TOXICITY IDENTIFICATION/REDUCTION EVALUATION (TI/RE) PLAN

for

VISTA CHEMICAL COMPANY
NPDES PERMIT NUMBER LA0000336
WESTLAKE, LOUISIANA

February 1990

INTRODUCTION

The U. S. Environmental Protection Agency's (EPA) recent implementation of the "Water Quality-Based" approach for controlling toxics in surface waters has resulted in the increased use of whole effluent toxicity testing throughout the U.S. EPA Region VI has adopted EPA's policy by incorporating effluent toxicity testing into selected discharge permits for industries and municipalities throughout Louisiana.

In those instances where an effluent has been consistently demonstrated to be toxic, EPA requires an effort aimed at reducing that effluent's toxicity to acceptable levels. A Toxicity Identification/Reduction Evaluation (TI/RE) is the tool which is used to accomplish that objective. A TI/RE is a step-by-step, sequenced procedure which is designed to characterize, and ideally identify, the toxic constituent(s) in a complex effluent to determine the sources of the toxicant(s) and to implement toxicity reduction methods. The TI/RE process has been developed in response to the need for reducing toxicity in complex efflusnts, and improvements are routinely being made to TI/RE procedures and strategies.

BACKGROUND

Vista Chemical Company (VCC) is permitted under the National Pollutant Discharge Elimination System (NPDES) to discharge treated process water and stormwater into Bayou Verdine. Vista manufactures linear alkylbenzene, synthetic alcohols, ethylene, vinyl chloride monomer, methyl chloride, normal paraffins, and ethoxylated alcohols at the Lake Charles facilities.

The NPDES discharge permit is effective from April 3, 1987 until September 29, 1991. The permit (registry number is LA0003336) required Vista to conduct quarterly acute biomonitoring tests for a two year period which ended in 1989. In 1989 Vista was requested by EPA Region VI (through a Section 308 request) to conduct monthly chronic biomonitoring tests for a period of one year. These test, as well as the previous acute screenings and several other acute tests performed by Vista, all showed some toxicity to test organisms.

The plan presented here outlines the steps and procedures Vista will follow in conducting a TI/RE. The Toxicity Identification Evaluation (TIE) already underway comprises Tiers I,II,III of the overall TI/RE, (refer to Figure 1, Generalized TI/RE flowchart). This Plan has been prepared for submittal to EPA Region VI as a part of Vista Chemical Company's Toxicity Identification/Reduction Evaluation. This plan was developed based upon EPA's Industrial TRE protocol. Modifications to this plan may be incorporated based upon initial findings from tests conducted.

The goal of the Toxicity Reduction Evaluation (TRE) portion of the plan is to achieve "no observable effect" of toxicity in the final effluent using chronic testing procedures. Chronic toxicity is defined as a statistically significant difference between survival and/or reproduction or growth of the test organisms compared to the control organisms. The ten year low flow in Bayou Verdine requires the tests to be performed at a 76% effluent concentration.

In overview, the TI/RE plan will be conducted beginning with the TIE phase. The TIE phase consists of characterization and ideally identification of the toxicant or toxicants in VCC's discharge. This is followed by a TRE consisting of source identification, toxicity reduction method evaluation and preparation of an implementation plan. The Toxicity Reduction Evaluation effort will primarily be aimed at identifying the in-plant discharges or processes responsible for contributing non-treatable toxicants to VCC's wastewater treatment facility. This will allow VCC to optimize, or modify in-plant processes, or to pretreat process streams to achieve acceptable toxicity levels. Additional treatment procedures may be required to reduce the effluent toxicity to acceptable levels.

This plan, the data generated in the TI/RE and all results, findings, conclusions and recommendations are to be considered confidential and the exclusive property of Vista Chemical Company.

