



**INTER-OFFICE COMMUNICATION  
PALM BEACH COUNTY  
FACILITIES DEVELOPMENT & OPERATIONS**

**DATE:** December 19, 2008

**TO:** Edward Lowery, Director, Housing and Community Development

**FROM:** John Tierney, Regulatory Specialist, Facilities Compliance

**RE:** URS Corporation  
**Human Health Risk Assessment**  
Villa Lago Subdivision  
South Bay, Florida

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URS Corporation (URS) completed a Human Health Risk Assessment, December 15, 2008, for the Villa Lago Subdivision property (subject property) located at the northwest corner of the intersection of Island Road and N.W. 1<sup>st</sup> Avenue (aka North New River Canal Road) in South Bay, Florida. It should be noted that the full report should be read in its entirety and that the below information provides a brief summary of the report.

### **Background**

Dunkelberger Engineering & Testing, Inc. (DET) completed an Enhanced Phase I ESA of the approximately 33 acre subject property in July 2007. The property contained approximately 96 housing units (duplexes) owned and operated by Centro Campesino, Inc. as affordable housing for migrant farm workers. Other structures within the subject property include an approximately 5,500 sf single story day care facility, a 2,700 sf single story church, an approximately 1,632 sf sales/rental office, a 1,350 sf single story corrugated metal maintenance building and a 1,750 sf single story concrete block maintenance structure. The structures were constructed in the mid 1970s, prior to which the property was agriculturally developed land dating back to at least 1930.

As part of the Phase I ESA, DET conducted a Limited Soil Quality Evaluation to evaluate potential impacts from possible past agrichemical use at the subject property. The assessment involved the collection of eight soil samples from four locations at the property. The sample locations were designated as SS-1 through SS-4 and samples were collected at depths of 0 to 1.5 feet below land surface (bls) and 1.5 to 3 feet bls. DET indicated that the upper 1.5 feet was fill material brought in during residential development of the property. The 1.5 to 3 foot depth soils were believed to be native soils. The 0 to 1.5 foot bls samples were designated as A samples and the 1.5 to 3 foot

bls samples were designated as B samples. Laboratory analysis identified concentrations of arsenic and dieldrin above their respective residential direct exposure (RDE SCTL) soil cleanup target levels. Additionally, concentrations of toxaphene were also above their SCTL. The presence of arsenic, dieldrin and toxaphene at concentrations above regulatory levels was considered to be a recognized environmental condition. Based on review of the DET report it was recommended that a Phase II ESA be completed for the property.

URS Corporation completed a Phase II ESA of the subject property in December 2007. To further evaluate soil conditions at the subject property, URS subdivided the Villa Lago property into 2 acre grids and installed soil borings (S-1 through S-15) in each grid to a depth of 0 to 1.5 to 2 feet bls. At five additional locations (S-2, S-4, S-6, S-9, and S-14) the borings were advanced one additional foot deeper. Soil samples were collected from two intervals: a shallow interval (0 to 1.5 or 2 feet bls) and a deeper interval (1.5 to 2.5 or 2 to 3 feet bls). Concentrations of dieldrin and arsenic were identified throughout the shallow interval (backfill material) above Residential Direct Exposure (RDE) SCTLs. The underlying muck is also impacted with arsenic and dieldrin at concentrations above the RDE SCTLs.

Temporary monitoring wells were installed at the S-4, S-6 and S-14 locations and were identified as TMW-4, TMW-6 and TMW-14. Groundwater samples were collected from each temporary monitoring well and laboratory analyzed for organochlorine pesticides, arsenic and copper. Laboratory analysis did not identify any organochlorine pesticides at concentrations above laboratory method detection limits. Groundwater samples collected from TMW-6 and TMW-14 exhibited low levels of arsenic at 0.005 milligrams per liter (mg/l) and 0.003 mg/l, respectively. These concentrations were below the Groundwater Cleanup Target Level of 0.10 mg/l for arsenic. The groundwater sample from TMW-14 also exhibited copper at 0.012 mg/l, which is below the GCTL of 1.0 mg/l for copper. The other samples did exhibit detectable concentrations of arsenic or copper.

