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Attach L

Let's protect our earth



State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES
SOUTHERN BUREAU OF REGIONAL ENFORCEMENT
20 EAST CLEMENTON ROAD
THE PAINT WORKS
GIBBSBORO, NEW JERSEY 08026

JUL 12 1991

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Barry Nuss
Shieldalloy Metallurgical Corporation
West Blvd., P.O. Box 768
Newfield, New Jersey 08344

Re: Administrative Consent Order ("ACO")
Shieldalloy Metallurgical Corporation
NJ0004103
Newfield, Gloucester County

Dear Mr. Nuss:

Attached hereto is a fully executed ACO prepared by the New Jersey Department of Environmental Protection ("NJDEP") pursuant to the provisions of N.J.S.A. 58:10A-10b and d.

The attached document was signed by NJDEP on June 28, 1991 and is the effective date of this ACO is June 28, 1991.

If you have any questions concerning this ACO, please contact Mary Simpson at (609) 346-8032 or by letter through this Bureau.

This Bureau anticipates your continued cooperation in assisting us in the prevention and control of water pollution in New Jersey.

Very truly yours,

Edward H. Post, P.E., Chief
Southern Bureau of
Regional Enforcement

MS:mel
Enclosure



cc: Chief L. Livingston, Permits Admin. Branch, USEPA Region II
Patrick Durack, USEPA Region II
Gloucester County Health Department
Division of Hazardous Waste Management, Bureau of
Federal Case Management
Wastewater Facilities Management Element
Ground Water Quality Management Element
Sandy Kritzman, Superfund Coordinator
John Renella, Deputy Attorney General

bcc: Region/Post/Weigand
Callahan
Simpson
Donna Gaffigan, BFCM
Division/McCafferty



State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES

CN 029
Trenton, N.J. 08625-0029

Office of
the Director

(609) 292-1637
Fax # (609) 984-7938

IN THE MATTER OF :
SHIELDALLOY METALLURGICAL CORPORATION: ADMINISTRATIVE
NEWFIELD, GLOUCESTER COUNTY : CONSENT
ORDER

This ADMINISTRATIVE CONSENT ORDER is issued pursuant to the authority vested in the Commissioner of the New Jersey Department of Environmental Protection (hereinafter "NJDEP" or "the Department") by N.J.S.A. 13:1D-1 et seq. and the New Jersey Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq., and duly delegated to the Assistant Director of the Division of Water Resources pursuant to N.J.S.A. 13:1B-4.

FINDINGS

1. The Shieldalloy Metallurgical Corporation ("Shieldalloy"), a New York corporation, owns and operates a 61.6 acre speciality alloy manufacturing facility ("the facility") located at Block 7, Lot 7; and Block 26, Lots 1, 4, 5, and 16; Borough of Newfield, Gloucester County, New Jersey. Previously, from the early 1950's to September 1990, Shieldalloy had also conducted chromium manufacturing processes at this facility.
2. Past practices at the facility, including the discharge of chromium contaminated wastewater into unlined lagoons, have caused ground water contamination at and emanating from the site. In 1979, Shieldalloy began a program to recover and treat ground water at a rate of approximately 80 gallons per minute ("gpm") under Departmental guidance.
3. On September 5, 1984, Shieldalloy and NJDEP entered into an Administrative Consent Order ("the 1984 ACO") which required Shieldalloy to conduct a remedial investigation and feasibility study ("RI/FS") of remedial measures for the on-site and off-site ground water contamination, and to continue the ground water recovery program. The 1984 ACO was executed in response to concerns that the existing ground water recovery and ion exchange treatment system was not fully capturing the chromium plume and remediating the ground water contamination. During the required



investigation, it was additionally discovered that volatile organic contaminants were present in the ground water in addition to the chromium.

4. On March 25, 1985, NJDEP issued a New Jersey Pollutant Discharge Elimination System ("NJPDES") Permit No. NJ0004103 ("the Permit") to Shieldalloy for the discharge of treated process wastewater and ground water, stormwater, and non-contact cooling water (which are pollutants, as defined by N.J.A.C. 7:14A-1.9) into the Hudson Branch of the Maurice River via outfall 001. The effective date of the Permit was May 1, 1985 and the expiration date was April 30, 1990. Shieldalloy submitted an application for a permit modification on March 5, 1987 to allow for an increase of flow due to increased ground water recovery and for the construction of a new ground water treatment plant to treat this increased amount of recovered ground water. Shieldalloy has also requested a permit modification to include an ongoing, unpermitted discharge of non-contact cooling water and stormwater to the Hudson Branch commonly referred to as "002". NJDEP issued a draft NJPDES Permit on April 20, 1989 ("the draft") which contained water quality based effluent limitations for chromium which were more stringent than those listed in the Permit. The draft also proposed to revoke and reissue the Permit. This draft has not yet been issued as a final permit.

5. In August 1988, on behalf of Shieldalloy, Dan Raviv Associates, Inc. compiled information titled "Attachment II to the Surface Water Discharge Permit Summary of Flow and Quality Measurements of the Hudson Branch and Projected Conditions" which included documentation indicating that at ground water recovery rates under 400 gpm, there is an inflow of contaminated ground water to the Hudson Branch at a point down stream of Shieldalloy's NJPDES regulated outfall 001.

6. On October 5, 1988, NJDEP-Division of Hazardous Waste Management ("DHWM") and Shieldalloy entered into another Administrative Consent Order ("the 1988 ACO") because NJDEP determined that, among other things, Shieldalloy had not fully investigated and remediated the ground water contamination at and emanating from the site. The 1988 ACO included a requirement for Shieldalloy to begin operating a 400 gpm ground water remediation system as an interim remedial measure, which would discharge treated ground water to the Hudson Branch of the Maurice River through Shieldalloy's 001 outfall. Shieldalloy constructed a new ion exchange ground water treatment plant ("the treatment plant") to comply with the 1988 ACO and began the operation of the treatment plant in July 1989. The 1988 ACO also required Shieldalloy to perform a site wide RI/FS and conduct other interim remedial actions.

7. Part IV, page 13, Table 1A of the Permit sets forth specific parameters to be reported on Discharge Monitoring Reports ("DMRs") and identifies discharge limitations for each parameter. Shieldalloy submitted DMRs to NJDEP as required by the Permit for

the periods of June 1, 1987 to April 30, 1989 which demonstrated that Shieldalloy had violated the discharge limits of the Permit. On June 29, 1989, NJDEP issued an Administrative Order and Notice of Civil Administrative Penalty Assessment in the amount of \$502,000 for the aforementioned violations. On July 25, 1989, Shieldalloy formally requested an Administrative Hearing on this matter.

8. Shieldalloy subsequently submitted DMRs for the period of June 1989 to April 1991 which is attached hereto as Appendix V and incorporated herein, which demonstrated that Shieldalloy continued to violate the discharge limits of the Permit sporadically up to and including the monitoring period of July 1990. Shieldalloy is currently complying with the discharge limits of the Permit.

9. Shieldalloy performed a treatability study dated February 27, 1990 to determine the cause for the inability of the treatment plant to meet its Permit limitations while complying with the pumping rate in the 1988 ACO. This report indicated that the ground water contained colloidal metals limiting the treatment efficiency of the treatment plant. Further treatability studies are ongoing by Shieldalloy.

10. Based on these FINDINGS, NJDEP has determined that Shieldalloy has violated the Permit and the Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq., specifically N.J.S.A. 58:10A-6, and the regulations promulgated pursuant thereto, N.J.A.C. 7:14A-1 et seq., specifically 7:14A-1.2(c).

11. Based upon the information available to the parties on the effective date of this Administrative Consent Order and to amicably resolve the above matters, the Department and Shieldalloy enter into this Administrative Consent Order without trial or adjudication of any of the facts or issues contained herein.

ORDER

NOW THEREFORE IT IS HEREBY ORDERED AND AGREED THAT:

12. Shieldalloy shall comply with the terms and conditions of its Permit except as set forth by the terms and conditions outlined in paragraph seventeen (17) below and Appendix I.

I. ENFORCEMENT COMPLIANCE AND MONITORING SCHEDULE

A. TREATMENT OPTIMIZATION STUDY

13. Shieldalloy shall conduct a Treatment Optimization Study to determine the actions Shieldalloy will implement to comply with Permit discharge limitations while also maintaining the ground water recovery pumping requirements of the 1988 ACO. This study should include, but not be limited to the following:

- a. a concentration monitoring program to monitor the Total Chromium content of the ion-exchange discharge as it leaves the ion-exchange plant vis-a-vis the concentration of Total Chromium and flow rates at outfall 001;
- b. the feasibility of utilizing equalization or surge tanks in order to increase pumping efficiency; and
- c. any other interim measures that may be utilized for increasing the groundwater recovery/treatment system's ability to meet the 400 gpm continuous pumping requirement while maintaining compliance with the Permit limits.

The results of this study shall be summarized and submitted to NJDEP on or before September 15, 1991 along with a proposed compliance schedule to implement these measures to meet the Permit discharge limitations while maintaining the ground water recovery pumping requirements of the 1988 ACO.

14. Shieldalloy shall, within forty-five (45) days of receipt of NJDEP's comments on the proposed interim measures and compliance schedule, submit a revised Treatment Optimization Study and compliance schedule incorporating NJDEP's comments. Upon receipt of NJDEP's final approval of the study and schedule, Shieldalloy shall begin to implement the interim measures in accordance with the approved schedule. The approved schedule shall become a part of this Administrative Consent Order.

B. INSTREAM SAMPLING REQUIREMENTS

15. Shieldalloy shall conduct instream sampling for total suspended solids, total chromium, hexavalent chromium, and stream flow which should include, at a minimum, samples obtained at sample points upstream of Shieldalloy's discharge point 001, immediately downstream of 001, downstream of the ground water recharge point in the stream, and in the non-degradation area of the Maurice River upstream and downstream of the confluence with the Burnt Mill Branch, including the sample points listed in the July 12, 1990 report by Dan Raviv Associates, Inc. on behalf of Shieldalloy which is attached hereto and incorporated herein as Appendix II. This sampling shall be conducted twice-quarterly for a one year period, with at least two sets of samples conducted during the assumed low flow period of August 15 through October 15. The reports summarizing the quarterly results must be submitted to the address listed in paragraph twenty-eight (28) below in accordance with the schedule listed in paragraph eighteen (18) below.