TI/RE FLOWCHART

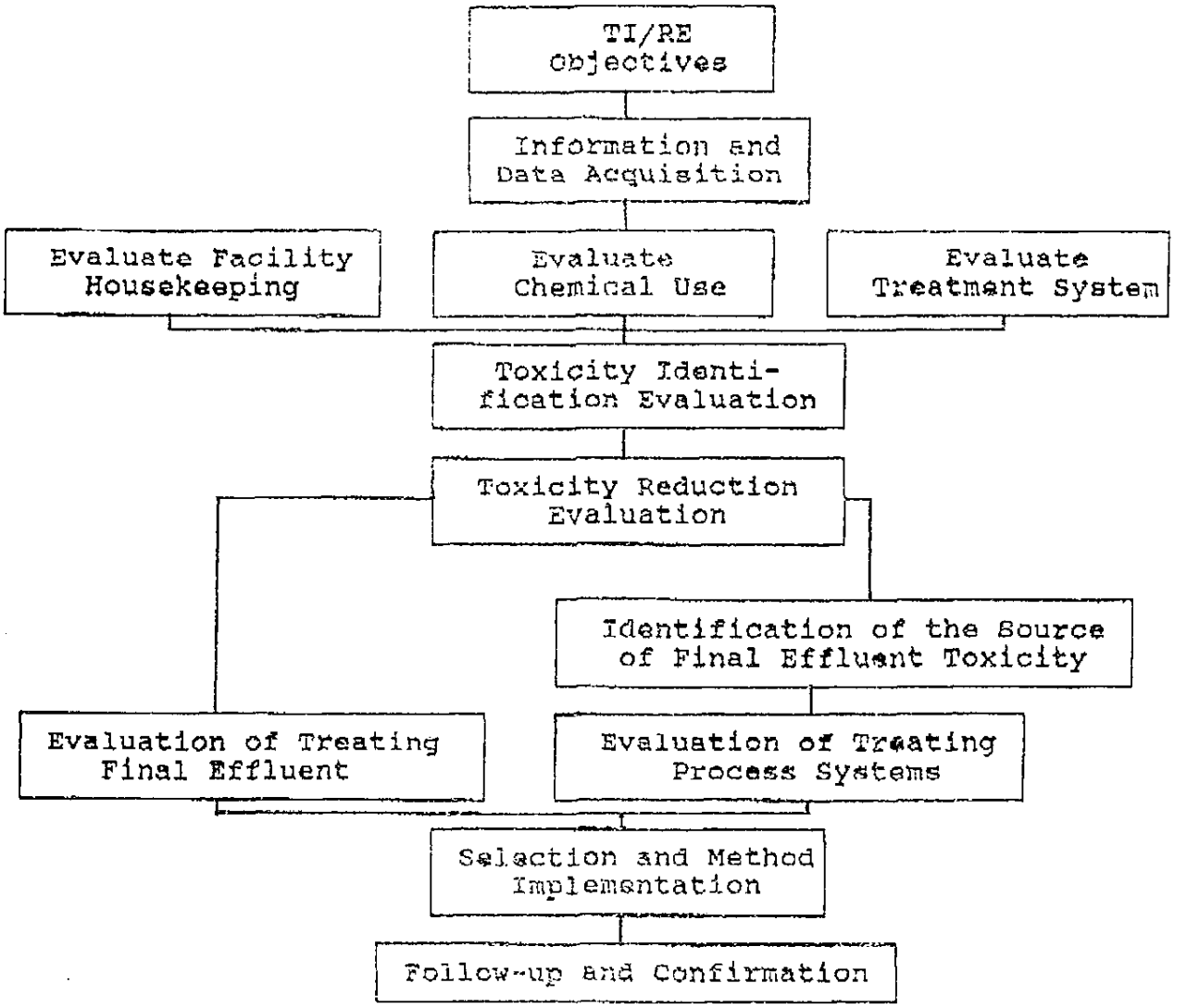

Figure 1. GENERALIZED TI/RE FLOWCHART

PROJECT ORGANIZATION

Facilities, Personnel and Services

VCC will select a consulting firm to provide all project management and coordination for the completion of the TI/RE. All facilities, personnel and services will be coordinated and monitored by that consulting firm with project oversight performed by VCC personnel.

The consulting firm chosen will have a diversity of personnel and experience in the disciplines of toxicology, chemistry, chemical engineering, and wastewater treatment system design suitable to successfully complete the TI/RE. The toxicity testing laboratory will have a sufficient in-house organism culturing capacity, testing capacity and personnel to accommodate the volume of toxicity testing required to complete the TI/RE.

Agency liaison and interdisciplinary coordination will be the responsibility of VCC and the consulting firm. Toxicity testing and chemical analysis will be performed by reputable laboratories.

Delineation of Responsibility and Coordination Between Groups

The VCC Project Manager will be responsible for project oversight and will be the primary contact in gathering plant-specific data and process information. The Project Manager for the consulting firm will be responsible for directing the activities of the toxicity testing laboratory, the analytical laboratory and the professionals that will makeup the Project Team including chemical engineers, civil engineers, toxicologists, chemists, and process engineers. Daily interaction between team members will be crucial to successful and timely completion of the TI/RE.

QA/QC Program

Standard Quality Assurance (QA) practices that will govern sample collection, handling and testing procedures, chain-off-custody procedures, maintenance of instrument logbooks and field logs will be employed at all times through all phases of this TI/RE. QA/QC programs already in place at the toxicity testing laboratory and analytical laboratories will be strictly adhered to throughout the project. Chronic reference toxicant testing shall be completed monthly throughout the project. As site specific procedures are developed during the TI/RE, these procedures will be documented and adhered to at all times. Because the constituents in the toxic affluent are unknown at this time, project-specific quality control procedures and checkpoints will have to be developed as the project proceeds.

Chain-of-Custody

Sample integrity will be of the utmost importance in the TI/RE; therefore, strict chain-of-custody procedures will be observed at all times. Samples will be tracked from the initiation of sample collection through the testing procedures, and through report preparation.

Analytical Methods

All chemical analyses will be performed according to EPA approved methods and any deviations from those methods will be documented and approved prior to use. Aquatic toxicity testing protocols will be performed according to the procedures outlined in Methods for Measuring Acute Toxicity of Effluents to Freshwater and Marine Organisms, by Peltier and Weber, 1985, EPA 600/4-85-013 and Short Term Methods for Estimating Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Horning and Weber, 1985, EPA, 600/4-85-014. Any deviations from these protocols will be documented.

The subsequent sections of this TI/RE Plan, present the planned approach to performing the TIE and TRE.

PHASE I TOXICITY IDENTIFICATION EVALUATION (TIE)

TASK 1: COLLECT, REVIEW AND EVALUATE EXISTING INFORMATION

The first task of the TIE is to utilize all of the available information in developing a candidate list of suspect toxicants for VCC. The first step of this task includes a review of VCC's personnel and operations, the contributing chemical processing units at the facility and the industrial wastewater treatment plants (IWTPs). It will be very important to continue to work closely with the operations and management personnel at VCC in order to fully understand the potential sources of toxicity and the operation of the IWTPs. During this first part of the project the team will review,

- Analytical data available that can be correlated to existing toxicity data.
- Historical effluent discharge monitoring data (chemical and biological).
- Wastewater treatment plant operation information.
- Information on raw materials used, catalysts, process initiators, water treatment chemicals, any by-products produced in the process units, any final products that may be in contact with wastewater.

- Descriptions of contributions to the wastewater treatment plant of the major chemical processing units.

- An understanding of the processes at Vista

- Other relevant historical information.

These data will be evaluated by the Project Team members including process engineering personnel, toxicologists, chemists, and chemical engineers to evaluate any potential sources of toxicity.

After this review, the team will evaluate the data and information collected, emphasizing the development of a candidate list of potential toxicants or sources of toxicity. This list of candidate toxicants or in-plant sources will be developed by:

- Correlating available toxicity test results with concentrations of any known toxicants found when evaluating the influent/effluent chemistry data. For example, if toxicity correlates positively with metals, surfactants, or polymer concentrations, those compounds could become suspects as potential causative agents.

- Examining the correlation of operational upsets (either process or IWTP) with the toxicity of VCC's effluent. This will require detailed input on the part of VCC engineering, operations, and management staff.

- Identification of any obviously suspect influents from the various chemical processing unit inputs based upon existing chemical analysis data.

- A thorough investigation of current housekeeping practices will determine if washdown procedures, maintenance procedures, turnaround procedures, disposal procedures, or any other operational procedures are contributing potential toxicants to the wastewater stream that are currently unknown or that VCC personnel are unaware of.

The suspect sources and agents identified in this task will become candidates for further evaluation in the subsequent tasks of this program. Actual determination of the specific causative agent(s) and the sources(s) of toxicity will be made in later phases of the TI/RE. Past experience of the consultants in industrial TI/REs and discussions with VCC personnel will guide the team in this effort.

TASK 2: MODIFY THE TI/RE PLAN

The team will modify this Toxicity Identification/Reduction Evaluation Plan, if needed, after the Plan has been reviewed by Vista and regulatory agencies (if required).