## **Human Health Risk Assessment**

The Human Health Risk Assessment (HHRA) was conducted to characterize chemicals of potential concern (COPCs), to evaluate the extent of impacted soils and to assess the risks and hazards to human health in the event that no action is taken to abate the contaminants.

The HHRA consisted of: an evaluation of site data and identification of site specific chemicals of potential environmental concern; an exposure assessment that included a site conceptual model, identification of potentially exposed receptor populations and exposure assumptions; a toxicity assessment that identified the critical toxicity values used to evaluate the COPCs; a risk characterization section that identified risk

estimates for the Reasonable Maximum Exposure (RME) and Central Tendency Exposure (CTE) scenarios and present equations used to perform risk calculations; an uncertainty analysis that identified the primary sources of uncertainty inherent in the risk assessment process; and a summary/conclusion section that presented the investigation results and provided recommendations based on the results of the risk evaluation.

The elements of the investigation are briefly discussed below.

### **Chemicals of Potential Concern**

Based on the results of the Phase I and II ESA investigations, the following chemicals were identified as COPCs in surface soil (0 to 1.5 feet below land surface [bls]): dieldrin, arsenic and copper. The following chemicals were identified in total surface and subsurface soil (0 to 3 feet bls): 4,4-DDE, dieldrin, arsenic and copper. Although the other pesticides did not exceed SCTLs, 4,4-DDD and chlordane were also included in the risk assessment to account for cumulative risk.

The exposure point concentrations (EPCs) for surface and total soils were developed to evaluate exposure for the potential receptors. The resident and groundskeeper were assumed to be exposed to surface soil only (0 to 1.5 feet bls). Surface soil and subsurface soil (1.5 feet to 3.0 feet bls) were combined for the excavation worker, residential gardener and for the purpose of evaluating residential produce ingestion.

### **Exposure Assessment**

The exposure assessment portion of the report identified the potential receptors, identification of potentially complete exposure pathways and identification of assumptions used to estimate exposure to receptors. As the Villa Lago property is a residential development, the potential receptors were identified as the resident, resident gardener, excavation worker and groundskeeper. The resident scenario assumes a full time resident exposed to surface soil (0 to 1.5 foot) on a daily basis. A combined age-adjusted adult and child scenario (0 to 30 years) was evaluated. This scenario also factors in produce gardening which occurs in the surface soil. The resident gardener is an adult resident assumed to be exposed to surface and subsurface soil for a limited time while digging and/or planting. The excavation worker scenario includes individuals who may be exposed to surface and subsurface soils during some type of intrusive activity (excavation).

Included in the exposure assessment is a produce ingestion which was evaluated for the residential scenario. The consumption of homegrown produce was evaluated for three different produce intake rates. Three age groups were evaluated (ages 1-8, 8-15 and 18-31) and averaged to determine lifetime daily produce intake rates. The produce ingestion was evaluated for three different sizes of garden. The large garden scenario

assumed 8 categories of fruit and vegetable consumption; the small garden scenario assumed 4 categories of fruit and vegetable consumption; and the limited garden scenario assumed 2 categories of fruit and vegetable consumption. Additionally, the percentage of produce intake solely from home gardens was evaluated based on two scenarios. The first is the produce ingestion model developed by the Massachusetts Department of Environmental Protection which assumes that 25 percent of annual produce intake will be from the home garden. The second scenario is based on information from the USEPA Exposure Factors Handbook which assumes that, on average, less than 10 percent of produce intake comes from home gardens.

An exposure pathway is the mechanism by which a receptor may come into contact with a chemical. As defined in the Risk Assessment Guidance for Superfund (RAGS; USEPA 1989) four major elements characterize a complete exposure pathway. These elements are: a source and mechanism of chemical release; a transport medium for the chemical; a point of potential receptor contact with the medium; and a route of exposure (e.g. ingestion) for the receptor to come into contact with the chemical.

For an exposure pathway to be complete, all four elements must be complete. The absence of any one of the elements results in an incomplete exposure pathway for which site related health risks do not exist. Potential exposure routes could include direct dermal contact, incidental ingestion, or inhalation of airborne particulate matter.

