ATTACHMENT 15

CONCRETE MANAGEMENT PROGRAM

CONCRETE MANAGEMENT PROGRAM PROCEDURES

1.0 Introduction

This attachment describes the Concrete Management Program (CMP) proposed by the World Resource Company (WRC). The CMP has two principal purposes. The first is to increase the likelihood that WRC's Hazardous Waste Management Unit (HWMU) may be closed in accordance with relevant closure criteria set forth in the Closure Plan's Section 11.4, *i.e.,* compliance with *non-residential* soil remediation standards and the minimum groundwater protection levels (GPLs), or other GPLs approved by the Arizona Department of Environmental Quality. The second purpose is to recognize WRC's voluntary objective of achieving clean closure, *i.e.*, compliance with *residential* soil remediation standards and minimum GPLs, or other GPLs approved by the Arizona Department of Environmental Quality. Compliance with the Section 11.4 criteria will require a Declaration of Environmental Use Restriction (DEUR) but ensures that post-closure structures such as a landfill-like cap will not be required. Achievement of clean closure eliminates the need for a DEUR, as would otherwise be required for properties that are remediated to the non-residential soil remediation standards or that require engineered structures to meet post-closure criteria.

The CMP is designed to minimize the potential for the migration of hazardous constituents into the HWMU's concrete floor and the soil layer between the concrete and the underlying membrane liner. It is also designed—if damage to the lowermost liner is observed during the replacement of damaged concrete and the sampling of the underlying soil layer—to provide data regarding the extent of constituent migration in damaged concrete, the underlying soil layer, and the soil below the lowermost membrane liner.

In accordance with the procedures and schedules described in Section 6 of the RCRA permit application, portions of the HWMU's concrete floor will be inspected on a daily basis, and the entire surface at least annually. The observations made during the inspections and any resulting repairs or replacement of the concrete will be documented using the inspection form in Section 6, or a similar form that is at least as comprehensive as that form. The sampling logs, analytical data, and records regarding replacement of concrete and underlying soil will be maintained at the WRC facility until closure of the HWMU has been approved by ADEQ.

The CMP includes sampling and analytical procedures used to produce data needed for comparison with the action criteria described in Section 2.8 below. However, the CMP will remain in effect only until the Closure Plan goes into effect following notice of final closure as provided in Section 11.1 of the Closure Plan. The determination of compliance with the closure criteria set forth in Section 11.4 of the Closure Plan will be based on data developed in accordance with the sampling and analytical procedures set forth therein.

2.0 Procedures

2.1 Criteria for Concrete Repair and Replacement

The objective of concrete repair is to maintain the integrity and effective life of the HWMU concrete floor before degradation of damaged concrete potentially results in a release pathway through the concrete and to underlying soils. The objective of the concrete replacement is to replace damaged portions of the HWMU concrete surface that cannot be repaired with a reasonable assurance

that the repaired portion will not include release pathways through the concrete. Replacement of the damaged portions of the concrete surface therefore minimizes the potential for the migration of hazardous constituents into the soil layer below the concrete floor.

WRC developed the narrative criteria provided below for the repair and replacement of the HWMU concrete surface as part of the inspection program described in Section 6 of the RCRA permit application. Results of the concrete surface inspection procedures are compared against objective criteria to determine whether repair is appropriate or replacement is necessary.

2.2 Concrete Surface Repair Criteria

Repair activities will be conducted if any of the following is observed:

- Linear types of cracks found to be wider than 0.125 inch at the surface or deeper than 0.5 inch are designated to be repaired;
- Construction or expansion joints exhibiting evidence of deterioration of the joint sealant; and
- Deterioration of the concrete surface includes breaking, splitting, and separation of the sealant from the joint, but not discoloration, minor wear, and other non-substantive conditions.

When crack repair is required, a concrete saw or a hand grinder with a diamond-tipped "crack chaser" is used to prepare a clean, uniform surface. The cut or grinded surface is cleaned by vacuum. The cut or grinded crack is then filled with an appropriate commercial sealant and allowed to cure. On completion, the surface is coated with a chemically resistant sealant.

2.3 Concrete Surface Replacement Criteria

Concrete will be replaced if any of the following is observed.

- Corner break: A corner break is a crack that intersects the joints at a distance less than or equal to one-half the slab length on both sides, measured from the corner of the slab.
- Linear or diagonal cracking affecting the structural integrity of section. These cracks would normally divide the slab into two or three pieces. They are differentiated from linear types of cracks that simply need repair at the point where multiple repairs (three or more) are required for a particular crack.
- Map or pattern cracking within a contiguous area exceeding 150 square feet. Map or pattern cracking is a series of cracks that extend only into the upper surface of the pad.
- Erosion of the concrete surface exceeding 0.5 inch within a contiguous area exceeding 150 square feet.