TASK 3: INITIATE TOXICITY TESTING

The regulatory requirement for sampling and reporting imposed by Region VI adresses the aquatic toxicity related requirements of the Clean Water Act. These regulatory requirements mandate that the effluent from VCC's outfall must not demonstrate chronic toxicity at effluent concentrations of 76 percent or less to Ceriodaphnia dubia and fathead minnows (Pimephales promelas) in 7-day reproduction and growth tests, respectively. Whole effluent toxicity test data from previous toxicity tests demonstrate acute as well as chronic toxicity in VCC's final effluent. Acute toxicity tests will be used throughout most of the TI/RE, with confirmations using chronic toxicity tests at critical decision points. If less expensive, more rapid tests (such as 24-96 hour acute tests) are found to correlate well with results of conventional toxicity tests, the shorter tests will be employed as surrogates for much of the program to track toxicity.

In this task the following will be accomplished:

- Evaluate toxicity variability by performing a series (2-3) of conventional chronic toxicity tests. These test results will be compared with short-term results to determine if the short-term results reflect the longer-term results.

- Determine the most sensitive test species (either fathead minnows, or Ceriodaphnia dubia). If one species is consistently more sensitive to the VCC's effluent, that species will be used in conducting the TI/RE, with occasional verification with the other permitted species. Decisions on which species will be used in the TI/RE will be made in conjunction with VCC. At critical decision points throughout the TI/RE we will confirm our conclusions with both permitted species.

TASK 4: CONDUCT TOXICITY CHARACTERIZATION/IDENTIFICATION/CONFIRMATION

The objective of this component of the TIE is to identify, or at a minimum characterize, the toxicant or toxicants in VCC's effluent, so that the sources(s) of the toxicant(s) can be identified and an appropriate strategy implemented to reduce effluent toxicity to an acceptable level. This is an evaluation which, depending upon the results, could be completed after the following sequenced steps:

1. Characterization of the effluent toxicity according to general chemical class.

2. Evaluation of the role of candidate toxicants which were identified in the analysis of the existing data and detected by class in the toxicity characterization.

3. Identification (to the extent possible) of the toxicant or toxicants.

4. Confirmation of the identified toxicant(s) or toxic characteristics.

CHARACTERIZATION

The toxicity characterization procedures will be primarily those provided by EPA; "Methods for Aquatic Toxicity Identification Evaluations: Phase I - Toxicity Characterization Procedures," EPA 600/3-88/034. These methods are used to characterize the physical/chemical nature of the causative toxicants in an effluent and to assess the variability in the characteristics of the toxic constituents. It is anticipated that a number of characterizations, perhaps over several months, will be needed to characterize the nature of VCC's effluent toxicity. However, if the characteristics of the toxicants in the effluent are highly variable, both qualitatively and quantitatively, a larger number of characterizations will be needed. A great deal of flexibility is required in carrying out this step of the study.

VCC's effluent toxicity will be characterized to determine the general chemical class of the toxicant or toxicants. Characterizations will be performed to determine if VCC's effluent toxicity is associated with:

- filterable materials,
- organic or inorganic (anionic or cationic) compounds,
- volatile organic compounds,
- compounds with toxicity affected by pH,
- oxidizable or reducible compounds,
- persistent or non-persistent constituents, or
- chelatable metals.

EVALUATION

During the review of the existing data (Task 1), the team will develop a candidate list of suspect sources and toxicants. At this point metals, surfactants, chlorine salinity, excessive hardness and polymers are tentative candidate toxicants. This list may expand or shrink as more information is obtained. The role of these and any additional extremely strong candidates identified will be evaluated in this task by one or more of the following procedures if their chemical class is detected in the effluent characterization procedures:

- By reviewing existing data in the aquatic toxicology literature to ascertain if the suspect agent(s) is likely to be toxic to either test species at the levels found in the effluent.

- By removing the suspect agent from the effluent and determining if some or all of the toxicity is removed by this step. Conversely, by restoring the toxic agent to the effluent and ascertaining whether the toxicity returns at the anticipated levels.

- By varying the levels of the suspect toxicant in the effluent to determine if there is a correlation between the concentration of the toxicant and the effluent toxicity.

- By evaluating responses of different species known to have varying sensitivities and toxicity symptoms to the suspect toxicant.

It is important to recognize in advance that pursuing a suspect toxicant while performing a complete toxicity characterization represents a risk, because if the suspicion is incorrect, it will be necessary to perform additional toxicity characterizations in addition to the effort expended in pursuing the suspect toxicant.

CHEMICAL IDENTIFICATION

After characterization and review of the existing data, the next steps are fractionation followed by, if possible, chemical identification of the causative agent(s), and then confirmation of the identified toxicant(s). The basic fractionation procedures to be used will be those that have been developed by U.S. EPA. The choice of the fractionation procedures used will depend upon the effluent characterization results, as well as upon species being used in the toxicity testing for the TIE. A possible combination of fractionation procedures is also possible.

Following isolation of the toxic fraction or fractions, attempts will be made to identify the specific toxicant or toxicants. EPA's "Methods for Aquatic Toxicity Identification Evaluations: Phase II Toxicity Identification Procedures", EPA/600/3-88/035, will be used. Chemical identification will be carried out using accepted standard analytical chemistry techniques. Modifications of standard analytical techniques will be developed and used when necessary.

CONFIRMATION

The final step in the TIE will be to confirm the toxicants which have been identified. The methods to be used for the confirmation of the constituents(s) responsible for toxicity will be those included in the EPA's Generalized Methodology for Conducting Industrial TREs and those presented in EPA's "Methods for Aquatic Toxicity Identification Evaluations: Phase III (Toxicity Confirmation Procedures", EPA/600/3-88/036). No single confirmations will be employed. It is important to recognize that this is a critical step in the TI/RE process. Sufficient time and effort will be taken to ensure that the toxicants(s) identified are in fact those responsible for causing the toxicity. It is far more reasonable to expend extra effort at this point than it is to run the risk of making an error which results in the implementation of the wrong solution in the TRE phase.

TASK 5: REPORT TIE FINDINGS

Reports of the TIE investigations will be submitted quarterly to VCC. It is very difficult to predict the duration of a TIE, although one year of investigation is not unusual in complex situations. Meetings with VCC to report and discuss results of the TIE and to obtain comments and suggestions for the subsequent TRE work will be held as needed throughout the year. The team will also be prepared to discuss the progress and results at any time with Region VI and the Louisiana Department of Environmental Quality.