In order to calculate the chronic daily intake of chemicals from exposure to contaminated soils and estimate the potential health risks, a number of exposure assumptions were quantified. The exposure values used were selected from the Exposure Factors Workbook OSWER Directive 9285.6-03 (Standard Default Exposure Factors; USEPA 1991), and RAGS (USEPA 1989). To provide an estimate of the likely range of risks that could occur for these populations, exposures were evaluated for both Reasonable Maximum Exposure (RME) and Central Tendency (average) Exposure (CTE) scenarios.

## **Toxicity Assessment**

The toxicity assessment provided a summary of the critical toxicity values (CTVs) that have been developed by the USEPA to evaluate potential adverse health effects associated with chemical exposure. The non-carcinogenic CTV is known as the reference dose (RfD), while the carcinogenic CTV is the slope factor (SF). Both RfDs and SFs are developed from human and animal studies and are designed to be health protective (i.e. to over-estimate the actual risk).

RfDs, used to evaluate non-cancer effects, are based on the premise that non-carcinogenic effects (toxic effects) exhibit a threshold. As long as the CDI of a compound is less than the RfD, exposure is unlikely to result in any adverse (non-

carcinogenic) health effect. The potential for non-carcinogenic effects to occur as a result of exposure is evaluated by comparing the exposure level over a specified time period with the RfD derived for a similar exposure period. A Hazard Quotient (HQ) is derived for each chemical and is the exposure is equivalent to or less than the RfD, the HQ is 1.0 or less, which represents an intake level unlikely to be associated with potential adverse effect due to the chemical. If exposure exceeds the RfD, the resulting HQ exceeds 1.0, indicating that a hazard may exist. In the HHRA, a HQ is derived for each non-carcinogenic COPC for each exposure pathway. HQs for each chemical are then summed for each exposure pathway to derive a value referred to as a Hazard Index (HI). HIs greater than 1.0 generally indicate that exposure to a particular medium represents a potential health hazard. HIs are summed across pathways whenever appropriate since individuals may be simultaneously exposed to chemicals by more than one pathway.

Slope Factors, used to evaluate potential carcinogenic effects, are developed based on a dose response curve for carcinogenicity of the specific chemicals. Risks associated with the COPCs are derived by multiplying the SF and the estimated chronic daily intake for each exposure pathway. An overall risk estimate for each exposure scenario is calculated by combining the risk estimates for the individual chemicals and exposure routes. Risk estimates were then compared with the USEPA's risk range of  $1E-06$  (1 in 1,000,000) to  $1E-04$  (1 in 10,000) to incremental excess lifetime cancer risk. The concept of an acceptable risk of  $1E-06$  of developing cancer means an increased lifetime chance of 0.0000001 in 1.

### **Risk Characterization – Villa Lago**

The purpose of risk characterization was to quantify the potential health risks associated with site specific contamination only. Naturally occurring chemicals found below background levels were not evaluated. The potential risks for each COPC and exposure pathway were calculated and are provided below.

Resident exposed to surface soil – the summed cancer risks for all chemicals and pathways was  $9E-06$  for RME and  $3E-06$  for CTE. This is within the USEPA's risk range of  $1E-06$  to  $1E-04$ . The cumulative HI was 0.1 for RME and 0.06 for CTE which are below the target hazard index of 1.0.

Resident gardener exposed to surface and subsurface soil – the summed cancer risk was  $5E-07$  for RME and  $2E-08$  for CTE which are below the USEPA's risk range. The cumulative HI was 0.005 for RME and 0.0004 for CTE which are below the target hazard index of 1.0.

Produce ingestion pathway for residents for three garden size scenarios (large garden, small garden and limited garden) as well as for two percentages of produce consumed

solely from a home garden (25 percent and 10 percent) on an annual basis. The 25 percent scenario is identified as the RME and the 10 percent scenario is identified as the CTE. Large Garden RME - summed cancer risk of  $1E-04$  which is at the USEPA's target risk range and a cumulative HI of 2.5 which is above the target hazard index. Large Garden CTE – summed cancer risk of  $4.E-05$  which is within the USEPA's risk range and a cumulative HI of 1.0 which is at the target hazard index.

