APPENDIX B – CORRECTIVE MEASURES STUDY (CMS), CORRECTIVE MEASURES IMPLEMENTATION (CMI) AND LONG-TERM SITE MANAGEMENT

1. OBJECTIVES

The objectives of the CMS and CMI are to evaluate corrective action alternatives and design and implement the chosen alternative as needed for protection of human health and the environment. The CMS and CMI shall be completed for each site that does not meet the risk based no further action (NFA) or industrial closure criteria outlined in Appendix A, Module IV, Utah Administrative Code (Utah Admin. Code) R315-101 and as recommended in approved Phase II Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Reports and CMS Workplans. The corrective action design and implementation information shall be included in the CMI plan.

1.A. Establish Corrective Action Objectives (CAO)

The CMS Workplan shall establish site specific CAOs. These objectives shall be based on public health and environmental criteria, information gathered during the RFI, Environmental Protection Agency (EPA) and State of Utah guidance, and the requirements of any applicable State and Federal statutes. Any corrective actions concerning groundwater releases must provide human health and environmental protection consistent with those required under Utah Admin. Code R315-101 and other requirements or groundwater management plans approved by the Director, Utah Division Waste Management and Radiation Control (Director).

2. DEVELOPMENT OF CORRECTIVE ACTION ALTERNATIVES

Based on the results of RFI, the Permittee shall identify, screen and develop the alternative(s) for removal, containment, treatment or other corrective action of the contamination based on the CAOs. This information shall be included in the CMS Workplan. This information shall be developed and reported as described below:

2.A. Description of Remedial Actions

The CMS Workplan shall include a statement of the purpose for the response. The statement of purpose shall identify the actual or potential exposure pathways that should be addressed by corrective measures. The RFI Reports and CMS Workplan shall also include information regarding previous response activities, interim measures and voluntary cleanup activities.

2.B. Screening of Corrective Measure Technologies

The Permittee shall review the results of the RFI to identify technologies, which are appropriate for the facility. The Permittee shall screen technologies and identify those having severe limitations, presenting, safety hazards for a given set of waste and site-specific conditions or do not meet the requirements of this permit or the Rules. The screening may eliminate technologies based on these criteria. Site, waste, and technology characteristics, which are used to screen inapplicable technologies, are described in more detail in following sections.

2.B.1. Site Characteristics and History

Site data shall be reviewed to identify conditions that may limit or promote the use of certain technologies. Technologies whose use is clearly precluded by site characteristics or safety hazards shall be eliminated from further consideration. If information that is classified by the U.S. Government will impact the CMS, and the Director has not reviewed or will not have access to this information, the existence of the classified information shall be identified in the CMS Workplan. The Permittee shall devise a way for the Director to review or be made aware of the essential elements of this information.

2.B.2. Waste Characteristics

Identification of waste characteristics that limit the effectiveness or feasibility of technologies is an important part of the screening process. Technologies clearly limited by these waste characteristics shall be eliminated from consideration. Waste characteristics particularly affect the feasibility of in-situ methods, direct treatment methods, and land disposal (on/off-site). For SWMUs where chemical warfare agent or chemical warfare agent residues are present, the Permittee shall identify chemical warfare agent surety or other Amy requirements that may impact use of certain technologies.

2.B.3. Technology Limitations

During the screening process, the level of technology development, performance record, and inherent construction, operation, and maintenance problems shall be identified for each technology considered. Technologies that are unreliable, perform poorly, or are not fully demonstrated shall be eliminated in the screening process. Technologies evaluated by the Interstate Technology Regulatory Council (ITRC) (see http://www.itrcweb.org/) may be favored for use with minimum requirements for site specific testing and prove-out.

2.C. Identification of Corrective Measure Alternatives

The Permittee shall develop the corrective measure alternatives based on the corrective action objectives, and shall report these alternatives in CMS Workplans. The Permittee shall rely on engineering practice to determine which technologies appear most suitable for the site. Technologies can be combined to form the overall corrective action alternative or alternatives. The alternative developed should represent a workable number of option(s) that appear to address all site problems and corrective action objectives. The Permittee shall document the reasons for excluding technologies.

3. EVALUATION OF THE CORRECTIVE MEASURE ALTERNATIVES

The Perrnittee shall describe each corrective measure alternative that passes the screening as described in Condition 2 above, and evaluate each corrective measure alternative and its components. The evaluation shall be based on technical, environmental, human health and institutional concerns. The Permittee shall also develop cost estimates of each corrective measure.

3.A. Technical/Environmental/Human Health/Institutional

The Permittee shall evaluate each alternative using the following criteria outlined in the below sections.