PHASE II - TOXICITY REDUCTION EVALUATION (TRE)

The TRE phase can only be initiated following completion of the toxicity identification phase. The scope of the toxicity reduction phase will be highly dependent upon the results of the TIE. This section outlines the expected approach based on the following scenarios, each of which is possible, depending upon the findings of the TIE.

1. A readily identifiable toxicant or limited number of toxicants are identified. This finding has been experienced with some TI/RE studies, and generally results in the most straightforward approach to toxicity reduction.

2. A single class of compounds (i.e., volatile organics, chelatable metals or reducible compounds are identified as consistently causing toxicity.

3. No single class of compounds can be consistently correlated with toxicity. This outcome may either be the result of a number of variable sources of toxicity, or a single, but complex, source of toxicity. This is sometimes the outcome of toxicity identification studies, and reflects the real world problems of complex effluents.

SCENARIO 1 - READILY IDENTIFIABLE TOXICANT

As a result of the TIE phase, it may be possible to readily identify a single compound or a limited number of compounds as the cause of toxicity. If this toxicant is a rather ubiquitous compound(s), such as zinc or a surfactant, then the sources of the toxicant(s) will be identified by analyzing their concentrations in the major influent streams flowing to the treatment plant from the various chemical processing units at VCC. These results will be evaluated, and based on a mass balance determination, process stream concentration limits would be suggested for those specific constituents. The unique characteristics of each process stream at VCC may allow pretreatment at the source; however, substitution or process modification are also alternative toxicity reduction options.

If the toxicant(s) is a less widespread compound, VCC's process stream data will be reviewed in an effort to determine the source or sources of the toxicants(s). If a suspect process stream is identified a sampling program aimed at that select source will be developed. If a suspect discharge is not readily identifiable, the team may design a process stream discharge study to methodically isolate the source of toxicity at the VCC facility by working upstream throughout the discharge system. Such a study would only be a last resort if all other means of identifying the source of the toxicant are unsuccessful.

SCENARIO 2 - SINGLE CLASS OF COMPOUNDS IDENTIFIED IN THE TIE

Because the causes of aquatic toxicity are often complex, it is frequently difficult to identify the specific compound or compounds responsible for the observed toxicity. However, toxicity in some effluents is largely limited to a particular class or classes of compounds such as chelatable metals, nonpolar organics or volatile organics. This class would be identified in the toxicity characterization/fractionation procedures.

Depending upon the particular toxic fraction or fractions, it may or may not be possible to readily identify the source or sources of the toxicants. For instance, if the toxic fraction is a non-volatile organic compound, and GC/MS identification suggests that the toxic

fraction is a mixture of compounds commonly used or produced at VCC, VCC's chemical use and production data from the various processes will be reviewed. If these compounds are found to be present in the effluent, then these materials will be traced to their source or sources and their presence and contribution to toxicity confirmed. In addition, the individual percentages of toxicity contributed by of each compound to the overall toxicity of the effluent would be determined.

SCENARIO 3 - NO SINGLE CLASS OF COMPOUNDS INDENTIFIED IN THE TIE

If the TIE determines that the toxicity is either due to a wide variety of compounds, or that its cause is highly variable (both quantitatively and qualitatively) over time, source identification and subsequent reduction will be more complex. In this case, it may be necessary to utilize toxicity testing alone to track the source. This can be particularly difficult, because toxicity in an untreated process discharge to the wastewater treatment system does not necessarily translate to toxicity after treatment. Many toxicants are highly treatable and therefore may be removed by VCC's treatment process. Thus, even if an influent to the wastewater system is toxic, it is possible that the influent stream's toxicants are readily removed by VCC's treatment, and are therefore not responsible for the effluent's toxicity. Consequently, it will be necessary to confirm each individual steam as a contributor to VCC's effluent toxicity. This would be accomplished either by testing the suspect process streams to verify that they are contributing toxicants to the IWTP, and/or by identification of the toxic process stream(s) by selective temporary isolation of each process stream within the collection system (if possible).

Toxicity tracking using pilot scale treatment is another alternative for determining the source(s) of pass-through toxicants. As discussed above, due to the differential treatability characteristics of constituents responsible for toxicity, the toxicity of any given influent stream discharging to VCC's wastewater treatment system will not necessarily directly relate to toxicity in VCC's discharge. If necessary, the toxicity of both VCC's effluent and the various influent streams will be tested to determine VCC's toxicity removal efficiency. Assuming that only a significant portion of the influent toxicity is removed by the treatment process, toxicity tracking will be necessary. In order to verify that a given process is contributing to toxicity at the end of the pipe, and to enable VCC to develop process stream treatment requirements, treatability of the waste streams may be evaluated. This could be accomplished by utilizing a pilot scale simulation of VCC's treatment system and individually "spiking" the process stream wastes. The pilot plant would duplicate VCC's wastewater treatment systems, and would be allowed to operate for several days until it has stabilized. Parallel bioassays would be run with actual plant effluent to assure similar toxicity treatability is achieved. Wastewater from selected suspect process streams would then be spiked into the pilot plant at varying

concentrations, and the impact on effluent toxicity would be determined. Toxic streams will be identified as those contributing refractory or pass-through toxicity when treated by the pilot plant. Pilot testing methods are very complex and will only be used if other, more direct methods are inconclusive in determining the cause of toxicity, or ineffective at reducing toxicity.

TOXICITY REDUCTION METHOD EVALUATION

Based upon the results of the TIE and the earlier stages in the TRE, the team will evaluate the various alternatives for toxicity reduction. Options such as process modification, chemical substitution, improved housekeeping practices and others will be considered. The process modification testing could be conducted utilizing the pilot plant described above, and depending upon the nature of the toxicity, various operating conditions would be manipulated. Utilization of the pilot system will also allow determinations to be made regarding the impact of these modifications on other operating parameters and the ability of the treatment system to meet numerical discharge standards as well as toxicity requirements. The most economical (including both implementation and operation and maintenance costs) and effective approaches will be recommended, as well as any alternatives which may exist.

Removal of toxicity at its source is normally preferable to end-of-pipe treatment. This is consistent with EPA's developing waste minimization and pollution prevention philosophies, and is usually the most economical and effective alternative. However, should it prove to be impossible to obtain the required toxicity removal at the source, pretreatment of process streams or final effluent treatment will be evaluated.

The effectiveness of pretreatment of individual process streams at the plant would be evaluated using the pilot plant in conjunction with appropriate pretreatment technologies. Post treatment options such as activated carbon addition, modifications to the management procedures for the wastewater treatment facility, or other options would also be tested on a pilot scale utilizing plant influents. The most appropriate treatment option(s) would be recommended based upon these investigations.