Small Garden RME – summed cancer risk of  $5E-05$  which is within the USEPA's risk range and a cumulative HI of 1.3 which is above the target hazard index. Small Garden CTE – summed cancer risk of  $2E-05$  which is within the USEPA's risk range and a cumulative HI of 0.5 which is below the target hazard index.

Limited Garden RME– summed cancer risk of  $3E-05$  which is within the USEPA's target risk range and a cumulative HI of 0.6 which is below the target hazard index. Limited Garden CTE – summed cancer risk of  $1E-05$  which is within the USEPA's risk range and a cumulative HI of 0.2 which is below the target hazard index.

Excavation worker exposed to surface and subsurface soil – the summed cancer risk was  $4E-07$  for RME and  $1E-07$  CTE which are below the USEPA's risk range. The cumulative HI was 0.06 for RME and 0.02 for CTE which are below the target hazard index.

Groundskeeper exposed to surface soil – the summed cancer risk was  $5E-07$  for RME and  $2E-08$  for CTE which are below the USEPA's risk range. The cumulative HI was 0.003 for RME and 0.0008 for CTE which are below the target hazard index.

## **Summary and Conclusions**

The risk assessment evaluated potential exposure to surface and subsurface soil containing 4,4-DDD, 4,4-DDE, dieldrin, chlordane, arsenic and copper at the Villa Lago development. Risks and hazards were evaluated for the age adjusted resident, adult resident gardener, excavation worker, groundskeeper and consumption of homegrown produce by the resident. The risk due to direct contact with soil was within or below the target risk range of  $1E-06$  to  $1E-04$  established by the National Oil and Hazardous Substances Pollution Contingency Plan (USEPA, 1990) and below the target hazard index of 1 for all evaluated receptor populations with the exception of the scenarios with the two highest produce ingestion rates. Ingestion rates of homegrown produce can vary depending upon assumptions regarding overall produce intake, percentage of intake that is homegrown and whether the average intake (CTE) rates or upper bound intake (RME) rates are used. Risks ranged from  $3E-05$  to  $1E-04$  for the RME and  $1E-05$  to  $4E-05$  for the CTE. The HI ranged from 0.63 to 2.5 for the RME and 0.25 to 1.0 for the CTE.

This indicated that detected concentrations of COPCs at the Villa Lago property do not pose an unacceptable level of cancer risk or non-cancerous health hazard for the average exposures (CTE) evaluated in this HHRA, but may pose a risk for the conservative RME scenarios.

*Based on the above information, it is recommended that the HHRA be provided to the County Attorney's office for review as well as to applicable regulatory agencies for their review and comment. Any comment or requirement from any of these agencies would supersede the below.*

*Review of the report indicated that only the scenarios with the two highest produce ingestion rates (RME scenarios for the large and small gardens) had cumulative HI's above 1. The summed cancer risks for all scenarios considered, and the cumulative HI's for the remaining scenarios, were within or below USEPA's risk range (1E-04 to 1E-06) and target HI (equal to or less than 1), respectively. Although it is considered unlikely for the two highest produce ingestion rates to occur, it is believed that appropriate methods should be put in place to eliminate the possibility of those scenarios at the subject property. It is recommended that a limit on garden size be put in place to eliminate the possibility of the highest levels of produce consumption. It is understood that the property is a mix of occupied residences and residences that are to be rehabilitated for occupation. Therefore, existing and future tenants should be informed of the potential for risk and any control should apply to both existing and future residence owners.*

Should you have any questions with regard to the above information, please contact me at 233-0252.

JET:jet

Attachment: URS Corporation Phase II ESA Report

cc: Shannon LaRocque, Assistant County Administrator  
Audrey Wolf, Director, FD&O (w/o attachment)  
Ross Hering, Director, PREM (w/o attachment)  
Elena Escovar, Manager – Planning, HCD (w/o attachment)  
Michael Sklar, Planner II, HCD  
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