3.A.1. Technical - The Permittee shall evaluate each corrective measure alternative based on performance, reliability, implementability, and safety.

a. The Permittee shall evaluate performance based on the effectiveness and useful life of the corrective measure:

i) Effectiveness shall be evaluated in terms of the ability to perform intended functions, including but not limited to containment, diversion, removal, destruction, or treatment. The effectiveness of each corrective measure shall be determined either through design specifications or by performance evaluation. The evaluation shall also consider the effectiveness of combinations of technologies; and

ii) Useful life is defined as the length of time the level of effectiveness can be maintained. Each corrective measure shall be evaluated in terms of the projected service lives of its component technologies. Resource availability in the future life of the technology, as well as appropriateness of the technologies, must be considered in estimating the useful life of the project.

b. The Permittee shall provide information on the reliability of each corrective measure including its operation and maintenance requirements and its demonstrated reliability. Demonstrated reliability measures the risk and effect of failure. The Permittee shall evaluate whether the technologies have been used effectively under analogous conditions, whether the combination of technologies have been used together effectively, whether failure of any one technology has an immediate impact on receptors, and whether the corrective measure has the flexibility to deal with uncontrollable changes at the site.

c. The Permittee shall describe the implementation of each corrective measure including the relative ease of installation (constructability) and the time required to achieve a given level of response. The Permittee shall estimate the time that will be required to implement a corrective measure and the time it takes to actually see beneficial results. Beneficial results are defined as the reduction of contaminants to some acceptable, pre-established level.

d. The Permittee shall evaluate each corrective measure alternative with regard to safety. This evaluation shall include threats to the safety of nearby communities and environments as well as those to workers during implementation. Factors to consider include but are not limited to fire, explosion, and exposure to hazardous substances.

3.A.2. Environmental

The Permittee shall perform an environmental assessment for each alternative. The environmental assessment for each alternative will include an evaluation of any adverse effects on environmentally sensitive areas, and an analysis of measures to mitigate adverse effects.

3.A.3. Human Health

The Permittee shall assess each alternative in terms of the extent to which it mitigates short and long-term potential exposure to any residual contamination and protects human health both during and after implementing the corrective measures. The assessment will describe the types and levels of contaminants on-site, potential exposure routes, and potentially affected populations. Each alternative will be evaluated to determine the level of exposure to

contaminants and the reduction over time. For management of mitigation measures, the relative reduction of impact will be determined by comparing residual levels of each alternative with existing criteria, standards, and guidelines acceptable to the Director.

3.A.4. Institutional

The Permittee shall assess the effects of federal, State and local environmental and public health standards, regulations, guidance, advisories, ordinances, and community relations on the design, operation, and timing of each alternative.

3.B. Cost Estimate

The Permittee shall develop an estimate of the cost of each corrective measure alternative and for each phase or segment of the alternative. The cost estimate shall include capital and operation and maintenance costs.

4. RECOMMENDATION OF A CORRECTIVE MEASURE AND PREPARATION OF THE CMS REPORT

The Permittee shall justify and recommend a corrective measure alternative in the CMS Report. The Permittee shall submit summary tables of the corrective measure alternative recommendations. Tradeoffs among health risks, environmental effects, and other pertinent factors shall be highlighted. The Director shall approve the corrective measure alternative or alternatives to be implemented. The following criteria will be used to select the final corrective measure or measures.

4.A. Technical

1. Performance - corrective measure or measures, which are most effective at performing their intended functions and maintaining performance over extended periods of time;

2. Reliability - corrective measure or measures, which do not require frequent or complex operation and maintenance activities and that have proven effective under waste and facility conditions similar to those anticipated;

3. Implementability - corrective measure or measures which can be constructed and operating to reduce levels of contamination to attain or exceed applicable standards in the shortest period of time; and

4. Safety - corrective measure or measures, which pose the least threat to the safety of nearby residents and environments as well as workers during implementation.

4.B. Human Health

The corrective measure or measures must comply with existing federal and state criteria, standards, and guidelines for the protection of human health. Corrective measures, which provide the minimum level of exposure to contaminants and the maximum reduction in exposure with time, are preferred.

4.C. Environmental

The corrective measure or measures posing the least adverse impact (or greatest improvement) over the shortest period of time on the environment will be favored. The corrective measure(s) will be assessed as to the degree to which it employs treatment that reduces toxicity, mobility or volume of hazardous wastes and/or hazardous waste constituent(s).