PRELIMINARY SCHEDULE

Vista plans to accomplish this TI/RE in a stepwise fashion. Phase I, the TIE could require up to 1 year, while Phase II (the TRE) could require up to 12 months. The following is a tentative schedule:

It is important for all parties to recognize that flexibility in the schedule is extremely important in this investigation. There is no way of knowing at this point how difficult or simple the identification and reduction of toxicity will be. Therefore, the schedule must remain flexible in order to allow the investigation to

proceed in a logical, step-wise fashion so that Vista's resources are utilized in the most cost effective manner.

PROPOSED
SCHEDULE

Task	Start Time	Duration
Phase I, TIE		
Task 1, Site visit and Data Review	January 1990	1 month
Task 2, Prepare TI/RE Plan	To be Conducted Simultaneously with Task 1	1 month
Task 3, Routine Testing	February 1-March 1 1990	1 month
Task 4, Toxicity Characterization/ Identification and Confirmation	March 1-December 1 1990	9 months
Task 5, TIE Report	December 1-January 1 1991	1 month
	Subtotal for the TIE	12 months
Phase II, TRE		
Causative Agents and Source Evaluation	January 1 - April 1, 1991	3 months
Pilot Plant Design and Start Up Process Stream Survey as Appropriated	April 1 - July 1, 1991	3 months
Pilot Plant Operations	July 1 - November 1, 1991	4 months
TRE Report	November 1 - December 31, 1991	2 months
	Subtotal for the TRE	12 months[1]

1 This is a reasonable operational time in which usable results can be anticipated; the schedule could be reduced or extended, depending upon the results of the TIE and TRE.

TO: Biotoxicity Team Members

FROM: Wendy S. Call, Houston
DATE: March 16, 1990

SUBJECT: CONFERENCE CALL MEETING MINUTES - MARCH 14, 1990 MEETING

Interoffice Communication

VISTA

The following team members were present:

LCVCM - PLF SVC DRB
LCCP - TRB
R&D - AMN GLR
Houston - TWH WSC

The objective of the meeting was to review Battelle's TI/RE plan. The comments of the team members are recorded below. The page, paragraph, and sentence numbers refer to Battelle's TI/RE plan with the cover letter dated February 19, 1990. Unless otherwise noted, 2nd paragraph refers to the 2nd full paragraph on a page, not counting a paragraph continued from the previous page.

The team noted that the Battelle plan seemed to be more of a proposal to Vista than a plan we can submit to the agencies.

TWH - Pointed out that Battelle references the EPA document, "Methods for Toxicity Reduction Evaluations: Phase I - Toxicity Characterization Procedures." This is on p. 7 at bottom. Battelle also references EPA's Generalized Methodology for Conducting Industrial TREs and EPA's Phase III Document (Toxicity Confirmation Procedures.) These are on p. 9, 3rd paragraph. Action Step: All - Read the Generalized Methodology document before the next meeting.

DRB - Concerned that we need a more generic document so that any other company could execute the plan even if they did not write it.

AMN - Cover letter, 2nd paragraph, last sentence. This sentence is wrong. Needs to say that the regulatory agency (EPA Region VI, not LDEQ) has imposed chronic toxicity testing, not chronic toxicity limits.

DRB - Only Region VI has requested anything from Vista. LDEQ has not requested anything. We don't even have a State permit.

TWH - P. 2, 3rd paragraph, 2nd sentence. "The objective of this TI/RE is to reduce the acute toxicity in VCC's effluent to acceptable levels (one acute toxic unit)." This is not agreed upon by Vista, and it is not even right.

DRB - Same reference as directly above. We need to state up front the main goal of this TI/RE, which is NOEL (no observed effect level.)

DRB - P. 2, 2nd paragraph, last sentence. "Modifications to this plan can be incorporated based upon comments from Vista and EPA Region VI." Strike the phrase, "and EPA Region VI." The EPA agency will not approve the plan so we will not invite their comments.

PLF - P. 4, 1st paragraph. Nothing spelled out about confidentiality. The subject of confidentiality needs to be included somewhere in the document.

AMN - P.4, 1st paragraph. This is just a lecture on team work and should be deleted altogether. Team agreed.

PLF - P. 5, last sentence of paragraph continued from previous page. "In addition, over the next several weeks VCC has agreed to supply Battelle with a list of chemicals used in cooling tower treatment and wastewater treatment." Who is doing this? Action Step: SVC and TRB will collect this info and send to Battelle.

PLF - P. 5, last paragraph. Asked AMN if R&D will be able to assist in some of the toxicity evaluations.

DRB - P. 6, 1st paragraph. Change "...been reviewed by Vista, EPA Region VI, and LDEQ." to "...been reviewed by Vista and regulatory agencies, if required."

AMN - P. 6, 2nd paragraph, 1st sentence. Strike "and of the Louisiana Department of Environmental Quality (LDEQ)."

TWH - P. 7, 1st paragraph, last sentence. This is unclear and implies that confirmation of the identified toxicants is not a required step in the TI/RE.

AMN/DRB - P. 8, 1st paragraph, 2nd sentence. "At this point in time metal, surfactants, chlorine, salinity, excessive hardness and polymers are tentative candidate toxicants." Is this necessary or recommended to have in the TI/RE plan?

WSC - P. 8, last sentence. Strike this sentence.

PLF - P. 9, 2nd paragraph, 2nd sentence. "Generally, we will use EPA's Phase II Toxicity Identification Procedures." The generally implies that they will use some other procedures besides the EPA procedures. What are these other procedures and are they approved by the EPA?

DRB - P. 10, 2nd paragraph. Of these three scenarios, which one does Battelle see more often?

DRB - P. 11, 1st paragraph, 2nd sentence. Change "..., Battelle will develop a sampling program aimed at that select source." to "..., a sampling program will be developed aimed at that select source." This will make the plan more generic.

PLF - P. 12, last sentence of paragraph continued from the previous page.

SVC - P. 12, 1st paragraph, last sentence. "...identification of the toxic process stream(s) by selective temporary isolation of each process stream within the collection system." The feasibility of this temporary isolation is questionable.

DRB - P. 13, first full sentence of paragraph continued from the previous page. "This will be accomplished by utilizing a pilot scale simulation of VCC's treatment system...." Concerned that we may be locked into this pilot testing. We need to get Battelle to list the other possibilities besides pilot testing.

ACTION STEPS

All - Read the Generalized Methodology document before the next meeting.