C. EFFLUENT MONITORING

16. In addition to the monitoring required in the Permit, Shieldalloy shall conduct 1.) a chronic toxicity characterization study and chronic toxicity biomonitoring in accordance with Appendix III; 2.) acute toxicity biomonitoring in accordance with Appendix IV; and 3.) a Toxicity Reduction Evaluation ("TRE") as

required in accordance with Appendix IV which are attached hereto and made part hereof. These studies shall consist of quarterly definitive acute and chronic toxicity tests (after the chronic toxicity characterization study is conducted) of the wastewater discharge and shall be conducted for at least a one year period, and reports summarizing the quarterly results must be submitted to the address listed in paragraph twenty-eight (28) below in accordance with the schedule listed in paragraph eighteen (18) below. After one year of monitoring, Shieldalloy may request a reduction in these sampling requirements.

III. INTERIM ENFORCEMENT EFFLUENT LIMITATIONS AND MONITORING AND REPORTING REQUIREMENTS

17. From the effective date of this Administrative Consent Order until the effective date of Final Effluent Limitations in a final, effective NJPDES permit or equivalent NJDEP decision document is issued to Shieldalloy, Shieldalloy shall meet the interim enforcement effluent limits specified in Appendix I which is attached hereto and made part hereof. The Department shall use the interim enforcement effluent limitations in determining Shieldalloy's compliance with the terms and conditions of the Permit.

II. PROGRESS REPORTS

18. Shieldalloy shall submit to NJDEP quarterly progress reports, the quarters being January through March, April through June, July through September, and October through December of each calendar year. Each report shall be submitted to the addresses in paragraph twenty-eight (28) on or before the last day of the month following the quarter being reported. Shieldalloy shall submit the first progress report to NJDEP by October 31, 1991.

19. Each progress report shall detail the status of Shieldalloy's compliance with this Administrative Consent Order and shall include the following:

- a. identification of the site and reference to this Administrative Consent Order;
- b. status of work at the site and progress to date;
- c. difficulties or problems encountered during the reporting period;
- d. actions taken or to be taken to rectify difficulties or problems;
- e. an explanation of any non-compliance with any approved schedule;
- f. an evaluation of performance of all corrective, remedial measures implemented to date;

23. Any such penalty shall be due and payable fourteen (14) calendar days following receipt of a written demand by NJDEP. Payment of stipulated penalties shall be made by a cashier's or certified check payable to the "Treasurer, State of New Jersey" and shall be submitted to the address listed in paragraph twenty (20) above.

24. If Shieldalloy fails to pay stipulated penalties pursuant to the preceding paragraph, NJDEP may bring an action for a civil penalty or assess civil administrative penalties for violations of the Administrative Consent Order or may institute civil proceedings to collect stipulated penalties. NJDEP may also bring an action in New Jersey Superior Court pursuant to N.J.S.A. 58:10A-10 to enforce the provisions of this Administrative Consent Order or initiate any other appropriate enforcement action.

25. The payment of stipulated penalties does not alter Shieldalloy's responsibilities to complete any requirements of this Administrative Consent Order.

IV. FORCE MAJEURE

26. If any event occurs which Shieldalloy reasonably believes will or may cause delay in the compliance with any provision of this Administrative Consent Order, Shieldalloy shall notify NJDEP in writing within seven (7) calendar days of the delay or anticipated delay, as appropriate, referencing this paragraph and describing the anticipated length of the delay, the precise cause or causes of the delay, any measures taken or to be taken to minimize the delay, and the time required to take any such measure to prevent or minimize any such delay. Shieldalloy shall take all necessary actions to prevent or minimize any such delay.

27. If NJDEP finds that: (a) Shieldalloy has complied with the notice requirements of the preceding paragraph; (b) that any delay or anticipated delay has been or will be caused by fire, flood, riot, strike or other circumstances beyond the control of Shieldalloy; and (c) that Shieldalloy has taken all necessary actions to prevent or minimize the delay, NJDEP shall extend the time for performance hereunder for a period no longer than the delay resulting from such circumstances. If NJDEP determines that Shieldalloy has not complied with the Notice requirements of either the preceding paragraph, or the event causing the delay is not beyond the control of Shieldalloy, or Shieldalloy has not taken all necessary actions to prevent or minimize the delay, this paragraph shall not be applicable and failure to comply with the provisions of this Administrative Consent Order shall constitute a breach of the requirements of the Administrative Consent Order. The burden of proving that any delay is caused by circumstances beyond the control of Shieldalloy, the length of any such delay attributed to those circumstances and all necessary actions were taken to prevent or minimize the delay shall rest with Shieldalloy. Increase in the cost or expenses incurred by Shieldalloy in fulfilling the requirements of this

Administrative Consent Order shall not be a basis for an extension of time. Delay in an interim requirement shall not automatically justify or excuse delay in the attainment of subsequent requirements. Force Majeure shall not automatically include contractor's breach unless such breach falls within (a), (b), or (c) of this paragraph.

V. GENERAL PROVISIONS

28. Shieldalloy shall submit three (3) copies of any document required by this Administrative Consent Order by certified mail, return receipt requested or by hand delivery with an acknowledgement of receipt form for NJDEP's signature to:

Edward H. Post, P.E., Chief
Southern Bureau of Regional Enforcement
Division of Water Resources
20 East Clementon Road, Suite 301 South
Gibbsboro, New Jersey 08026

However, any penalty payments shall be made as instructed and to the address in paragraph twenty (20) above.

29. All provisions of the Permit and the 1988 ACO shall remain in full force and effect and are not modified by this Administrative Consent Order. The enforcement compliance and monitoring schedule and interim enforcement effluent limitations are enforcement compliance requirements that Shieldalloy shall meet while working to meet the final effluent limitations as established by NJDEP. The enforcement compliance requirements of this Administrative Consent Order do not modify any provisions of the Permit or the 1988 ACO or any of the duties or liabilities of Shieldalloy thereunder.

30. Nothing in this Administrative Consent Order shall preclude NJDEP from taking enforcement action against Shieldalloy for matters not set forth in the FINDINGS of this Administrative Consent Order.

31. This Administrative Consent Order shall be binding on Shieldalloy, its principals, directors, officers, agents, successors, assignees and any trustee in bankruptcy or receiver appointed pursuant to a proceeding in law or equity.

32. Shieldalloy shall perform all work conducted pursuant to this Administrative Consent Order in accordance with prevailing professional standards.

33. This Administrative Consent Order shall not relieve Shieldalloy from obtaining and complying with all federal, state and local permits, as well as all applicable statutes and regulations while carrying out the obligations of this Administrative Consent Order.

34. This Administrative Consent Order shall not preclude NJDEP from requiring that Shieldalloy apply for any permit or permit modification issued by NJDEP under the authority of the Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq., and/or any other statutory authority for the matters covered herein. The terms and conditions of any such permit or equivalent NJDEP decision document shall not be preempted by the terms and conditions of this Administrative Consent Order even if the terms and conditions of any such permit are more stringent than the terms and conditions of this Administrative Consent Order.

35. To the extent that the terms and conditions of any such Permit, Permit modification, or equivalent NJDEP decision document are substantially equivalent with the terms and conditions agreed to under this Administrative Consent Order, Shieldalloy waives any rights it may have to a hearing on such terms and conditions during any such permit process. Under all other circumstances related to the terms of this paragraph, Shieldalloy's hearing rights are specifically reserved.

36. All appendices referenced in this Administrative Consent Order, and all reports, work plans and documents required under the terms of this Administrative Consent Order are, upon approval by NJDEP, incorporated into this Administrative Consent Order by reference and made a part thereof.

37. Obligations and penalties of this Administrative Consent Order are imposed pursuant to the police powers of the State of New Jersey for the enforcement of law and the protection of the public health, safety and welfare and are not intended to constitute debt or debts which may be limited or discharged in a bankruptcy proceeding.

38. In addition to NJDEP's statutory and regulatory rights to enter and inspect, Shieldalloy shall allow NJDEP and its authorized representatives access to the facility at reasonable times for the purpose of monitoring compliance with this Administrative Consent Order.

39. NJDEP reserves the right to require Shieldalloy to take additional action should NJDEP determine that such actions are necessary to protect human health or the environment. Nothing in this Administrative Consent Order shall constitute a waiver of any statutory right of NJDEP to require Shieldalloy to undertake such additional measures should NJDEP determine that such measures are necessary.

40. Shieldalloy shall not construe any informal advice, guidance, suggestions or comments by NJDEP, or by persons acting on behalf of NJDEP, as relieving Shieldalloy of its obligation of obtaining written approvals as may be required herein, unless such advice, guidance, suggestions, or comments by NJDEP shall be submitted in writing to Shieldalloy.

41. Shieldalloy hereby consents to and agrees to comply with this Administrative Consent Order which shall be fully enforceable as an Order in the New Jersey Superior Court upon the filing of a summary action for compliance pursuant to the Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq.

42. In any action brought by the Department to enforce this Administrative Consent Order, Shieldalloy may raise, inter alia, a defense that Shieldalloy failed to comply with a decision of the Department, made pursuant to this Administrative Consent Order, because the Department's decision was arbitrary, capricious, unreasonable, or otherwise unlawful. If Shieldalloy is successful in establishing that defense, then Shieldalloy shall not be liable for stipulated penalties for failure to comply with that particular Department decision.

43. Shieldalloy agrees not to contest the authority or jurisdiction of NJDEP to issue this Administrative Consent Order and also agrees not to contest the terms of this Administrative Consent Order in any action to enforce its provisions.

44. Shieldalloy shall give written notice of this Administrative Consent Order to any successor in interest no later than ninety (90) days prior to transfer of ownership of the facilities which are the subject of this Administrative Consent Order, and shall simultaneously verify to NJDEP that such notice has been given. This requirement shall be in addition to any other statutory or regulatory requirement arising from the transfer of ownership of Shieldalloy's facilities.

45. The requirements of this Administrative Consent Order shall be deemed satisfied upon the receipt by Shieldalloy of written notice from NJDEP that Shieldalloy has demonstrated, to the satisfaction of NJDEP, that all the terms of this Administrative Consent Order have been completed.