4.D. Other Pertinent Factors

The Permittee shall justify the recommended alternative by describing other pertinent factors, such as cost. In addition, all other factors being equal, *in-situ* technology alternatives shall be favored.

5. CORRECTIVE MEASURE(S) IMPLEMENTATION (CMI) PROGRAM AND PREPARATION OF CMI WORKPLANS

The purpose of the Corrective Measure Implementation Program is to design, construct, operate, maintain, and monitor the performance of the corrective measure or measures selected to protect human health and the environment as described below. This information shall be included in the CMI Workplans.

5.A. Corrective Measure(s) Design

The Permittee shall prepare final construction plans and specifications to implement the corrective measure(s) at the facility as defined in the Corrective Measure Study. The construction plans and specifications shall include, but not be limited to:

1. Design plans and specifications:

   a. Design strategy and basis for implementation;

   b. The Director has approved use of a design rather than technology-based standard for landfill covers. The objective of the design standard is to minimize potential water infiltration through the waste. This design standard is one millimeter or less water infiltration per year through any proposed landfill covers. The design standard may be developed through the use of infiltration predictive modeling. Implementing a cover with this design standard may reduce the frequency or need for groundwater monitoring required in regional Groundwater Management Plans. If any landfill cover designs do not meet the one-millimeter standard, justification shall be provided for an alternative design. In cases where there is an existing cover the Permittee may prefer to demonstrate that the existing cover conditions are adequate to meet the standard through modeling or through direct measurements.

   c. Assumptions, detailed drawings including, but not limited to, process flow diagrams, general arrangement, and any applicable piping and instrumentation diagrams), equipment and specifications, and material and energy balances; and

   d. Discussion of the possible sources of error and potential operation and maintenance problems.

2. Short-term and long-term operations, inspection, maintenance and monitoring plans as needed:

    a. Normal and alternate operation and maintenance practices including, but not limited to tasks for operation, tasks for maintenance, prescribed treatment or operation conditions, and schedule identifying frequency;

    b. Routine monitoring and laboratory testing including, but not limited to, description of monitoring tasks, required laboratory tests and their interpretation, required Quality Assurance/Quality Control, and a schedule of monitoring frequency;

    c. Equipment description, (including equipment identification, installation of monitoring components, maintenance procedures, and replacement schedule), and records and reporting including, but not limited to, daily operating logs, laboratory records, records for operating costs, reporting emergencies, personnel and maintenance records, and required reports to be stored at the facility;

    d. Alternate operating and maintenance procedures to prevent undue hazard due to system failure and analysis of vulnerability and additional resource requirements should a failure occur; and

    e. Safety plan during routine operation and safety tasks in the event of systems failure.

3. Cost estimate.

4. Project schedule identifying timing for initiation and completion of all critical path tasks, dates for completion of the project, and major milestones.

5. Construction quality assurance objectives (including but not limited to the responsibility and authority, personnel qualifications, inspection activities, sampling requirements, and documentation).

6. Health and safety plan.

7. Design phases may include a preliminary design, additional studies, prefinal design, and final design as specified in approved plans or reports:

    a. Preliminary Design/ 30% Design. The technical design requirements of the project shall be adequate to determine if the final design will provide an operable and usable corrective measure. Supporting data and documentation shall be provided with the design documents defining the functional aspects of the program. The Permittee shall include calculations reflecting the same percentage of completion as the designs they support. If the approved alternative(s) is a standard industry practice or considered a presumptive remedy (see http://www.epa.gov/superfund/cleanup/index.htm and can be easily implemented, the Director may not require a preliminary design for review and approval.

    b. Additional studies to supplement the available technical corrective measure implementation data may be required. Upon written notification from the Director, the Permittee shall provide sufficient sampling, testing and analysis to optimize the required treatment and/or disposal operations and systems. A final report of the testing shall include all data taken during the testing and a summary of the results of the studies.

c. Prefinal Design, 95% Design. The pre-final design submittal shall include the Design Plans and Specifications, Operations and Maintenance Plan, Project Schedule, Quality Assurance Plan, and Specifications for the Health and Safety Plan. Depending on the site and alternative proposed, the Director may not require a pre-final design for review and approval.

d. Final design, 100% Design. The final design submittal shall include the Final Design Plans and Specifications, the Final Operation Maintenance and Monitoring Plan, Final Quality Assurance Plan, Construction Quality Assurance Plan as described in 5.B below, Final Project Schedule, and Final Health and Safety Plan specifications. The final design and pre -final design may be the same submittal.