When replacement of a portion of the concrete floor is required, the designated area for replacement will be cordoned off, the location documented, and recyclable material within the cordoned-off area will be removed. The area cordoned off will initially include an area at least six inches beyond all evidence of irreparable damage to the concrete or to the distance of an intact construction or expansion joint if the joint is less than six inches from the damaged concrete. The area will be swept clean in preparation for repairs.

2.4 Sampling of Removed Concrete and Materials in Soil Layer

Samples of concrete will be collected at locations where maximum constituent concentrations are expected based on the locations of observed seams and cracks, as well as any visible staining that is observed on the concrete. Samples will be collected from the soil and other material located between the sampled concrete and the membrane liner below the soil layer. If that liner appears to be damaged and there is no lower membrane liner, samples of soil below the damaged liner will be collected for analysis before the liner is repaired. If there is a membrane liner below the damaged liner, the soil layer immediately below the two liners will be sampled and the integrity of the lower liner will be observed. If the lower liner appears to be damaged, samples of soil below the damaged portion of the liner will be collected before the lower liner is repaired, the soil layer between the two liners is replaced, and the upper liner repaired. Sampling and removal activities described above will be expanded horizontally where removal of contiguous concrete is indicated by observed conditions in, or analytical results obtained from, impacted concrete or an impacted soil layer.

Sample management procedures described below will apply to all CMP samples. Sampling will be conducted using a decontaminated stainless-steel spoon or disposable sampling trowel for each different media at each sampling location. All samples collected and analyzed as part of the removal of a specific portion of the concrete floor will be identified and reported as such.

Removed materials will be characterized by sampling and analysis in accordance with procedures of Sections 2.5 and 2.6 below. The removed materials may be placed into containers or roll-off bins, covered, and labeled while awaiting analytical results, or temporarily stockpiled on a decontaminated portion of the HWMU and covered with a tarp or plastic sheeting. Replacement soil and concrete will be analyzed for the metals listed in Section 2.5 below.

2.5 Characterization of Removed Concrete, Replacement Cement and Materials in the Soil Layer

Characterization of removed concrete, replacement cement, material in the soil layer, and the soil below the portions of the lowermost membrane liner where damage was observed during replacement activities will include the analysis of all metals and cyanides that form the basis for demonstrating clean closure. The samples will be analyzed by an Arizona Department of Health Services certified laboratory for the constituents and methods described below:

- Total aluminum, antimony, arsenic, barium, beryllium, cadmium, cobalt, copper, chromium, lead, manganese, nickel, selenium, silver, thallium, tin, vanadium, and zinc using United States Environmental Protection Agency (USEPA) Test Methods 3050 (sample preparation) and 6010B (sample analysis);
- Total mercury using USEPA Test Methods 3050 (sample preparation) and 7471 or equivalent (sample analysis);
- Total and amenable cyanide using USEPA Methods 9010C or 9012B; and
- Total hexavalent chromium using USEPA Test Methods 3060 (sample preparation) and 7196 (sample analysis) if total (trivalent chromium) exceeds 30 milligrams per kilogram (mg/kg). (Samples will be extracted and held for possible hexavalent chromium analysis, pending the results of total chromium analysis).

2.6 Toxicity Characteristic, Treatment Standards for Hazardous Wastes and Universal Treatment Standard Criteria

The following table describes analyses that may be required for purposes of characterization of waste for shipment to off-site disposal facilities. It includes the Toxicity Characteristics (TC) and Universal Treatment Standards (UTS) for the Resource Conservation and Recovery Act (RCRA) "Eight" metals and the Underlying Hazardous Constituents for the D004 through D011 Waste Codes. It also includes the Treatment Standards for Hazardous Waste (TSHW) criteria for F006 and F019 waste. The criteria are presented in two forms. The first is based on the Toxicity Characteristic Leaching Procedure (TCLP) and the values are presented in milligrams per liter (mg/l). The second form is based on total metals (TM) analysis and the "20 times" rule and the values are presented in mg/kg. If the TM analyses specified in the following table yield concentrations less than the concentrations presented as mg/kg, analyses based on the TCLP will not be required.