46. HEARING WAIVER. When this Administrative Consent Order becomes effective, Shieldalloy waives its rights to a hearing on the matters contained hereinabove pursuant to N.J.S.A. 52:14B-1 et seq. Additionally, Shieldalloy hereby withdraws its July 25, 1989 request for an adjudicatory hearing regarding the June 29, 1989 Administrative Order and Notice of Civil Administrative Penalty Assessment.

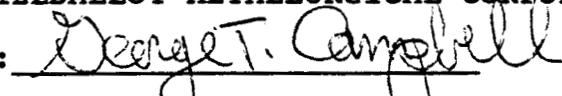
47. No modification or waiver of this Administrative Consent Order shall be valid except by written amendment duly executed by Shieldalloy and NJDEP, or by NJDEP's modification in writing of any of the provisions pursuant to the Force Majeure provisions hereinabove.

48. This Administrative Consent Order becomes effective upon the execution hereof by all parties.

DATE 6-28-91

BY: 
James K. Hamilton
Assistant Director
Enforcement Element

DATE 6/28/91

SHIELDALLOY METALLURGICAL CORPORATION
BY: 
NAME: George T. Campbell
TITLE: Vice President - Technology

APPENDIX I

APPENDIX I
 INTERIM ENFORCEMENT EFFLUENT LIMITATIONS
 AND MONITORING REQUIREMENTS - "001"

(Sampling shall be on a monthly basis utilizing grab samples unless otherwise specified)

STANDARDS CHARACTERISTICS	Maximum Load Allocations (1)		Maximum Concentrations (1)		Maximum Percent (1) Removal Limitations	
	Average Monthly Discharge Limitation (kg/day)	Max. Daily Discharge Limitation (kg/day)	Average Monthly Discharge Limitation (mg/l)	Max. Daily Discharge Limitation (mg/l)	Average Monthly	Any Four Hour Period
Chromium (Total).(1)	NL	.13	NL	NL	NA	NA
Chemical Oxygen Demand (COD)	NA	NA	NL	100 ⁽²⁾	NA	NA
Total Volatile Organics (3) (4) (5)	NA	NA	NL	NL	NA	NA
Acute Toxicity (5) (6)	NA	NA	NA	NMAT	NA	NA
Chronic Toxicity (5) (6)	NL	NL	NL	NL	NA	NA

- (1) Sampling shall be conducted on a weekly basis during a working week
- (2) Daily Maximum
- (3) Total Volatile Organics means the sum of the concentration of those Volatiles listed under N.J.A.C. 7:14A Appendix which are present at over 10 ug/L in the liquid phase
- (4) If one year of monitoring data indicates that these pollutants are not present in detectable amounts Shieldalloy may request a deletion of these monitoring requirements
- (5) Sampling shall be conducted on a quarterly basis
- (6) Sampling shall be in accordance with paragraph (16) and Appendices III and IV

APPENDIX I
 INTERIM ENFORCEMENT EFFLUENT LIMITATIONS
 AND MONITORING REQUIREMENTS - "002"

(Sampling shall be on a monthly basis utilizing grab samples unless otherwise specified)

STANDARD CHARACTERISTICS	Maximum Load Allocations (2)		Maximum Concentrations (1)		Maximum Percent (1) Removal Limitations	
	Average Monthly Discharge Limitation (kg/day)	Average Daily Discharge Limitation (kg/day)	Average Monthly Discharge Limitation (mg/l)	Average Daily Discharge Limitation (mg/l)	Average Monthly	Any Four Hour Period
Flow (mgd)			NL	NL		
Total Suspended Solids (3)	NA	NA	NL	50 ⁽²⁾		
Chemical Oxygen Demand (3)	NL	NL	NL	100 ⁽²⁾		
Petroleum Hydrocarbons	NL	NL	NL	15 ⁽²⁾		
Chromium (Total)	NL	NL	NL	NL		
Temperature	NL	NL	NL	30°C (86°F)		
Acute (4)	NA	NA	NA	NMAT		
Chronic (4)	NA	NA	NA	NL		

(1) The effluent values for pH shall remain within the limits of 6.0 to 9.0 standard units.

(2) Daily Maximum

(3) Quarterly Grab Samples

(4) Sampling shall be in accordance with paragraph (16) and Appendices III and IV

APPENDIX II

- d. Is accompanied by a certification of acknowledgement that is identical to the wording specified in Appendix H.

49. Within fourteen (14) calendar days after receipt of the Department's written comments on the proposed letter of credit, the proposed trust agreement, and the proposed certification of acknowledgement, Shieldalloy shall modify the documents to conform to the Department's comments and resubmit them to the Department.

50. Within fourteen (14) calendar days after receipt of the Department's written approval of the letter of credit, the trust agreement, and the certification of acknowledgement, Shieldalloy shall:

- a. Obtain and provides to the Department the irrevocable letter of credit in the amount of \$8,000,000.00 (eight million dollars);
- b. Establish the irrevocable standby trust fund and deposit an initial amount of \$1,000.00 (one thousand dollars) into the irrevocable standby trust fund; and
- c. Submit an originally signed duplicate of the trust agreement to the Department accompanied by the certification of acknowledgement.

51. Shieldalloy shall maintain the standby trust fund until terminated by the written agreement of the Department, the trustee and Shieldalloy, or of the trustee and the Department if Shieldalloy ceases to exist. Shieldalloy shall maintain the letter of credit until the Department returns the letter of credit to the issuing institution of termination. In the event that the Department determines that Shieldalloy has failed to perform any of its obligations under this Administrative Consent Order, the Department may draw on the letter of credit; provided, however, that before any draw can be made, the Department shall notify Shieldalloy in writing of the obligation(s) which it has not performed, and Shieldalloy shall have a reasonable time, not to exceed fourteen (14) calendar days, to perform such obligation(s).

52. At any time Shieldalloy may apply to the Department to substitute other financial assurances in a form, manner and amount acceptable to the Department.

B. Cost Review

53. Beginning three hundred sixty-five (365) calendar days after the effective date of this Administrative Consent Order and annually thereafter on that same calendar day, Shieldalloy shall submit to the Department a detailed review of all costs required for Shieldalloy's compliance with this Administrative Consent Order. This cost review shall include a detailed summary of all monies spent to date pursuant to this Administrative Consent Order, the estimated cost of all future expenditures required to comply with this Administrative Consent Order (including any operation and maintenance costs), and the reason for any changes from the previous cost review submitted by Shieldalloy.

54. At any time after Shieldalloy submits the first cost review pursuant to the preceding paragraph, Shieldalloy may request the Department's approval to reduce the amount of the letter of credit to reflect the remaining of performing its obligations under this Administrative Consent Order. If the Department grants written approval of the request, Shieldalloy may amend the amount of the then existing letter of credit.

55. If the estimated cost of meeting Shieldalloy's obligations in this Administrative Consent Order at any time exceed the amount of the letter of credit, Shieldalloy shall, within thirty (30) calendar days after receipt of written notice of the Department's determination, increase the amount of the then existing letter of credit so that it is equal to the estimated cost as determined by the Department.

C. Oversight Cost Reimbursement

56a. Within twenty-eight (28) calendar days after receipt from the Department of an itemized accounting of all costs incurred in connection with its oversight functions of this Administrative Consent Order for a fiscal year, or any part thereof, Shieldalloy shall submit to the Department a certified check payable to the "Treasurer, State of New Jersey" for the full amount of the Department's oversight costs.

b. For the purpose of this paragraph, oversight costs include, but are not limited to, hourly rates and hours worked by each individual and fringe benefits and overhead for monitoring Shieldalloy's compliance with this Administrative Consent Order; reviewing and presenting comments to Shieldalloy on materials submitted by Shieldalloy and conducting onsite inspections; sampling and analysis costs; and copy costs.

c. Shieldalloy agrees to pay oversight costs pursuant to this paragraph not to exceed \$100,000 annually, on a calendar year basis. The Department reserves the right to seek recovery from Shieldalloy of any administrative costs in excess of \$100,000.00. Shieldalloy is not agreeing to pay or that it is liable for administrative costs in excess of \$100,000.00 for any calendar year.

D. Stipulated Penalties

57. Shieldalloy shall pay stipulated penalties to the Department for its failure to comply with any of the paragraphs in this Administrative Consent Order according to the following schedule, unless the Department has modified the compliance date pursuant to the force majeure provisions hereinbelow:

<u>Calendar Days After Due Date</u>	<u>Stipulated Penalties</u>
1 - 7	\$ 100. per calendar day
8 - 14	500. per calendar day
15 - 21	1,000. per calendar day
22 - 28	2,500. per calendar day
29 - over	5,000. per calendar day

58. Any such penalty shall be due and payable fourteen (14) calendar days following receipt of a written demand by the Department. Payment of such stipulated penalties shall be made by cashier's or certified check payable to the "Treasurer, State of New Jersey". Each payment of a stipulated penalty shall include a letter describing the basis for the penalty.

V. Force Majeure

59. If any event occurs which Shieldalloy believes will or may cause delay in the achievement of any provision of this Administrative Consent Order, Shieldalloy shall notify the Department in writing within seven (7) calendar days of the delay or anticipated delay, as appropriate, referencing this paragraph and describing the anticipated length of the delay, the precise cause or causes of the delay, any measures taken or to be taken to minimize the delay, and the time required to take any such measures to minimize the delay. Shieldalloy shall take all necessary action to prevent or minimize any such delay.

60. If the Department finds that: (a) Shieldalloy has complied with the notice requirements of the preceding paragraph and; (b) that any delay or anticipated delay has been or will be caused by fire, flood, riot, strike or other circumstances beyond the control of Shieldalloy, the Department shall extend the time for performance hereunder for a period no longer than the delay resulting from such circumstances. If the Department determines that either Shieldalloy has not complied with the notice requirements of the preceding paragraph, or the event causing the delay is not beyond the control of Shieldalloy, failure to comply with the provisions of this Administrative Consent Order shall constitute a breach of the requirements of this Administrative Consent Order. The burden of proving that any delay is caused by circumstances beyond the control of Shieldalloy and the length of any such delay attributable to those circumstances shall rest with Shieldalloy. Increases in the cost or expenses incurred by Shieldalloy in fulfilling the requirements of this Administrative Consent Order shall not be a basis for an extension of time. Delay in an interim requirement shall not automatically justify or excuse delay in the attainment of subsequent requirements.

