

## Memorandum

To: James D. Werner, Director of Air & Waste Management

Through Kathy Stiller Banning, Program Manager II  
Tim Ratsep, Program Manger I

RE: Recommendation concerning sampling for dioxin<sup>1</sup> at Hercules Golf Course

From: Stephen F. Johnson, PE

Date: May 1, 2007

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The purpose of this memo is to respond to questions and comments presented to the Site Investigation and Restoration Branch (SIRB) at the public meeting held on March 21, 2007. The meeting concerned the cleanup and development of the Hercules Golf Course in New Castle County. A copy of the comment regarding dioxin sampling is attached to this memo.

After an extensive review of the existing literature and information, the SIRB recommends against sampling for dioxin. The SIRB's reasoning is summarized in the *Findings* and *Conclusions* below.

The SIRB recognizes that decisions of this nature are not made on a purely technical basis and that there may be other reasons to proceed with a sampling program. Dioxin is frequently "featured" in the news media and has extreme negative associations for most people. Three examples are the recent dioxin poisoning of Viktor Yushchenko, the industrial accident at Seveso, Italy and, notoriously, dioxin in Agent Orange used by the US Air Force in Vietnam.

Dioxin is also in the news because it is controversial in the scientific world. There is a wide range of expert opinion on its toxicity and carcinogenicity. Judging by information available on the world wide web, new dioxin studies are frequently greeted with charges of "junk science" by those who have formed differing conclusions. The dioxin debate combined with the strong feeling against the re-development of the Hercules site makes for a contentious issue. Therefore, the SIRB recognizes that there unusual public relations aspects to both dioxin and this specific project that may support sampling.

A caution: if the decision is made to sample for dioxin, then it should not establish a precedent to perform similar sampling at other sites. Sampling for dioxin should always be a site by site decision. If sampling does occur, the sampling plan should consider that dioxin is ubiquitous in the environment. Care should be taken to establish a background data set to which the site information can be usefully compared.

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<sup>1</sup> Dioxin is the name of a family of over 200 related compounds which vary significantly in toxicity. The most toxic form is 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Concentrations of complex mixtures of dioxins are usually stated as Total Toxic Equivalenty (TEQ) to TCDD.

## **Findings**

The SIRB pursued two lines of inquiry to address the comments concerning dioxin:

- First the SIRB examined available published documents on the chemical dioxin, its environmental persistence, presence in herbicide and presence in soil as a result of herbicide application. Among other sources, the SIRB relied on a summary document compiled by its contractor, the environmental consulting company, CDM. The CDM report is attached as a useful and readable summary. It is also thoroughly referenced.
- Second, the SIRB inquired through an extensive network of federal and state site cleanup programs as to the regulatory practice in other jurisdictions pertaining to testing for dioxin at golf courses and other herbicide application sites.

### *Dioxin contamination in commercial weed killer*

Various authorities confirm that dioxin compounds may be present in 2,4,-D. Its presence in 2,4,5-T has been repeatedly confirmed and contributed to the ban of 2,4,5-T. The process used to produce 2,4,5-T was apparently more likely to produce dioxin as a by-product. Since 1990, the presence of dioxin in 2,4-D has been limited to 1 ppm by federal regulation.

### *Weed killer use at Hercules Golf Course*

2,4-D application is noted in Hercules Golf Course pesticide application logs that go back to 1970. The logs do not show any use of 2,4,5-T. However, 2,4,5-T was banned for use on turf grass in 1970, so logs do not cover the period when it could have been legally used. The SIRB found one turf management magazine recommending use of 2,4,5-T to control clover (Daniel). If 2,4,5-T were ever applied to the golf course, it was prior to 1970.

### *Dioxin persistence*

Dioxin is frequently described as a persistent compound. However, there is a difference between dioxin accumulation in the food chain and dioxin in the environment. When a herbicide is applied to green plants, most of the dioxin that may be present in it sticks to plant matter where it is photo-degraded and never reaches the soil (Nathan). Soil tests taken over a ten year period in an Agent Orange test area showed a 99% reduction in dioxin concentrations in soil (Young).

The SIRB reviewed a report on dioxin sampling along a pipeline in Alaska that received documented treatment with 2,4,5-T containing herbicides between 1955 and 1970 (USACE). Sampling occurred in 2003. None of the 23 sample results exceeded the State of Alaska's risk based cleanup of 39 ng/kg. Four were between 3.9 ng/kg and 39 ng/kg. (The SIRB's guidance gives a screening concentration of 4 ng/kg [parts per trillion]).

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### *Practices in other states*

The SIRB has not found a single instance in which a state or federal cleanup program required testing for dioxin at a golf course site due to herbicide application. Several experts and experienced program managers explicitly stated that they had never heard of this being done. This is significant given that inorganic contaminants in golf course soil are receiving heightened attention in the site cleanup field. However it should also be noted that agricultural chemicals are excluded from most state cleanup programs.

The commenter referred specifically to the State of Oregon's "Guidance for Evaluating Residual Pesticides on Lands Formerly Used for Agricultural Production" as requiring dioxin testing (Oregon). In fact, the guidance recommends sampling for dioxins in cases where 2,4,5-T is known to have been applied. Known applications of 2,4-D are reviewed individually. The Oregon web page does not list any cleanup sites where dioxin contamination in soil was caused by herbicide application, either 2,4-D or 2,4,5-T.

The SIRB did find two instances of dioxin testing on golf courses at US Air Force bases, but both had suspected dioxin sources off the golf course and were not related to the usual application of herbicides.

### **Conclusions**

In the opinion of the SIRB, the weight of evidence is that dioxin released during the application of herbicide would not persist at significant levels in soil for the 37 years since 1970. More recent applications of 2,4-D (rather than 2,4,5-T) would have had very little or no contamination by dioxin.

The remedial action proposed for the inorganic contaminants, soil removal and blending, would be reasonably expected to reduce the volume and concentrations of any dioxins that might be present on the site.

The SIRB found no regulatory precedent in other jurisdictions to require sampling for dioxin at a golf course due to herbicide application.

### **References**

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