Applicable Toxicity Characteristic (TC) Criteria, Treatment Standards for Hazardous Wastes Criteria and Universal Treatment Standards (UTS) Criteria[1]

Metals	TC Criteria[2]	UTS Criteria[3]	TSHW Criteria[5]
RCRA Eight Metals			
D004, Arsenic	5.0 mg/l, 100 mg/kg	5.0 mg/l, 100 mg/kg	
D005, Barium	100.0 mg/l, 2,000 mg/kg	21 mg/l, 420 mg/kg	
D006, Cadmium	1.0 mg/l, 20 mg/kg	0.11 mg/l, 2.2 mg/kg	
D007, Chromium (total)	5.0 mg/l, 100 mg/kg	0.6 mg/l, 12 mg/kg	
D008, Lead	5.0 mg/l, 100 mg/kg	0.75 mg/l, 15 mg/kg	
D009, Mercury	0.2 mg/l,4.0 mg/kg	0.025 mg/l, 0.5 mg/kg	
D010, Selenium	1.0 mg/l, 20 mg/kg	5.7 mg/l, 114 mg/kg[6]	
D011, Silver	5.0 mg/l, 100 mg/kg	0.14 mg/l, 2.8 mg/kg	
F006 and F019 Waste			
F006, Cadmium			0.11 mg/l, 2.2 mg/kg
F006, Chromium (total)			0.6 mg/l, 12 mg/kg
F006, Nickel			11 mg/l, 220 mg/kg
F019, Chromium (total)			0.6 mg/l, 12 mg/kg
F006 and F019, Total Cyanide			590 mg/kg[4]
F006 and F019, Free Cyanide			30 mg/kg[4]
Applicable Underlying Hazardous Constituent Criteria for D004 through D011 Waste Codes			
Antimony		1.5 mg/l, 30 mg/kg	
Beryllium		1.22 mg/l, 24.4 mg/kg	
Thallium		0.2 mg/l, 4 mg/kg	

[1] USEPA Test Methods 1311 (TCLP) followed by Method 6010B (sample analysis for all metals except mercury), and 7471 (for mercury analysis) or, for total metals (Method 3050 (sample preparation) followed by Method 6010B (sample analysis for all metals except mercury), and Method 7471 (for mercury analysis).

[2] Value from R18-8-261.24, Table 1: first value based on TCLP analysis; second value based on TM analysis and 20 times rule.

[3] Value from R18-8-268-48, Universal Treatment Standards Table, Nonwastewater Standard: first value based on TCLP analysis; second value based on TM analysis and 20 times rule.

[4] Both Total Cyanides and Amenable Cyanides are to be analyzed using USEPA Test Method 9010C and Method 9012B, respectively, with a sample size of 10 grams and a distillation time of one hour and 15 minutes.

[5] Treatment Standards for Hazardous Wastes Table, Nonwastewater Standard: first value based on TCLP analysis; second value based on TM analysis and 20 times rule.

[6] This constituent is not an underlying hazardous constituent as defined at § 268.2(i) of this part because its UTS level is greater than its TC level, thus a treated selenium waste would always be characteristically hazardous, unless treated to below its characteristic level (R18-8-268.48, Footnote 7).

mg/l = milligrams per liter

mg/kg = milligrams per kilogram

2.7 Sample Documentation

Information will be recorded on chain-of-custody forms, sampling log sheets, and a field notebook.The field notebook is used to keep a diary of field activities and to record pertinent data that are not necessarily included on the chain-of-custody form or the sampling data log sheet. The information recorded on the sampling data sheets includes the following:

- Sample identification number recorded on the container label;
- Type of sample, e.g., concrete, soil within soil layer, soil beneath the lowermost liner;
- Sample location number;
- HWMU Site Map/Site Inspection Log, Section 6 of RCRA Permit Application, showing sample location (by sample location number) relative to area (pad) being sampled;
- Random or biased sampling location coordinates;
- Sampling equipment used;
- Sampling depth (in inches if sample collected above lowermost membrane liner or in feet if sample is collected below lowermost liner);
- Moisture observations;
- Visual observations
- Sampling time and date; and
- Identification of blind duplicate samples and fictitious sampling times.

2.8 Evaluation of Concrete Management Program Data

As explained in Section 1.0, the CMP is designed to increase the likelihood that constituent concentrations in the HWMU's concrete floor, the soil layer between the concrete and the underlying membrane liner(s), and the soil below the lowermost liner will meet closure criteria set forth in Section 11.4 of the Closure Plan or criteria for clean closure. As also explained in Section 1.0, the CMP will not be in effect once the Closure Plan takes effect following notice of final closure in accordance with Section 11.1 of the Closure Plan. The data generated in accordance with the sampling and analysis procedures of the Closure Plan will be used to determine whether the required closure criteria have been met. The criteria for clean closure include compliance with minimum or ADEQ-approved GPLs and residential (pre-determined or risk-based) soil remediation standards. The applicable criteria for closure as described in Section 11.4 of the Closure Plan include compliance with minimum or ADEQ-approved GPLs and non-residential (pre-determined or risk-based) soil remediation standards.