VI. General Provisions

61. This Administrative Consent Order shall be binding on Shieldalloy, its agents, successors, assignees and any trustee in bankruptcy or receiver appointed pursuant to a proceeding in law or equity.

62. Shieldalloy shall perform all work conducted pursuant to this Administrative Consent Order in accordance with prevailing professional standards.

63. Pursuant to the requirements of N.J.S.A. 45:8-27 et seq., all engineering drawings, land surveying, design and construction reports and any plan or specification involving professional engineering prepared by or on behalf of Shieldalloy under this Consent Order shall be signed and sealed by a New Jersey Licensed Professional Engineer or Land Surveyor or Registered Architect, or a Licensed Professional Engineer or Land Surveyor or Registered Architect as defined under N.J.S.A. 45:8-40, as the case may

be. In addition, pursuant to N.J.S.A. 45:8-41, all plans, specifications and estimates in the design, construction or maintenance of any public work involving professional engineering shall be made, and the construction and maintenance shall be supervised, by a Licensed Professional Engineer or a Registered Architect, and any work involving land surveying shall be performed only by a New Jersey Licensed Land Surveyor.

64. Shieldalloy shall conform all actions pursuant to this Administrative Consent Order with all applicable Federal, State, and local laws and regulations. Shieldalloy shall be responsible for obtaining all necessary permits, licenses and other authorizations.

65. All appendices referenced in this Administrative Consent Order, as well as the RI Report, the FS Report, and all other reports, work plans and documents required under the terms of this Administrative Consent Order are, upon approval by the Department, incorporated into this Administrative Consent Order by reference and made apart hereof.

66. Shieldalloy shall make available to the Department all data and information, including raw sampling and monitoring data, concerning pollution at and/or emanating from the site.

67. Shieldalloy shall make available to the Department all technical records and contractual documents maintained or created by Shieldalloy or its contractors in connection with this Administrative Consent Order.

68. Shieldalloy shall preserve, during the pendency of this Administrative Consent Order and for a minimum of six (6) years after its termination, all data, records and documents in their possession or in the possession of their divisions, employees, agents, accountants, contractors, or attorneys which relate in any way to the implementation of work under this Administrative Consent Order, despite any document retention policy to the contrary. After this six year period, Shieldalloy shall notify the Department within twenty-eight (28) days prior to the destruction of any such documents. If the Department requests in writing that some or all of the documents be preserved for a longer time period, Shieldalloy shall comply with that request. Upon request by the Department, the Shieldalloy shall make available to the Department such records or copies of any such records.

69. In order to assert a claim of confidentiality or privilege for any information submitted by Shieldalloy pursuant to this Administrative Consent Order, Shieldalloy must follow the procedures in N.J.A.C. 7:14A-11.1 et seq.

70. No obligations imposed by this Administrative Consent Order (with the exception of paragraph 57) are intended to constitute a debt, claim, penalty or other civil action which should be limited or discharged in a bankruptcy proceeding. All obligations imposed by this Administrative Consent Order shall constitute continuing regulatory obligations imposed pursuant to the police powers of the State of New Jersey intended to protect human health or the environment.

71. In addition to the Department's statutory and regulatory rights to enter and inspect, Shieldalloy shall allow the Department and its authorized representatives access to the site at all times for the purpose of monitoring Shieldalloy's compliance with this Administrative Consent Order provided that: (i) the Department or its representative seeking access to the facility shall endeavor to notify Shieldalloy's Project Coordinator upon their arrival at the facility, the Department or its representative shall give the Project Coordinator ninety (90) minutes to arrive at the facility during times other than normal business hours before proceeding with the inspection; (ii) the Department or its representatives shall comply with the applicable Worker Health and Safety Plan for the site; and (iii) the Department or its representative shall supply their own safety equipment.

72. The Department reserves the right to require Shieldalloy to take additional actions should the Department determine that such actions are necessary to protect human health or the environment. Nothing in this Administrative Consent Order shall constitute a waiver of any statutory right of the Department pertaining to any of the laws of the State of New Jersey should the Department determine that such measures are necessary.

73. Shieldalloy shall not construe any informal advice, guidance, suggestions, or comments by the Department, or by persons acting on behalf of the Department, as relieving Shieldalloy of its obligation to obtain written approvals as may be required herein, unless such advice, guidance, suggestion, or comments by the Department shall be submitted in writing to Shieldalloy.

74. No modification or waiver of this Administrative Consent Order shall be valid except by written amendment to this Administrative Consent Order duly executed by Shieldalloy and the Department.

75. Shieldalloy hereby consents to and agrees to comply with this Administrative Consent Order which shall be fully enforceable as an Order in the New Jersey Superior Court upon the filing of a summary action for compliance pursuant to N.J.S.A. 13:1D-1 et seq., the Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq. and/or the Solid Waste Management Act, N.J.S.A. 13:1E-1 et seq.

76. Shieldalloy agrees not to contest the authority or jurisdiction of the Department to issue this Administrative Consent Order and also agrees not to contest the terms of this Administrative Consent Order in any action to enforce its provisions.

77. In any action brought by the Department to enforce this Administrative Consent Order, Shieldalloy reserves any rights it may have to defend itself including the right to assert the defense that the Department decisions were unreasonable, arbitrary or capricious. Further, Shieldalloy reserves any rights it may have to contest any requirements of permits issued by the Department, but only to the extent that such requirements are in addition to the requirements of this Administrative Consent Order.

78. Shieldalloy shall give written notice of this Administrative Consent Order to any successor in interest prior to transfer of ownership of Shieldalloy facilities which are the subject of this Administrative Consent

Order, and shall simultaneously verify to the Department that such notice has been given.

79. The Department recognizes that the site is regulated by the Nuclear Regulatory Commission, therefore, certain activities conducted pursuant to this Administrative Consent Order at this site may require the approval of the Nuclear Regulatory Commission in addition to the approval of the Department.

80. The Department agrees to provide an opportunity for Shieldalloy to meet with the Director of the Division in the Department responsible for monitoring Shieldalloy's compliance with this Administrative Consent Order concerning the Department's decision on any selection of a remedial/corrective action alternative and NJDEP's actions or determinations on RI/FS reports (Paragraphs 25, 31, 32 and 36), if Shieldalloy objects in writing to any NJDEP's actions or determinations made pursuant to this Administrative Consent Order, within ten (10) calendar days after receipt of such decision from NJDEP. NJDEP and Shieldalloy shall have ten (10) calendar days thereafter to meet with the Director to resolve the objection. After the meeting, NJDEP will provide to Sheildalloy a written statement of the reasons for its final decision.

81. The requirements of this Administrative Consent Order shall be deemed satisfied upon the receipt by Shieldalloy's of written notice from the Department that Shieldalloy has demonstrated, to the satisfaction of the Department, that all the terms of this Administrative Consent Order have been completed.

82. If the last day allowed by this Administrative Consent Order for the doing of any act falls on a Saturday, a Sunday, or a legal Federal or State holiday, the time allowed for such act will be extended to include the next day which is not one of the aforementioned days.

83. This Administrative Consent Order shall become effective upon the execution hereof by both parties.

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Date: Oct 5, 1988

By: Ronald T. Corcory

Ronald T. Corcory, Assistant Director
Responsible Party Cleanup Element
Division of Hazardous Waste Management

Shieldalloy Metallurgical Corporation

Date: 9/30/88

By: W. Ferguson Porter

Name: W. Ferguson PORTER

Title: PRESIDENT

APPENDIX III

CHRONIC TOXICITY BIOMONITORING REQUIREMENTS

Shieldalloy shall conduct quarterly definitive chronic toxicity tests of the wastewater discharge. Such testing will determine if appropriately selected effluent concentrations will affect the survival, growth and/or reproduction of the test species.

The first chronic toxicity tests shall be initiated no later than August 25, 1992. All samples and measurements taken for the purpose of monitoring shall be representative of the monitored discharge.

A. All testing shall be conducted in accordance with the following specifications:

1. Testing shall be conducted in conformance with "Interim Chronic Toxicity Testing Methodologies for use in the NJPDES Permit Program, Version 1.0," February 1989, Part V designated for the use under the authority of NJDEP's NJPDES program. The laboratory performing the chronic testing shall be within the existing acute toxicity testing laboratory certification program established under N.J.A.C. 7:18-6.

2. The laboratory performing the testing shall be within the chronic toxicity testing laboratory certification program established under that subchapter.

3. Test results shall be expressed as both the NOEC (No Observable Effect Concentration) and the LOEC (Lowest Observable Effect Concentration) for each test endpoint. Where a chronic toxicity testing methodology yields NOEC's from more than one test endpoint, the most sensitive endpoint will be used to determine compliance.

4. The initial monitoring frequency shall be:

One set of tests every three months

Chronic toxicity tests shall be submitted according to the schedule listed in paragraph eighteen (18).

5. The test species shall be designated by NJDEP upon review of the results of the Chronic Toxicity Characterization Study.

CHRONIC TOXICITY CHARACTERIZATION STUDY

Shieldalloy shall conduct a chronic toxicity characterization study. This study will consist of concurrent chronic toxicity testing with two species conducted on the wastewater discharges DSN001 and 002. The first toxicity tests shall be initiated no later than August 25, 1991. All samples and measurements taken for the purpose of monitoring shall be representative of the monitored discharge.

A. All testing shall be conducted in accordance with the following specifications:

1. Testing shall be conducted in conformance with "Interim Chronic Toxicity Testing Methodologies for use in the NJPDES Permit Program, Version 1.0," February 1989, Part V designated for the use under the authority of NJDEP's NJPDES program. The laboratory performing the chronic testing shall be within the existing acute toxicity testing laboratory certification program established under N.J.A.C. 7:18-6.

2. Test results shall be expressed as both the NOEC (No Observable Effect Concentration) and the LOEC (Lowest Observable Effect Concentration) for each test endpoint.

3. The initial monitoring frequency shall be:
One set of split sample tests every three months

Chronic toxicity tests shall be submitted according to the schedule listed in paragraph eighteen (18).