SVC/TRB - Collect the information on the chemicals used in cooling tower treatment and wastewater treatment and send to Battelle.

PLF - Get other companies' TI/RE plans.

PLF - Schedule a conference call between the team and Battelle's Mick DeGraeve to convey our required revisions. Inform everyone of the meeting time.

The next regular Biotoxicity Team Meeting/Conference call has not been scheduled yet.

Wendy S. Call

Wendy S. Call
Process Engineer

DISTRIBUTION
LCVCM - PLF SVC DRB
LCCP - TRB
R&D - AMN GLR
Houston - TWH

To: Distribution

From: A. M. Nielsen

Date: February 15, 1990

Interoffice Communication

VISTA

Subject: **MINUTES OF BIOTOXICITY TEAM CONFERENCE CALLS ON JANUARY 29, 1990, AND JANUARY 30, 1990**

Attendees:

Paul Fetzer	LCVCM
David Booth	LCVCM
Sandra Corkran	LCVCM
Theresa Bell	LCCP
Tom Heller	PED - Houston
Wendy Call	PED - Houston
Chuck LeVesque	GED - Houston
Allen Nielsen	R&D - Austin
Geoff Russell	R&D - Austin

Business:

1. Cooling Tower Study Status -
   A. Drew testing results on 4 chemicals -
   - 96 hr. LC_{50} for Na_2Mo = 54.8 mg/L
   - Less toxic than zinc
   - Do not know how much is in our effluent
   - Drew Polymer flocculent 96 hr. LC_{50} = 320 mg/L
   - Drew currently using zinc in their cooling tower treatments

Action Steps:

1. Theresa Bell will send R&D information on dosages, names and samples of Drew Chemicals for confirmation toxicity testing.

2. R&D will do toxicity testing on molybdenum.

   B. Dearborn Grace Study
   - ENSR is doing testing.
   - Both proposed chemicals are being tested in chronic toxicity tests (fatheads, Ceriodaphnia).
   - Chemicals will be mixed in well water, tested separately in well water and at a variety of concentrations.

   C. Houston assignments for Cooling Tower Project
   Doug Landgrover (PED); Chuck LeVesque (GED)

D. Nalco activities

- To present their plans on 2/2/90. Nalco presently treats all cooling towers but alcohol. Drew treats alcohol cooling tower.

- Nalco may be more amenable to paying for toxicity testing if Grace appears to be getting a shot at the LCCC business.

F. R&D Membrane Work

- Testing on metals not done yet, but membranes are available which will separate heavy metals from water.

G. Plant Test

- Portable tower testing will be done once a candidate treatment scheme has been found.

2. Metals in Effluents

A. Copper

- Ranges 0.05 ppm to 0.01 ppm in 001 effluent. Chronic values are 10-50 ppb as reported in EPA "Gold Book".

- R&D confirmed that copper is toxic at 12 ppb even with acute testing.

Action Steps:

Stolen

1. R&D to confirm toxicity of zinc, copper, calcium, nickel by mixing into dilution water and then backing out individual components.

2. P. Fetzer will get current effluent metals data together and share with team and Battelle.

B. Calcium

- Ranges 800 - 1,400 ppm in 001. R&D LC_{50} at 1,100 ppm. Dickson LC_{50} at 800 - 1,200 ppm.

- Conclusion: Calcium could be an intermittent problem.

- PED is looking at possibility of changing from HCl to Cl_2 so as to eliminate the necessity of neutralization.

No

- S. Corkran is working on $Mg(OH)_2$ neutralization.

- T. Heller is evaluating the use of soda ash (Na_2CO_3) neutralization.

Action Step:

T. Heller will check with Baltimore plant to learn about their evaluation of soda ash evaluation.

C. Zinc

- How much zinc is in sludges will be determined in R&D "quick & dirty" treatability test.

- Zinc appears to be a higher priority than calcium.

- No money is being spent in methyl chloride area. In fact, the meter at WA1 is broken and plant is not willing to fix it.

- Some Zn is getting into the effluent from the limestone used to neutralize HCl.

3. Use of Saltwater Species for EPA Chronic Toxicity Testing

- EPA may let us use a saltwater species.

- It may more accurately reflect the true environment because of tide intrusions in the Bayou Verdine.

- R&D will evaluate setting up saltwater species testing.

Action Step:

Geoff Russell will compare and evaluate all saltwater and freshwater comparison data that we have on hand to determine if there is a need to switch to saltwater species.

4. Battelle Status

Action Steps:

- A. M. Nielsen to issue letter to J. Friend and V. Weiss by 2/15/90 explaining that R&D efforts will help support, direct and confirm, but will NOT replace Battelle's TIE work.

- T. Bell will have a checklist developed to correlate plant conditions during toxicity tests. This will be ready before next set of samples are shipped to Battelle.

- First reporting will be 2/16/90 at 10:00 a.m. Eastern, 9:00 a.m. Central time. P. Fetzer will set up the call.

- ENSR will still do monthly chronic tests.

5. Reporting of Battelle's and Toxicity Team's Activities

Step 1- Progress report and billing from Battelle
Step 2- Conference call with Battelle

Step 3- A week later, issue report to management on Battelle's and Biotoxicity Team's activities. The report will be issued by P. Fetzer with appropriate review by Biotoxicity Team.
Distribution of Report:

LCCC Plant Managers
C. Watson
J. Roheim
Team Members
G. Hopkins
M. Hayes, Plant Environmental Coordinators
T. Grumbles/J. Ledvina
C. Dutra

6. Cooling Tower Treatment Coordinator

The team strongly felt that someone needed to be overall Cooling Tower Treatment Change Coordinator since so many interrelated activities are going on.

It was suggested that Curt Watson get someone designated to be this coordinator.

Action Steps:

T. Heller will contact C. Watson and G. Hopkins about getting this coordinator selected by 2/15/90.

- There needs to be a coordination on potential areas of solution to Cooling Tower issue.

1. Changing of Cooling Tower chemical treatment, or
2. End of pipe metals removal.
3. Removal of zinc from methyl chloride unit or from neutralization pit.
4. Potential capital and operating costs to make either of these options work.

7. Other Battelle Issues

Action Step:

P. Fetzer will send to team members before the 2/16 conference call, a copy of the TIE proposal written to Vista management in 10/89.

8. Toxicity Team Action Plan

The team agreed that of the major segments of the Biotoxicity Action Plan, the team had control only over Item A (TIE/TRE work by Battelle and R&D) and Item E (propose alternate test species to EPA/DEQ). Team has no control

over Item F (selection of an alternative outfall). The team can make recommendations on Items B (Cooling Tower Treatment), calcium, zinc, and copper reduction.