Existing data (Table 5 of the Demonstration) indicate that average concentrations of metals, except arsenic, are well below the clean closure criteria, i.e., the concentrations are well below minimum GPLs and well below residential pre-determined soil remediation standards. Arsenic is unique because its pre-determined residential and non-residential standards are both 10 mg/kg and that is the lowest concentration of all metals for which pre-determined soil remediation standards have been established. Still, as explained below, it is unlikely that the average arsenic concentration will exceed 10 mg/kg within the foreseeable future. Whenever it exceeds the pre-determined 10 mg/kg standard, a risk-based standard will be developed in accordance with R18-7-206 and submitted to ADEQ for approval.

Based on the average concentrations shown in Table 5, arsenic is the only metal likely to exceed a pre-determined residential soil remediation standard and require a risk-based standard. If other metals exceed the pre-determined residential standards, WRC may develop risk-based standards in

accordance with R18-7-206 and submit the standards to ADEQ for approval. WRC may develop the risk-based standards for either residential or non-residential use. However, a DEUR will be required if the data generated during closure indicate that the metal concentrations meet non-residential soil remediation standards (either pre-determined or risk-based).

Table 5 of the Demonstration includes average constituent concentrations and relevant criteria. As new data are generated, they will be added to the data base represented in Table 5 by the constituent concentrations in (1) the damaged concrete that is being replaced, (2) the replacement cement, and (3) the soil between concrete floor and the underlying membrane liner. Concentrations from a minimum of 10 separate samples concentrations is considered the minimum number required for a statistically representative concentration to be compared with the action criteria of Table 2-1 below. The table will be expanded to include constituent concentrations in the soil below the lowermost liner if samples are collected for soil below the lowermost liner. Constituent concentrations in the replacement cement will be monitored to provide an improved understanding of potential constituent migration. The replacement cement has no action criteria.

Because the concrete is not replaced unless it is determined to be damaged beyond the point of reasonable repair, the CMP data provides a conservative, if not a worse case, basis for projecting future constituent concentrations in the concrete and in the soil layer between the concrete and the underlying membrane liner, Those projections also serve as a basis for projecting worse-case conditions in soil below the membrane liner because there is no reason to assume that constituent concentrations below the membrane liner will be greater than the concentrations above the liner.

The data from the concrete replacement activities may tend to overestimate future constituent concentrations in the soil below the lowermost membrane liner. Even the replaced concrete may increase the degree of overestimation because it will act somewhat as a landfill cap and will tend to minimize further migration of constituents that might have migrated through the removed concrete. The CMP procedures importantly require soil sampling below any lowermost liner observed to be damaged during concrete replacement activities.

WRC will report the results of the CMP sampling and analysis activities to ADEQ annually. However, it will notify ADEQ within 30 days following the receipt of a final laboratory report that includes a constituent concentration, when added to the existing data base for that constituent, yields an average concentration that exceeds one of the action criteria listed in Table 2-1. The notification will include a description of what actions (*e.g.*, soil removal, development of an alternate GPL, or the development of a non-residential (risk-based) soil remediation standard) WRC proposes for determining whether a move to another stage will be necessary.

Although the CMP data likely overestimate constituent concentrations in soil below the lowermost liner, Table 2-1 requires WRC to either indicate its plans to remove impacted soil or to begin the preparation of a contingent closure plan and a contingent post-closure plan whenever laboratory data indicate that the Stage 3 action criteria are exceeded. If WRC elects to prepare contingent plans rather than attempting soil removal at that time, it may submit for ADEQ's approval a closure plan for a land-fill like cap to cover all, or a certain portion of the HWMU floor, depending on the horizontal extent to which constituent concentrations exceed the action criteria in the concrete floor and the soil layer between the concrete and the underlying membrane liner. The closure plans will be prepared in sufficient detail to provide a realistic cost estimate. The cost estimate will form the basis for the required financial assurance.