4. Initially, chronic toxicity tests shall be conducted concurrently using two species. These species shall be:

Fathead minnow (Pimephales promelas), 7 day larval survival and growth test

Ceriodaphnia, 7 day, 3 brood survival and reproduction test

5. Shieldalloy has the option of concurrently testing with a third species from among the methods specified in paragraph A.1. above. The selection of the third species must be approved by NJDEP prior to commencing this study.

6. After a minimum of 4 pairs of concurrent acceptable tests, using split samples on the two species have been completed, subsequent toxicity testing will be conducted in accordance with the Chronic Toxicity Biomonitoring Requirements section of this Administrative Consent Order.

7. A preliminary report shall be submitted on or before July 25, 1991 or within two (2) months when there is a change in the contract laboratory. This report shall include:

a) a complete chronic methodology summary questionnaire, copies of which are provided to the certified laboratories; and

b) a schematic diagram of the facility with the sampling point clearly marked.

8. If a test has been evaluated for quality control and found to be unacceptable to NJDEP, the two concurrent split samples shall be repeated within 30 days of notification by NJDEP that the test is unacceptable.

9. Two copies of all test reports and all other information requested shall be submitted to:

Industrial Biomonitoring Program
Bureau of Industrial Discharge Permits
Division of Water Resources
CN029
Trenton, New Jersey 08625

APPENDIX IV

ACUTE TOXICITY BIOMONITORING REQUIREMENTS

Shieldalloy shall conduct definitive flow-through or definitive static renewal acute toxicity tests (bioassays) on its wastewater discharges.

A. All toxicity tests shall be conducted in accordance with the following:

1. Acute toxicity test procedures shall conform to the "Regulations Governing Laboratory Certification and Standards of Performance" (N.J.A.C. 7:18). Subchapter 6 of the regulations contains the criteria and procedures for acute toxicity testing and analysis. The laboratory performing your acute toxicity testing will have to be within the laboratory certification program included within those regulations.
2. Test results shall be expressed in terms of the mortalities in each effluent concentration and if they can be calculated, the median lethal concentration (LC50) with confidence interval.

B. Test Species and Test Duration

1. The test species and test duration shall be:

Fathead Minnow (Pimephales promelas), 96 hr.
2. The Department may designate the use of an alternate test species, or require concurrent testing with a second species.

C. Monitoring Frequency

1. The initial monitoring frequency shall be:

One test every three months for each outfall
2. If the results of any two valid acute toxicity tests for a single outfall, conducted within any six month period violated the acute toxicity limitation, the monitoring frequency for acute toxicity testing for that outfall shall be increased to one test per month, beginning within 3 months of the second violation. Shieldalloy must also initiate a Toxicity Reduction Evaluation ("TRE").
3. If the control mortality in any acute toxicity test is greater than or equal to 10% the test is invalid and the permittee shall begin an additional definitive acute toxicity test no later than 30 days after the completion of the invalid test in accordance with N.J.A.C. 7:18-6.

4. If the results of a valid acute toxicity test for a particular outfall indicate that a violation of the acute toxicity limitation has occurred, Shieldalloy shall begin an additional definitive test, for that outfall, no later than 30 days after the violation occurred, unless paragraph C.2. above is in effect.

D. The following information shall be submitted within two months from the effective date of this Administrative Consent Order:

1. A fully completed "Methodology Questionnaire for Acute Toxicity Test" form, which includes an identification of the certified acute toxicity testing laboratory responsible for the testing. Copies of this form are provided to certified laboratories.
2. A schematic diagram which depicts the location that the effluent samples will be taken; the diagram shall indicate the location of effluent sampling in relation to any wastewater treatment facilities and all Discharge Serial Numbers ("DSNs").
3. A photocopy of a county map or USGS quad with the location of the dilution water sampling site relative to the effluent discharge point marked (unless the use of an artificial water has been approved).

E. Acute toxicity test results shall be reported on the "NJPDDES Biomonitoring Report Form-Acute Bioassays," copies of which are provided to certified laboratories.

F. TOXICITY REDUCTION EVALUATION

If the results of two valid acute toxicity tests, for a single outfall, conducted within any six month period violate the acute toxicity limitation contained in Appendix III, Shieldalloy shall conduct a Toxicity Reduction Evaluation (TRE) to determine how Shieldalloy can consistently achieve the acute toxicity limitation.

1. The permitted shall submit to NJDEP, within 90 days of the date of the second violation, a plan of study of reconducting the TRE. The TRE plan shall include appropriate measures to identify the causative toxicant and/or evaluate toxicity treatability, and a schedule for completing the study.

2. Shieldalloy shall conduct the TRE consistent with the submitted plan and schedule. Progress reports shall be submitted to NJDEP beginning 90 days from the date of the TRE plan submission and every 90 days thereafter until the study completion.

3. Within 90 days of study completion, Shieldalloy shall submit to NJDEP the final study results and a schedule for completing the implementation of those measures identified in the study as necessary to attain compliance with the acute toxicity limitations.

4. Shieldalloy shall implement those measures identified in the study as necessary to attain compliance with the acute toxicity limitations consistent with the submitted scheduler. If, for any reason, the implemented measures do not result in compliance with the acute toxicity limitation, Shieldalloy shall continue the TRE. The TRE shall not be complete until Shieldalloy has attained compliance with acute toxicity limitation in the permit.

APPENDIX V

VIOLATIONS FROM 5-89 THROUGH 4-91

Monitoring Period	Parameter	Permit Limit	Reported Results
5-89	Chromium (Hexavalent)	100 ug/l	280
5-89	Chromium (Hexavalent)	100 ug/l	140
	Total Dissolved Solids	1000 mg/l	2800
	pH	5-9 SU	4.7
7-89	Total Dissolved Solids	1000 mg/l	1100
11-89	Oil and Grease	10 mg/l	42
1-90	Oil and Grease	10 mg/l	20 ave/43 max
	Total Dissolved Solids	1000 mg/l	5400
2-90	Oil and Grease	10 mg/l	31
5-90	Total Dissolved Solids	1000 mg/l	1200
7-90	Temperature	30 ° C	32

INTERIM CHRONIC TOXICITY TESTING METHODOLOGIES .

FOR USE IN THE NJPDES PERMIT PROGRAM

Version 1.0

February 1989

TABLE OF CONTENTS

Authority and Purpose	1
General Conditions	2
Safety	2
Test Concentrations	2
Dilution Water	2
Effluent Sample Collection	4
Physical Chemical Measurements	5
Statistics	5
Standard Reference Toxicant Testing	6
Methods Specifications	7
Fathead Minnow (<u>Pimephales promelas</u>) Larval Survival and Growth Test	8
<u>Ceriodaphnia dubia</u> Survival and Reproduction Test	10
Algal (<u>Selenastrum capricornutum</u>) Growth Test	12
Sheepshead Minnow (<u>Cyprinodon variegatus</u>) Larval Survival and Growth Test	14
Inland Silverside (<u>Menidia beryllina</u>) Larval Survival and Growth Test	16
<u>Mysidopsis bahia</u> Survival, Growth, and Fecundity Test	18
<u>Champia parvula</u> Sexual Reproduction Test	20
Teratogenicity Endpoints	22
References	23

Notice: Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

AUTHORITY AND PURPOSE

These interim methods for the conduct of whole effluent chronic toxicity testing are established under the authority of the NJPDES permitting program (N.J.A.C. 7:14A-2.9) for discharges to the waters of the State. They are intended as interim measures until the formal establishment of a laboratory certification program to govern the conduct of whole effluent chronic toxicity testing is established under N.J.A.C. 7:18. As such these methods are intended to be used to determine compliance with discharge permits issued under the authority of the NJPDES permit program. Tests are to be conducted in accordance with the general conditions and test organism specific method specifications contained in this document. All other conditions and specifications can be found in the cited USEPA methodologies (USEPA 1988, 1989).

Until a subchapter on chronic toxicity testing within the "Regulations Governing Laboratory Certification and Standards of Performance" (N.J.A.C. 7:18) becomes effective, tests shall be conducted in conformance with the interim methodologies as designated herein. The laboratory performing the testing shall be within the existing acute toxicity testing laboratory certification program established under N.J.A.C. 7:18-6, as required by N.J.A.C. 7:9-4.5(c)5.

Testing shall be in conformance with the subchapter on chronic toxicity testing within the "Regulations Governing Laboratory Certification and Standards of Performance" (N.J.A.C. 7:18) when such regulations become effective. The laboratory performing the toxicity testing shall be within the chronic toxicity testing laboratory certification program to be established under that subchapter when it becomes effective.

These interim methods are incorporated into discharge permits as enforceable permit conditions. Each discharge permit will specify in Part IV of the permit the test species specific methods from this document which will be required under the terms of the discharge permit. Therefore, each individual permittee affected by these permit conditions has the right to comment on the methods applicable to their specific discharge during the public comment period on each individual permit. Although the test species specific methods for each permit are determined on a case-by-case basis, the purpose of this methods document is to assure consistency among dischargers and to provide certified laboratories with information on the universe of tests to be utilized so that they can make the necessary preparations.

GENERAL CONDITIONS

LABORATORY SAFETY, GLASSWARE, ETC.

All safety procedures, glassware cleaning procedures, etc., shall be in conformance with "Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, 2nd edition", (USEPA 1989), "Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms" (USEPA 1988), or "Regulations Governing Laboratory Certification and Standards of Performance" (N.J.A.C. 7:18).

TEST CONCENTRATIONS

All testing is to be performed at a minimum of five effluent concentrations plus a dilution water control. One effluent concentration shall be the chronic permit limitation unless the existing data for the discharge indicate that the NOEC is expected to be significantly less than the permit limit. An effort shall be made to bracket the anticipated NOEC/LOEC test result.

DILUTION WATER - MARINE AND ESTUARINE WATERS

A high quality natural water, such as the Manasquan River Inlet (collected at high tide), is strongly recommended as the dilution water source for chronic toxicity testing with marine and estuarine organisms. The use of the receiving water as the dilution water source is not required. Saline waters prepared with hypersaline brine and deionized water may also be used as the base dilution water. Hypersaline brines shall be prepared from a high quality natural seawater and shall not exceed a concentration of 100 ppt.

The standard test salinity shall be 25 ppt, except for Champia parvula, which shall be tested at 30 ppt. Since most effluents are freshwater based, in most cases it will be necessary to adjust the salinities of the test concentrations to the standard test salinity.