It was agreed that the team would concentrate on Items A and E.

Allen M. Nielsen

Allen M. Nielsen

To: Distribution

From: T. R. Bell
Date: January 24, 1990

Subject: **Minutes of Biotoxicity Team Conference Call on January 15, 1990**

Interoffice Communication

VISTA

Attendees:

Paul Fetzer	LCVCM
Sandra Corkran	LCVCM
Duane Every	LCCP
Theresa Bell	LCCP
Alan Nielsen	R&D-Austin
Geoff Russel	R&D-Austin
Tom Heller	PED-Houston
Wendy Call	PED-Houston

Business:

I. Cooling Tower Study Status

A. Background

- JF told MLA, superintendent of the LCCP Ethylene Unit, that we need to get zinc out of the cooling towers.
- The effluent biotoxicity is the driving force.
  - WSC: TRE may show that zinc is not the only cause
  - AMN: R&D has confirmed that zinc is a problem
- Currently, Nalco is our main supplier of the zinc based cooling tower additive.
- MLA has contacted a number of vendors and has suggested that we work with Grace.
- Grace is using this formulation, or a similar one, at their Lake Charles Complex.
- Due to the expansion work in the Ethylene Unit, the cooling tower test would need to be done at another cooling tower in the LCCC.
- TWH: We must prove that our cooling tower is toxic due to the zinc additive.
  - We sent an effluent sample of our current treatment system out Wednesday, to get chronic toxicity testing to prove zinc is a problem.

B. Comments on Grace

- PLF: We have told the vendor that we must get chronic toxicity data on their treatment process.

- Grace is willing to do the testing, and pay for it. ENSR is doing the testing.

  - We have seen the data which shows toxicity present at very low levels and has a very unusually shaped data distribution. The data is contradictory. The high dilution samples showed no toxicity, while the lower showed toxicity.

  - Grace is willing to retest. They feel they know the reason for their toxicity. They will split the next samples into 2 different segments (4 samples), testing each component separately, at treatment levels, in dilution. The sample for component #1 was sent on 1-10-90. The sample for component #2 was sent on 1-15-90. The results should be back the week of 1-22.

- If the individual samples show a low level of toxicity, Grace will bring in a portable cooling tower unit to obtain corrosion data.

  - We will supply a flowrate and a heat flux for our metallurgies and they will do coupon testing on 3 sets of conditions at a time. There will be no cost involved to Vista aside from utilities, water, lab analyses on BOD and COD, and the time of team members.

  - They will measure the coupon corrosion over a 1-2 week period. They will test all of our metallurgies at their most critical levels. They will run our current treatment process in their unit to get base line data.

  - Their test will not mess up Battelle's TIE work because their chemicals will not get into our effluent until actual cooling tower test.

  - If they pass everything, they will want a cooling tower to treat. The available cooling towers in the complex are:

LCVCM	LCCP-Ethylene
LCLAB	LCCP-Alcohol

    LCLAB is a likely candidate.

  - The Alcohol Unit uses a Zinc-based Drew system. All other units use Nalco Zinc-based.

- At this point, if everything looks good, the team suggests taking the effluent from the test cooling tower or portable unit and see what biotoxicity tests show.

- We need to write down the criteria for acceptability of these test chemicals.

  - TWH-need a group of people who will look at test results and evaluate, such as Chuck Leveque and operations.

  - SVC will take to Jim Paisley, the VCM Plant inspector, and specify an acceptable corrosion rate. She will also ask the other plants to supply operating conditions and acceptable corrosion rates, prior to the portable cooling tower test.

  - We will submit test results back to people after test has been run.

C. Other Items

- No formal presentation has been made to management about this. The cooling tower test and biotoxicity testing will be mentioned in the Environmental and Wastewater Meeting with R&D on Wednesday.

- DAE: Why have we limited ourselves to using Grace?

  - PLF: Grace is the only one that showed promise. They have an industrial application in the same water. However, we will work with any vendor which will show that the effluent from their cooling tower treatment is not biotoxic and will pay for their biotoxicity testing.

  - WSC: Cindy Gross had just started to work with Drew on their molybdate program. It seemed to have potential.

  - PLF: AMN might want to do some molybdenum toxicity testing: Acute testing for glimmer of hope.

  - Nalco is aware that we want them to do testing, but they want us to pay for it. They are aware of their toxicity, and want to talk to us at their next quarterly review with Operations.

- DAE: We asked Drew to do some acute testing for us.
  - They had data on rainbow trout but not Daphnia. They haven't gotten back with us yet.
  - DAE will get the information on the valances and concentration of the molybdenum, as well as the acute testing data if it was done.No chronic testing was requested.

II. Biotoxicity study and compliance: Geoff Russel

A. We decided to look at heavy metals, and determine their acute toxicity:

1. 48 hr LC_{50} on Daphnia Magna

	Concentration (mg/liter)		
Compound	Vista LC_{50}	Literature LC_{50}	Gold Book Chronic
Calcium	1100		
Zinc	0.42-0.5		
Nickel	not toxic	1.4	0.16
Lead	0.25	0.082	
Copper	0.012	0.018	0.012

* 1 mg/liter was the highest concentration tested for nickel. However, our outfall runs about .02, which is not very high when compared to the reported values.

- We don't have ~~must~~ much historical data for copper. We have never been asked to monitor for this. One value seen was 0.05 which is 2-3 times the acute and chronic levels. This raises the flag for copper. We have several sets of data from ENSR. PLF will check into this data.

2. A typical effluent mixture was made using an average concentration of ions.
   - A dilution test was run with this effluent. A 61% LC_{50} for was seen for the mixture, indicating an acutely toxic effluent. There was not enough data to determine if zinc is major contributor.
   - A similar test was run on a simulated effluent with a salinity level of 4.5. A 51% LC_{50} was seen.