As used in this section, "action criteria" means the action criteria listed in Table 2-1 for Stages 1, 2, and 3. Constituent concentrations used to determine compliance with the criteria will be based on the 95% UCL of at least 12 discrete samples collected from portions of four separate concrete pads. The 95% UCLs will be calculated using ProUCL, a software package available from the

USEPA. ProUCL automatically converts and presents input data as a variety of mathematical distributions and identifies which of the distributions (and which of the 95% UCLs) are more appropriate than others. ProUCL 4.1.00.02 or the most recent version of ProUCL may be used.

ADEQ's approval will be required of risk-based soil remediation standards developed by WRC in accordance with R18-8-206. ADEQ's approval will also be required of either alternate GPLs or GPLs based on a groundwater model that are developed by WRC in accordance with ADEQ's guidance document, "A Screening Method to Determine Soil Concentrations Protective of Groundwater."

Analytical data generated from the analysis of samples collected to date as part of the CMP indicate that the average concentrations of metals, except the concentrations of arsenic, in removed portions of the concrete floor and in the underlying soil layer are well below the minimum GPLs and the residential, pre-determined, soil remediation standards of R18-8-205. Because the concentrations are so low, there is no pressing need to calculate their 95% UCLs. Arsenic is the exception because the predetermined residential and non-residential soil remediation standards of R18-8-205 are both 10 mg/kg, a value much smaller than residential pre-determined soil remediation standards for other metals. Because the average arsenic concentrations reported in Table 5 of the Demonstration are relatively close to arsenic's pre-determined standard of 10 mg/kg, 95% UCLs were calculated using ProUCL in the manner described above. The average concentrations from Table 5 and the 95% UCL concentrations at the date of this RCRA permit application are respectively:

- Cement – 6.08 mg/kg and 6.298 mg/kg, 95% KM(t);
- Concrete – 6.19 mg/kg and 6.871mg/kg, 95%KM (BCA) UCL; and
- Soil – 7.47 mg/kg and 7.917, 95% KM (BCA) UCL.

Note: As described in the ProUCL user's manual, "KM" refers to the Kaplan-Meier method for nonparametric statistics, and "BCA" refers to the Bias Corrected Accelerated Bootstrap method for nonparametric statistics.

The following criteria and follow-up actions will be used during the implementation of the WRC's Concrete Management Program. The action criteria reflect conditions that may require a move to the next stage. For example, the current CMP data place the CMP in Stage 1. Conditions that may cause a move to the next stage are shown as action criteria. The CMP will remain in Stage 1 provided that the necessary and appropriate follow-up actions are successfully completed. In this example, the CMP would move to Stage 2 if the follow up actions are not successfully completed or if WRC decides to voluntarily move to Stage 2 because the identified options are not economically viable.

Table 2-1. Concrete Management Program – Criteria and Follow-Up Actions		
Stage 1 Criteria	Stage 1 Action Criteria	Stage 1 Follow-Up Actions
Compliance with residential (pre-determined) SRLs Compliance with a minimum GPLs	Objective – Comply with Clean Closure Criteria Exceedance of a residential (pre-determined) SRL Exceedance of a minimum GPL	As necessary and appropriate: • Remove impacted soil • Remediate to a residential (risk-based) SRL • Remediate to an alternate GPL Move to Stage 2 if follow-up actions are not successful or are not economically viable.
Stage 2 Criteria	Stage 2 Action Criteria	Stage 2 Follow-Up Actions
Compliance with non-residential (pre-determined) SRLs Compliance with a minimum or alternate GPLs	Objective – Comply with Closure Plan's Section 11.4 Criteria Exceedance of a non-residential (pre-determined) SRL Exceedance of a minimum or alternate GPL	As necessary and appropriate: • Remove impacted soil • Remediate to a non-residential (risk-based) SRL • Remediate to an alternate or modeled GPL Move to Stage 3 if follow-up actions are not successful or are not economically viable.
Stage 3 Criteria	Stage 3 Action Criteria	Stage 3 Follow-Up Actions
Compliance with non-residential (pre-determined or risk-based) SRLs Compliance with alternate or modeled GPLs	Objective – Determine if Contingent Closure and Contingent Post-Closure Plans Are Required Exceedance of a non-residential (pre-determined or risk-based) SRL Exceedance of alternate or modeled GPL	As necessary and appropriate: • Remove impacted soil; or • Remediate to a non-residential (risk-based) SRL • Remediate to a modeled GPL If follow-up actions are not successful or are not economically viable or cannot be accomplished without use of post-closure structures and care, notify ADEQ of intent to begin preparation of Contingent Closure and Contingent Post-Closure Plans.

SRL = soil remediation level (soil remediation standard)
GPL = groundwater protection level