The use of artificial seawater, prepared using artificial sea salts, is permitted but not recommended, only for the sheepshead minnow test (USEPA 1988, Method 1004) and for the mysid shrimp test (USEPA 1988, Method 1007). The acceptable sea salts include FORTY FATHOMS and HW MARINEMIX, as per the EPA marine chronic methods document (USEPA 1988). Use of any other salt(s) will require the submission in advance of adequate documentation, including at a minimum adequate standard reference toxicant data to demonstrate the acceptability of the salt(s) for use in chronic toxicity testing. They must be approved by the Department prior to the use.

Unless artificial seawater is to be used as the dilution water, hypersaline brine, concentrated to no more than 100 ppt, shall be the primary means of adjusting the test concentrations' salinities. In any test concentration, if the standard test salinity cannot be attained using 100 ppt hypersaline brine, the following procedure shall be used. This procedure shall not apply for any chronic toxicity testing using Champia parvula as the test organism.

1. Hypersaline brine, 100 ppt, shall be used to adjust the salinities of all test concentrations up to the standard test salinity, or the highest salinity attainable.
2. In those test concentrations where the standard test salinity cannot be attained using 100 ppt hypersaline brine, the salinity shall be brought up to the maximum attainable salinity using 100 ppt. hypersaline brine and shall then be adjusted above that salinity using artificial sea salts. Restrictions on the type of artificial sea salts as discussed above also apply.
3. A control prepared with hypersaline brine shall be included. An additional control prepared with artificial sea salts is recommended if sea salts are utilized as per paragraph 2, above.

The type of a dilution water for a permittee may not be changed without the prior approval of the Department.

Special attention should be given to the presence of required micronutrients in waters to be used for crustaceans. Refer to the specific test methodologies for more details.

If any distilled or deionized water is used, it should be prepared with Millipore Super Q^R or equivalent.

DILUTION WATER - FRESH WATERS

A high quality natural water, such as Round Valley Reservoir (if access is allowed) or Lake Hopatcong, is strongly recommended as the dilution water source for chronic toxicity testing with freshwater organisms. It is not required to perform the toxicity testing with the receiving water as dilution water. Tests performed with a reconstituted water or up to 20% Diluted Mineral Water (DMW) as dilution water are acceptable. The hardness of the dilution water must be within 10% of the hardness of the receiving water or 50 mg/L as CaCO₃, whichever is greater. The source of a dilution water for a permittee may not be changed without the prior approval of the Department. Reconstituted water and DMW should be prepared with Millipore Super Q^R or equivalent.

Special attention should be given to the presence of required micronutrients in waters to be used for crustaceans. Refer to the specific test methodologies for more details.

EFFLUENT SAMPLE COLLECTION

Effluent samples shall be representative of the discharge being regulated. For each discharge serial number (DSN), the effluent sampling location shall be the same as that specified in the NJPDES permit for other sampling parameters unless an alternate sampling point is specified in the NJPDES discharge permit. For industrial dischargers with a combined process/sanitary waste stream, effluent sampling shall be after chlorination, unless otherwise designated in the permit.

For continuous discharges, effluent sampling shall consist of 24 hour composite samples consisting either of equal volumes taken once every hour or of a flow-proportionate composite sample, unless otherwise approved by the Department. Effluent holding times and test solution renewal shall be consistent with the test organism specific methods in USEPA 1988 and 1989. For all other types of discharges, effluent sampling shall be conducted according to specifications contained within the discharge permit, or otherwise specified by the Department.

Except for filtration through a 2 mm or larger screen or an adjustment to the standard test salinity, no other adjustments to the effluent sample shall be made without prior written approval by the Department.

PHYSICAL CHEMICAL MEASUREMENTS

At a minimum, the physical chemical measurements must be consistent with the referenced test methodology (USEPA 1988, 1989).

The photoperiods should be phased in and out over a period of thirty (30) minutes for each transition period.

STATISTICS

Statistical analysis should follow the protocols in USEPA (1988, 1989) to evaluate adverse effects. Generally, a significance level of 0.05 will be utilized to evaluate such effects.

A dilution factor of 0.3 or 0.5 can be used. However, the Department recommends the use of the 0.5 dilution factor due to the increased test precision. Note that this may require more than five dilutions to cover the entire range of effluent concentrations.

If separate NOEC's can be calculated from multiple test end-points, as for example a reproductive end-point and a growth end-point, the most sensitive end-point will be used to determine permit compliance.

NOTE: Use of nonparametric statistical analyses requires a minimum of four (4) replicates per test concentration. If the data for any particular test is not conducive to parametric analyses and if less than four (4) replicates were included, the test may not be acceptable to the Department.

STANDARD REFERENCE TOXICANT TESTING

All chronic testing shall be accompanied by testing with a standard reference toxicant as a part of the each laboratory's internal quality control program. Such a testing program should be consistent with the quality assurance/quality control protocols described in the USEPA chronic testing manuals for freshwater organisms and for marine and estuarine organisms (USEPA 1989, 1989). Laboratories may utilize the standard reference toxicant of their choice.

At a minimum, this testing should include an initial series of at least five reference toxicant tests for each test species method. This testing should be completed prior to the initiation of any chronic effluent toxicity testing for each test species method. The laboratory should forward two copies of the initial testing, including control charts, the name of the standard reference toxicant utilized, the supplier, and appropriate chemical analysis of the toxicant, to the following address:

Municipal/Industrial Biomonitoring Programs
Wastewater Facilities Management Element
Division of Water Resources
CN-029
Trenton, NJ 08625-029

Subsequent testing should include testing of each batch of organisms obtained from a supplier and/or monthly testing of organisms cultured by the laboratory. Control charts should be maintained by the laboratory. Two copies of the control charts are to be forwarded annually to the Biomonitoring Programs at the above address. Results of appropriate chemical analyses of each lot of standard reference toxicant utilized must be included.

If standard reference toxicant tests fall outside the expected range of the control chart at a frequency greater than one in any twenty tests, a report shall be forwarded to the Biomonitoring Programs at the address above. This report shall include the identified problem which caused the value to fall outside the expected range and the corrective actions that have been taken by the laboratory. The Department may not accept or may require repeat testing for any required toxicity testing that may be affected by such an occurrence.

METHODS SPECIFICATIONS

SUMMARY OF TEST CONDITIONS FOR
THE FATHEAD MINNOW (PIMEPHALES PROMELAS)
LARVAL SURVIVAL AND GROWTH TEST

- | | | |
|-----|--|---|
| 1. | Test Type: | Static Renewal |
| 2. | Test Duration: | 7 days |
| 3. | Renewal of Test Solution: | Daily |
| 4. | Age of Test Organisms: | Newly hatched larvae (< 24 hours old). Testing with organisms up to 48 hours is allowed if they are all within one age group |
| 5. | Dilution Factor: | 0.3 or 0.5 |
| 6. | Number of Test Concentrations: | minimum 5 plus a control (a second control is optional when a dilution water other than the culture water is used) |
| 7. | Number of Replicates per Each Concentration & Control: | 4 (minimum of 3) |
| 8. | Number of Larvae per Replicate: | 15 (minimum of 10) |
| 9. | Test Chamber Size: | 500 ml recommended (covered) |
| 10. | Test Solution Volume: | minimum 250 ml/chamber |
| 11. | Loading Factor: | 20 ml/organism |
| 12. | Test Dilution Water: | natural water (60 micron mesh filtered), reconstituted water or up to 20% diluted mineral water (DMW). Reconstituted and DMW waters should be prepared with Millipore Super-Q ^R or equivalent water. Aerate a minimum of 24 hours. |
| 13. | Test Temperature: | 25 ± 1° C |
| 14. | Aeration: | none, unless the DO concentration falls below 40% saturation then all |

- replicates. Rate should be less than 100 bubbles/min.
15. Feeding Regime: Feed 0.1 ml newly hatched brine shrimp naupli twice daily, 6 hr. between feedings (at the beginning of the work day at time of renewal and at the end of the work day). No feeding day 7. Sufficient naupli should be added to produce an excess.
16. Photoperiod: 16 hr. light, 8 hr. darkness. 30 min. phase in and phase out recommended.
17. Light Intensity: Ambient laboratory levels (10-20 uE/m²/s or 50-100 ft-c)
18. Cleaning: Siphon daily, immediately before test solution renewal
19. Effects Measured: Survival and growth (dry weight)
20. Test Acceptability: $\geq 80\%$ control survival, .ve. dry weight of surviving controls ≥ 0.25 mg
21. Weighing/Drying Procedures: Immediately prepare for drying and weighing or preserve in 70% ethanol to dry and weigh at a later date. Dry at 100°C for a min. 2 hrs or until constant weight is achieved.
22. Other Test Specifications in: USEPA, 1989. Method 1000.0

SUMMARY OF TEST CONDITIONS FOR
CERIODAPHNIA DUBIA SURVIVAL AND REPRODUCTION TEST

1. Test type: Static renewal
2. Test duration: 3 broods (see 19)
3. Temperature (°C): 25 + 1°C
4. Light quality: Ambient laboratory illumination
5. Light intensity: 10-20 uE/m²/s, or 50-100 ft-c (ambient laboratory levels). Caution should be taken to avoid excessive photosynthetically mediated elevations in pH.
6. Photoperiod: 16 h light, 8 h dark
7. Test chamber size: 30 ml recommended (covered)
8. Test solution volume: 15 ml recommended. Test chambers should contain sufficient test solution to provide adequate surface area to maintain dissolved oxygen concentrations at or above 40 percent saturation
9. Loading factor: Minimum 15 ml/animal
10. Renewal of test solutions: Daily
11. Age of test organisms: Less than 24 h; and all released within a 8-h period
12. Number of neonates per replicates: Maximum of 1
13. Number of replicates per each concentration and control: Minimum of 10
14. Number of test concentrations: Minimum of 5 effluent concentrations and a control. (A second control is optional when a dilution water other than the culture water is used.)