5.B. Corrective Measure(s) Construction

Following the Director approval of the final design, the Permittee shall implement a construction quality assurance program to ensure, with a reasonable degree of certainty, that a completed corrective measure(s) meets or exceeds all design criteria, plans, and specifications. The construction quality assurance plan is a facility-specific document that must be submitted to the Director as part of the design for approval and prior to the start of construction. At a minimum, the construction quality assurance plan shall include the elements, which are summarized below. Upon the Director's approval of the construction quality assurance plan, the Permittee shall construct and implement the corrective measures in accordance with the approved design, schedule, and the construction quality assurance plan. The Permittee shall also implement the elements of the approved operation, maintenance plan, and any conditions listed in the post-closure permit.

1. The responsibility and authority of all organizations and the qualifications of all personnel shall be described in the construction quality assurance plan.

2. The observations and tests that will be used to monitor the construction and/or installation of the components of the corrective measure(s) shall be summarized in the construction quality assurance plan. The plan shall include the scope and frequency of each type of inspection. Inspections shall verify compliance with all environmental requirements and include, but not be limited to, air quality and emissions monitoring records, and waste disposal records. The inspections shall also ensure compliance with all health and safety procedures.

a. A preconstruction inspection and meeting shall be held to discuss methods for documenting and reporting inspection data, reviewing the distribution and storage of documents and reports, reviewing work area safety, discussing appropriate modifications to the construction quality assurance plan, and conducting a site visit.

b. Upon preliminary project completion, it is recommended the Permittee conduct a prefinal inspection, which should consist of a walk-through inspection of the entire site. The inspection is to determine whether the project is complete and consistent with the corrective measures as approved by the Director. The Permittee shall operationally test the treatment equipment. The Permittee shall demonstrate and document that the equipment has performed to meet the purpose and intent of the specifications. Retesting shall be completed where deficiencies are revealed. If necessary, a prefinal inspection

report shall outline the outstanding construction items, actions required to resolve items, completion date(s) for these items, and the date of the final inspection.

c. Upon completion of all outstanding construction items, the Permittee shall notify the Director, for the purposes of conducting a final inspection. A final inspection by the Director or his representatives will focus on confirming compliance with the design specifications and corrective measures objectives.

5.C. Sampling Requirements

The sampling activities, sample size, sample locations, frequency of testing, acceptance and rejection criteria, and plans for correcting problems shall be presented in the Corrective Measures Design.

5. D. Documentation

Reporting requirements for construction quality assurance activities shall be described in detail in the Corrective Measures Design and CMI Plan. This shall include but not be limited to such items as daily summary reports, inspection data sheets, problem identification and corrective measure reports, and design acceptance reports.

6. LONG-TERM INSPECTION, MAINTENACE AND MONITORING

The Permittee shall address long-term inspection, monitoring and maintenance in the CMI Workplan and as described in Module IV. The CMI plan shall propose addition of long-term monitoring plans to a post-closure permit or other plan as needed. The Permittee shall implement the inspection, maintenance and monitoring requirements contained in the CMI Plan upon implementing the corrective measure.

7. REPORTS

7.A. Corrective Measures Study (CMS) Workplan and CMS Reports

The Permittee shall prepare CMS Workplan and CMS reports in accordance with the schedule specified in Table 4.

7.B. Progress Reports

The progress reports shall contain the following information:

1. A description and estimate of the percentage of the Corrective Measures Study completed;

2. Summaries of all finding

3. Summaries of all changes made in the Corrective Measures Study during the reporting period;

4. Summaries of all problems or potential problems encountered during the reporting period;

5. Actions being taken to rectify problems;

6. Projected work for the next reporting period; and

7. Copies of daily reports, inspection reports, laboratory and monitoring data shall be held at the facility until the CMI is completed.

7.C. Corrective Measure Implementation (CMI) Reports

At the completion of construction, the Permittee shall submit a CMI Report to the Director for approval. The report shall establish that the project was implemented and/or built according to the specifications and that the corrective measure is performing adequately. The report shall include, but not be limited to, the following elements:

1. Certification by an independent professional engineer registered in the state of Utah of the design and construction;

2. Explanation of any modifications to the plans and why these modifications were necessary:

3. Listing of the performance or other criteria established for judging the functioning of the corrective measure and also justifying any modification to these criteria;

4. Results of facility monitoring, indicating that the corrective measure will meet or exceed the performance criteria; and

5. This report shall include all of the daily inspection summary reports, inspection summary reports, inspection data sheets, problem identification and corrective measure reports, block evaluation reports, photographic reporting data sheets, design engineers' acceptance reports, deviations from design and material specifications, and as-built drawings.