B. Summary of the data presented:

- Calcium seems to be less of a problem than originally thought. We were about twice the concentration that Ken Dickson indicated would be toxic.
  - PLF: We did some testing in summer '88, where we had a GSRI raise the total hardness of the water up to 1200 to 1400 parts. The Daphnia survived and thrived, giving essentially the same results as the control.
- Zinc seems to be a major problem. This is supported both by literature and R&D values. Our normal zinc level is about 5 times the nominal acute level. GLR will verify the zinc problem.
- We may want to get more data on copper. PLF will check on ENSR data for typical levels.
- AMN: It would be good confirmatory data to back out each component and see what is actually causing the toxicity. VWW requested that we test the toxicity of the normal concentrations of these ions on the bacterial populations that would be found in the ASU or lagoons. There has been no effect from the zinc or nickel, at these concentrations on the bacterial mass.
- Chlorides
  - TWH: Were chlorides a concern of the plant? The wastewater team is looking at running the wastewater from the whole complex through VCM's ASU.
  - PLF: It was more from a salting out effect, which would tend to make the sludge float instead of settling out. But it might not hurt for AMN to look at high chloride levels, about 3000 ppm to start with. The sewage sludge may have to be acclimated to the high salinity.
- AMN will be bringing in sludge vendors on Thursday and Friday. TRB and SW will take them around the plant.

III. Other Items

A. We will postpone talking about the biotoxicity study, compliance issues, potential study plans and implementation study until the next time. The next meeting will be at 8:30 AM Thursday, January 25, 1990.

B. Most group members feel that there is a lack of communication of what this team is doing to those outside the team. A better method of communicating ideas to the rest of the company needs to be developed, especially where management is concerned.

- Need to get more intrateam communications.
- Need to have better communications with R&D.
- Need to keep management appraised of our progress.
- Try to get Curt Watson involved in next meeting.
- Present biotoxicity team efforts at the meeting with R&D and LCCC management at the meeting on Wednesday.

ACTION ITEMS:

1. DAE will contact Drew representative to get concentration, valence and biotoxicity data on their molybdate program.

2. PLF will obtain typical and historical copper values of the effluent.

3. AMN will test copper and zinc further, as well as leave out single components to determine what ion is causing problems. He will also test high levels of chlorides for biotoxicity.

4. Group members will review letter on the Biotoxicity Study and Compliance Issues, and be ready to discuss it at the next meeting.

5. TWH will approach CW about attending the next biotoxicity meeting.

T. R. Bell

Distribution: JF PDC CRD GLF MLA JCS FBS - LCCP
PLF SVC DB GGB - LCVCM
VWW JRR JEH FLR DLW DAP PAM - Austin
TWH WSC CW - Houston

To: Distribution

From: A. M. Nielsen

Date: January 2, 1990

Interoffice Communication

Subject: **MINUTES OF BIOTOXICITY TEAM MEETING 12/20/89**

VISTA

Attendees: 12/20/89

Paul Fetzer	LCVCM	(318)494-5067
Doug Fodge	ChemGen Corp.	(301)330-4101
Sandra Corkran	LCVCM	(318)494-5026
Tom Heller	Vista PED Houston	(713)588-3886
Wendy Call	Vista PED Houston	(713)588-3863
Theresa Bell	LCCP	(318)494-5262
A. M. Nielsen	Vista R&D Austin	(512)331-2461
Don Wharry	Vista R&D Austin	(512)331-2464
George Hopkins	Vista PED Houston	(713)588-3976
David Booth	LCVCM	(318)494-5031
Charlie Dutra	LCCP	(318)494-5347
Jim Shamburger	LCCP	(318)494-5446
Gary Foshee	LCCP	(318)494-5156
Graham Bacon	LCVCM	(318)494-5025
Pat Morris	Vista R&D Austin	(512)331-2442
Dave Penney	Vista R&D Austin	(512)331-2468
Duane Every	LCCP	(318)494-5817
John Roheim	Vista R&D Austin	(512)331-2462
Ken Dickson	North Texas State	(817)565-2694

An overview of the R&D environmental effort was given by J. R. Roheim (see Attachment 1). A. M. Nielsen explained R&D's commitment to biotoxicity testing (Attachment 2) and D. L. Wharry showed the progress being made with membranes for treating waste water (Attachment 3).

Business

Sandra Corkran reviewed the history of the biotoxicity team.

P. Fetzer reviewed the status of 308 - Letter Testing.

- ENSER has had problems with fathead minnows recently. They are experiencing some sort of microbial infection. ENSER is now getting new cultures which should be free of infection.

- December testing shows:

Toxicity threshold		Outfall	7-day LC50
Zn	80 ppb	400-800 ppb	outfall - 38%
Ni	8-13 ppb	40-80 ppb	Bayou Verdine 8 - 100%

- Recently the methyl chloride unit was running and Zn^{+2} was up to 600 ppb in the outfall.

- Paul Fetzer reports that Grace has a cooling tower treatment system that is free of heavy metals.

- J. Roheim suggested that the team push ahead and do an in-plant test which would determine if the Grace system works.

- A copy of the most recent biotoxicity and chemical analysis done in response to the EPA letter of June 9, 1989, requiring chronic biomonitoring, Zinc and Nickel analyses. (See Attachment 4)

- A copy of questions from Battelle for the kickoff meeting on January 5, 1990 is Attachment 5.

Action Items:

1. Ken Dickson to visit Austin on January 4, 1990.

2. A. M. Nielsen to:

   - Visit ENSER in early January.

   - Contact Dow people to learn what they did to solve their toxicity problems internally.

   - Review with new metallurgist (Chuck Leveque) problems associated with replacing zinc in cooling towers.

   - Find acute/chronic aquatic toxicity of magnesium.

3. Team to come up with strategic plan for presentation to management.

4. P. Fetzer will provide physical chemical data on effluents, existing toxicity data to Battelle.

5. Wendy Call will provide information on streams which bypass WWTP, and biocides being used to Battelle.

6. Sandra Corkran will provide Battelle with any instream biological data on fish or invertebrates collected over past 2-5 years, information on herbicides, pesticides or fungicides used throughout the facility.

7. Tom Heller will provide future plans for WWTP to Battelle.

8. Battelle will also be given a copy of the basis of study, source survey, basis of design and basis of bids for the WWTP modification plan.

9. P. Fetzer to get a more complete explanation of the Grace cooling tower treatment system to the team and a proposal for carrying out an in-plant test to determine if the Grace system will work.

A. M. Nielsen

A. M. Nielsen

Distribution:
AUSTIN, V. W. Weiss, J. R. Roheim, J. E. Heinze, G. L. Russell, D. L. Wharry, D. A. Penney, P. A. Morris; HOUSTON, T. W. Heller, W. S. Call, G. E. Hopkins; LCVCM, P. L. Fetzer, S. V. Corkran, D. Booth, G. Bacon; LCCP, T. Bell, C. Dutra, J. C. Shamburger, G. L. Foshee, D. A. Every

CONSULTANT, Ken Dickson