15. Feeding regime: Diet must include an algal component. USEPA (1989) recommends feeding 0.1ml/15ml each of YTC (yeast, trout chow and Cerophyl) and Selenastrum capricornatum suspension per exposure chamber daily. Alternatives include algal diets of: 1. Ankistrodesmus convolutus and Nitzschia frustulum, and 2. A. convolutus, Chlamydomonas reinhardtii and N. frustulum (Cowgill et al., 1985, 1988; Keating and Dagbusan, 1986). Algal feeding rates and other algal diets must be approved prior to use.
16. Aeration: None.
17. Dilution water: Natural water (60um mesh filtered), reconstituted water, or up to 20% diluted mineral water (DMW). Reconstituted and DMW waters should be prepared with Millipore Super Q^R or equivalent. Addition of 5 ug/l selenite (2 ug/l selenium with natural water) and 1 ug/l vitamin B12 is recommended (Keating and Dagbusan, 1984; Keating, 1985 1988). Aerated prior to the test for a minimum of 24 hours, but not supersaturated.
18. Dilution factor: 0.3 or 0.5
19. Test duration: Until 60% of control females have three broods, up to a maximum of eight days.
20. End points: Survival and reproduction
21. Test acceptability: 80% or greater survival and an average of 15 or more young/surviving female in the controls. At least 60% of surviving females in the controls produced their third brood within eight days. No ephippa produced in the controls. The number of males in the controls and test concentrations should be minimal and not influence the determination of the NOEC and LOEC
22. Other test specifications in: USEPA, 1989. Method 1002.0

SUMMARY OF TEST CONDITIONS FOR
ALGAL (SELENASTRUM CAPRICORNUTUM)
GROWTH TEST

1. Test Type: Static, Non Renewal
2. Test Duration: 96 hours
3. Age of Test Organisms at Test Start: 4 to 7 days
4. Dilution Factor: 0.3 or 0.5
5. Number of Test Concentrations: Minimum of 5 plus a control (A second control is optional when a dilution water other than the algal culture medium is used).
6. Number of Replicates per Each Concentration and Control: 4 (Minimum of 3)
7. Initial Cell Density per Replicate: 10,000 cells/ml
8. Test Chamber Size: 125 ml or 250 ml chamber recommended (covered)
9. Test Solution Volume: 50 ml or 100 ml recommended
10. Dilution Water: Algal culture medium or filtered natural surface waters using a 0.45 um pore diameter filter, followed by addition of nutrient solutions (USEPA 1989, Method 1003, Table 1). The use of EDTA or other nutrient solutions is not recommended.
11. Reagent Water: Carbon filtered distilled or deionized water which does not contain substances which are toxic to the test organism. A water purification system may be used to generate reagent water (ie. Millipore Super Q^R or equivalent).
12. Test Temperature: 25° ± 1° C
13. Photoperiod: Continuous illumination

14. Light Quality: "Cool White" Fluorescent lighting
15. Light Intensity: $86 \pm 8.6 \text{ uE/m}^2/\text{s}$ ($400 \pm 40 \text{ ft-c}$)
16. Shaking Rate: 100 cpm continuous or twice daily by hand
17. Effects Measured: Growth (cell counts, chlorophyll content, fluorescence, absorbance, biomass)
- The algae in the test solutions must be checked under a microscope to detect abnormalities in cell size or shape.
- Algal growth determined daily
18. Test Acceptability: Algal density $\geq 2 \times 10^5$ cells/ml in the controls (without EDTA). Variability of controls should not exceed 20 percent.
19. Other Test Specifications in: USEPA, 1989. Method 1003.

SUMMARY OF TEST CONDITIONS FOR
SHEEPSHEAD MINNOW (CYPRINODON VARIEGATUS)
LARVAL SURVIVAL AND GROWTH TEST

1. Test Type: Static Renewal
2. Test Duration: 7 days
3. Renewal of Test Solutions: Daily
4. Age of Test Organisms at Test Start: Newly Hatched Larvae. (24 hrs old). Testing with organisms up to 48 hrs old is permitted if they are all within one age group.
5. Dilution Factor: 0.3 or 0.5
6. Number of Test Concentrations: Minimum of 5 plus a control (a second reference water control is optional when a dilution water other than the culture water is used).
7. Number of Replicates per Each Concentration and Control: Minimum of 3
8. Number of Organisms per Replicate: Minimum of 10
9. Test Chamber Size: Minimum of 600 mL chamber (covered)
10. Test Solution Volume: Minimum of 500 mL/replicate
11. Loading Factor: Minimum 50 mL/larvae
12. Dilution Water: Natural sea water or hypersaline brine

13. Salinity of Test Concentrations: 25 ppt +/- 2 ppt (varying not more than 2 ppt among replicate chambers each day)
14. Adjustment of Salinity of Test Concentrations: Hypersaline brine to 75% effluent. Acceptable artificial sea salts above 75% effluent.
15. Test Temperature: 25 +/- 2°C
16. Aeration: None unless the Dissolved Oxygen falls below 60% saturation, then all chambers. Rate less than 100 bubbles/min
17. Food Source: 24 hour post hatch Artemia nauplii. (Other supplements or variations approved prior to use.)
18. Feeding Regime: Days 0-2: feed once per day 0.1 g wet weight Artemia nauplii per replicate.
Days 3-6: feed once per day 0.15 g wet weight Artemia nauplii per replicate.
19. Photoperiod: 16 Light:8 Dark
20. Effects Measured: Survival and Growth
21. Weighing / drying Procedures: Immediately prepare for drying and weighing or preserve in formalin or ethanol to dry and weigh at later date.
22. Test Acceptability: 80% survival in controls and an average dry weight of \geq 0.60 mg (unpreserved larvae) or 0.50 mg (preserved larvae)
23. Other test specifications available in: USEPA 1988, Method 1004

SUMMARY OF TEST CONDITIONS FOR
INLAND SILVERSIDE (MENIDIA BERYLLINA)
LARVAL SURVIVAL AND GROWTH TEST

1. Test Type: Static Renewal
2. Test Duration: 7 days
3. Renewal of Test Solutions: Daily
4. Age of Test Organisms at Test Start: 7-11 days post hatch Larvae
5. Dilution Factor: 0.3 or 0.5
6. Number of Test Concentrations: Minimum of 5 plus a control (a second reference water control is optional when a dilution water other than the culture water is used)
7. Number of Replicates per Fish Concentration and Control: Minimum of 3
8. Number of Organisms per Replicate: Minimum of 10
9. Test Chamber Size: Minimum of 600 mL chamber (covered)
10. Test Solution Volume: Minimum of 500 mL/replicate
11. Loading Factor: Minimum 50 mL/larvae
12. Dilution Water: Natural sea water or hypersaline brine
13. Salinity of Test Concentrations: 25 ppt +/- 2 ppt (varying not more than 2 ppt among replicate chambers each day)

14. Adjustment of Salinity of Test Concentrations: Hypersaline brine to 75% effluent. Acceptable artificial sea salts above 75% effluent.
15. Test Temperature: 25 +/- 2°C
16. Aeration: None unless the Dissolved Oxygen falls below 60% saturation, then all chambers. Rate less than 100 bubbles/min
17. Food Source: 24 hour post hatch Artemia nauplii. (Other supplements or variations approved prior to use.)
18. Feeding Regime: Days 0-2: feed once per day 0.1 g wet weight Artemia nauplii per replicate.
Days 3-6: feed once per day 0.15 g wet weight Artemia nauplii per replicate.
19. Photoperiod: 16 Light:8 Dark
20. Effects Measured: Survival and Growth
21. Weighing/drying Procedures: Immediately prepare for drying and weighing or preserve in formalin or ethanol to dry and weigh at later date.
22. Test Acceptability: 80% survival in controls and an average dry weight of \geq 0.50 mg (unpreserved larvae) or 0.43 mg (preserved larvae)
23. Other test specifications available in: USEPA 1988, Method 1006

SUMMARY OF TEST CONDITIONS FOR
MYSID (MYSIDOPSIS BAHIA) SURVIVAL, GROWTH,
AND FECUNDITY TEST

- | | |
|---|--|
| 1. Test Type: | Static Renewal |
| 2. Test duration: | 7 days |
| 3. Renewal of Test Solutions: | Daily |
| 4. Age of Test Organisms at Test Start: | 7 days; 8 days maximum (all released within 24 hours from a single source). |
| 5. Dilution Factor: | 0.3 or 0.5 |
| 6. Number of Test Concentrations: | Minimum of 5 plus a control (a second control is optional when a dilution water other than the culture water is used). |
| 7. Number of Replicates per Each Concentration and Control: | Minimum of 5 recommended |
| 8. Number of Organisms per Replicate: | Minimum of 10 recommended |
| 9. Test Chamber Size: | Minimum of 500 ml recommended (covered) |
| 10. Test Solution Volume: | Minimum of 400 ml recommended |
| 11. Dilution Water: | Natural Sea Water or Hypersaline Brine |
| 12. Salinity of Test Concentrations: | 25 ppt \pm 2 ppt (varying not more than 2 ppt among replicates each day) |
| 13. Adjustment of Salinity of Test Concentrations: | Hypersaline Brine to 75 percent effluent. Artificial sea salts acceptable above 75 percent effluent. |
| 14. Test Temperature: | 26°- 27°C recommended |

15. Aeration: None unless the Dissolved Oxygen falls below 60% saturation, then all chambers.
16. Food Source: 24 hour post hatch Artemia naupli (other supplements or variations should be approved prior to use).
17. Feeding Regime: 150 naupli per mysid (approximately 0.1 ml of concentrated naupli) - half after test solution renewal and half at 8 - 12 hours.
18. Photoperiod: 16 h light, 8 h dark
19. Light Intensity: 50-100 ft-c
20. Effects Measured: Survival, Growth and Fecundity
21. Weighing/Drying Procedures: Animals examined within 12 hours of test termination. Pieces of aluminum foil or small aluminum foil weighing boats less than 10 mg in weight.
22. Physical/Chemical Measurements (In additon ot those specified in the General Conditions Section): Ammonia, Nitrite and Nitrate shall be measured in the controls at the test beginning.
23. Recommended Culture Water Specifications (Ward, 1989, 1989b):
 Salinity = 25 ppt
 Temperature = 25 degrees
 pH = 7.8 - 8.2 SU
 Dissolved Oxygen = 6.5 - 7.1 mg/l
 Ammonia = \leq 0.05 mg/l
 Nitrite = \leq 0.05 mg/l
 Nitrate = \leq 20 mg/l
 Alkalinity = 45 - 120 mg/l
24. Test Acceptability: \geq 80% control survival, an average weight of \geq 0.2 mg per mysid in the controls and egg production by 50 percent of the control females.
25. Other Test Specifications in: USEPA, 1988. Method 1007.

