemical constituents in aquatic life tissue, as they may impact the aquatic life with the elevated residue tissue levels, have been published. One of these is the US COE/US EPA (1998) Environmental Residue-Effects Database (ERED), and the other is developed by the US EPA (Jarvinen and Ankley, 1999). Therefore, in addition to considering whether there are excessive tissue residues as they may impact humans and wildlife that use the aquatic life as food, there is also need to evaluate whether the tissue residues are potentially harmful to aquatic life through a critical review of the information available in these databases.

In addition to considering the potential impact of tissue residues on humans who use local contaminated aquatic life as food as well as damage to the host organism for the tissue residue, there is need to consider whether higher trophic level birds and animals that use fish and other aquatic life as food can

be exposed to excessive concentrations of hazardous chemicals. The US EPA (1993) as part of the Great Lakes Initiative has developed a wildlife based water quality criterion for PCBs. This criterion considers whole organism content, not just edible tissue, as well as the fact that wildlife such as fish-eating birds and animals may consume greater amounts of fish than humans and thereby receive a greater exposure to hazardous chemicals. Fish-eating animals and birds diet may consist largely of local contaminated fish and shell fish.

Recommended Approach

The approach that should be followed in investigating whether the surface soil residues of mercury, chlordane, heptachlor epoxide and other constituents in the western dog pen, as well as LEHR site surface soils, represent significant threats to public health and/or the environment, is to first, reliably assess the tissue residues of these constituents in representative, appropriately sampled fish taken from Putah Creek. If these fish do not have excessive levels of the constituent of potential concern, then it can be concluded that the LEHR site, as well as all other potential sources of the constituent, are not causing excessive bioaccumulation of this constituent in the fish at the time of sampling. It is important, to maintain an ongoing bioaccumulation tissue residue monitoring program to evaluate the situation over the years, especially changes from wet to dry years and vice versa that could affect fish and other aquatic life tissue residues.

If, however, the concentrations of mercury, chlorinated hydrocarbon pesticides, PCBs, and dioxins are found to be excessive in Putah Creek fish, then studies should be conducted to determine whether the stormwater runoff of these constituents from the LEHR site is a contributor to the excessive levels. There are several well-established techniques that can be used to do this, such as those developed by the US EPA and Corps of Engineers (1991, 1998) in their dredged sediment evaluation manuals. If the constituents are found to be in nonbioavailable forms through these testing procedures, both within the stormwater runoff and in their receiving waters, then it may be concluded that the constituents in the stormwater runoff from LEHR site are not likely significant contributors to the excessive bioaccumulation problem.

It is important, however, in making this evaluation to properly consider the aqueous environmental chemistry of the constituents. For example, the bioaccumulation of mercury is well-known to be dependent on certain types of environmental situations such as anaerobic sediments. Therefore, conditions that either promote the development of anaerobic sediments or, where conditions exist, may convert nonbioavailable mercury, such as possibly in LEHR site stormwater runoff, to bioavailable mercury that, in itself or in combination with other mercury sources that are also bioavailable at that location, lead to excessive tissue residues in aquatic life.

Summary

The approach that has been proposed by DOE through its consultant, Weiss Associates, for evaluating the potential hazards of chemical constituents in the LEHR national Superfund site western dog

pen surface soils is significantly deficient. This approach fails to consider the absolute hazard that constituents represent to public health and/or the environment. The bioaccumulation route of uptake, as it may impact tissue residues in Putah Creek fish and other edible aquatic life, must be incorporated into a reliable assessment of whether chemical constituents in the surface soils at the LEHR site, including the western dog pens, are a significant threat to public health and/or the environment. Failure to incorporate this route of exposure in an evaluation of public health and environmental hazards of constituents in the western dog pen surface soils represents a fundamentally flawed approach.

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