Page 5

SUMMARY OF TEST CONDITIONS FOR
CHAMPIA PARVULA SEXUAL REPRODUCTION TEST

1. Test type: Static, non-renewal
2. Test duration: 2-day exposure to effluent, followed by 5- to 7-day recovery period for females only in control medium for cystocarp development
3. Test solution volume: 100 mL
4. Dilution water: 30 ppt salinity natural seawater, or a combination of 50% - 30 ppt salinity natural seawater and 50% - 30 ppt salinity artificial seawater as per USEPA (1988), method 1009.
5. Dilution factor: 0.3 or 0.5
6. Number of test concentrations: At least 5 and a control, the concentration of effluent used in this test is limited to a maximum of 50%.
7. Number of replicates per each concentration and control: 4 (minimum of 3)
8. Number of organisms per replicate: 5 female branch tips approximately 1cm in length and 1 male plant approximately 2cm in length (visibly producing spermatia).
9. Salinity: 30 ppt \pm 2 ppt
10. Temperature: 22 - 24°C
11. Photoperiod: 16 h light, 8 h dark
12. Light intensity: 100 $\mu\text{E}/\text{m}^2/\text{s}$ (500 ft-c)
13. Light source: Cool-white fluorescent lights
14. Test chamber: 200 mL polystyrene cups (covered), or 250 mL Erlenmeyer flasks (recommended)
15. Aeration: None during exposure period; chambers are either shaken at 100 rpm on a rotary shaker or handswirled twice a day.
16. Effects measured: Significant reduction in the number of cystocarps formed in test concentrations compared to controls.

17. Test acceptability:

80% survival in the controls (generally there is no control mortality), controls shall average 10 cystocarps or more per plant, plants in the control and lower test concentrations shall not fragment so that individual plants cannot be identified.

18. Other test specifications in:

USEPA, 1988. Method 1009.

TERATOGENICITY ENDPOINTS

If for any reason the Department has concerns regarding the teratogenicity of a particular effluent to aquatic life, in addition to the methods contained in the Methods Specifications section, the following methods may be used:

Fathead Minnow (Pimephales promelas) Embryo-larval Survival and Teratogenicity Definitive Test, Method 1001.0. (USEPA 1989).

Sheepshead Minnow (Cyprinodon variegatus) Embryo-larval Survival and Teratogenicity Definitive Test, Method 1005. (USEPA 1988).

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10. Ward, S.H. 1989b. Techniques to enhance laboratory culture of Mysidopsis bahia (Molenack). 118th Annual Symposium of the American Fisheries Society. September 9-15, 1988, Toronto, Ontario. (In press).



Laboratories Who Have Satisfied the SRT
Requirements For Chronic
Toxicity Testing (as of 4-26-91)

LABORATORY	SPECIES	DATE APPROVED
Aqua Survey	Fathead	02/01/90
Aqua Survey	Cerio	02/01/90
Aqua Survey	Sheepshead	05/02/90
Aqua Survey	Mysid	11/05/90
CFM	Fathead	06/01/90
CFM	Cerio	06/01/90
CFM	Sheepshead	08/21/90
Cosper	Fathead	03/29/90
Cosper	Cerio	03/29/90
Cosper	Mysid	03/01/90
Cosper	Sheepshead	03/01/90
IT Corp	Mysid	02/28/90
IT Corp	Sheepshead	02/28/90
IT Corp	Fathead	05/07/90
IT Corp	Cerio	05/07/90
IT Corp	Sheepshead	03/01/90
Princeton	Mysid	06/25/90
Princeton	Fathead	03/22/91
Princeton	Cerio	03/22/91
Princeton	Menidia	03/22/91
QC Inc	Fathead	01/02/90
QC Inc	Cerio	01/02/90
QC Inc	Sheepshead	03/19/90
QC Inc	Mysid	05/17/90
US Testing	Fathead	07/31/90
US Testing	Cerio	07/31/90



EXPLANATION

● STATION LOCATION AND NUMBER

DATE	1/10/90	5/15/90
T Cr	0.27	0.22
Cr+6	0.243	0.28

T Cr = TOTAL CHROMIUM
 Cr+6 = HEXAVALENT CHROMIUM
 ND = NOT DETECTED AT OR ABOVE DETECTION LIMIT SHOWN

- NOTES: (1) ALL RESULTS ARE IN ppm
 (2) 1/10/90 SAMPLES ANALYZED BY THE BMC LABORATORY.
 5/15/90 SAMPLES ANALYZED BY BMC AND ANALYTREM INC.
 (3) FIELD DUPLICATES SHOWN IN BRACKETS ()
 (4) SEE TABLE I FOR ADDITIONAL ANALYTICAL RESULTS.
 (5) SEE DATA SUMMARY OF GEOHYDROLOGIC INFORMATION COLLECTED SINCE JANUARY 1988 APRIL 1990 FOR ANALYTICAL RESULTS FROM ADDITIONAL SAMPLING LOCATIONS.

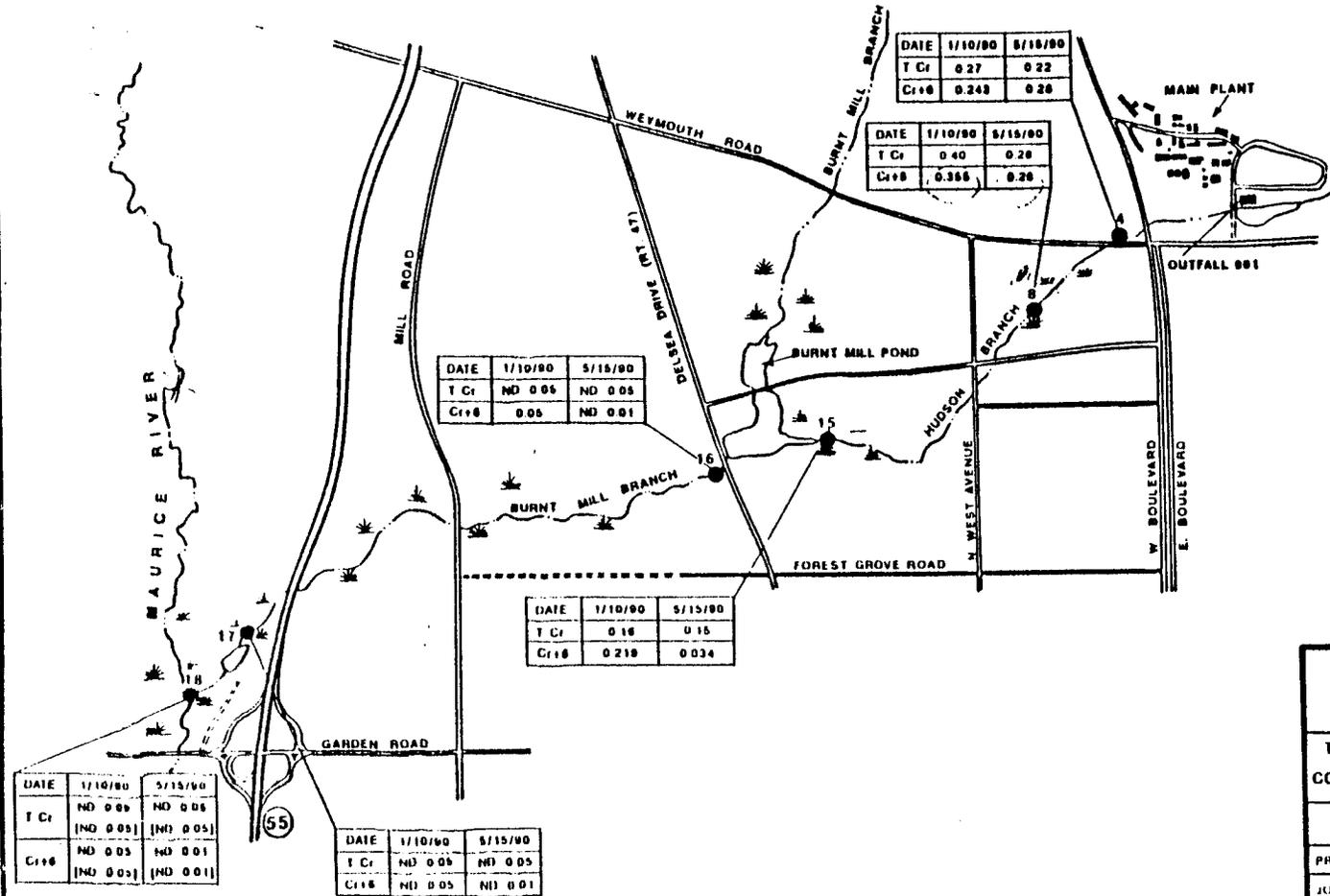


Dan Raviv Associates, Inc.
 57 E. Willow Street Millburn, NJ 07041

TOTAL CHROMIUM AND HEXAVALENT CHROMIUM RESULTS FOR SURFACE WATER SAMPLES COLLECTED FROM THE HUDSON AND BURNT MILL BRANCHES

**SHIELDALLOY METALLURGICAL CORPORATION
 NEWFIELD NEW JERSEY**

PREPARED BY: KRG/MV	DATE: JULY 1990
JOB NO: 83C152	FIGURE: 1



DATE	1/10/90	5/15/90
T Cr	0.27	0.22
Cr+6	0.243	0.28

DATE	1/10/90	5/15/90
T Cr	0.40	0.28
Cr+6	0.366	0.28

DATE	1/10/90	5/15/90
T Cr	ND 0.05	ND 0.05
Cr+6	0.05	ND 0.01

DATE	1/10/90	5/15/90
T Cr	0.18	0.15
Cr+6	0.218	0.034

DATE	1/10/90	5/15/90
T Cr	ND 0.05 (ND 0.05)	ND 0.05 (ND 0.05)
Cr+6	ND 0.05 (ND 0.05)	ND 0.01 (ND 0.01)

DATE	1/10/90	5/15/90
T Cr	ND 0.05	ND 0.05
Cr+6	NI 0.05	NI 0.01

NS 89497 CO