

Preliminary Report

AMMONIA TOXICITY STUDY IN THE COLORADO RIVER
NEAR GRAND JUNCTION, COLORADO

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Region VIII

APRIL 1979

Prepared by

ENGINEERING-SCIENCE
600 Bancroft Way
Berkeley, California 94710

TABLE OF CONTENTS

		<u>Page</u>
SECTION 1	INTRODUCTION	2
	Foreword	2
	Acknowledgements	2
	A Note about Terminology	3
SECTION 2	DESCRIPTION OF PROJECT	5
	Background	5
	Objectives	7
	Approach	7
SECTION 3	THE HISTORICAL RECORD	10
SECTION 4	MONITORING PROCEDURES	13
	Introduction	13
	Location of Sampling Stations	13
	Schedule of Monitoring Program	15
	Methods of Water Sample Collection and Analysis	16
	Flow Determination Method	18
SECTION 5	DYE TRACER STUDY	20
	Background	20
	Procedure	20
	Discussion	21
SECTION 6	INTENSIVE SURVEYS	29
	Introduction	29
	Procedure	29
	Summer Low Flow	30
	Results	30
	Winter Low Flow	32
	Discussion	34
SECTION 7	RESULTS AND DISCUSSION	38
	Results of Water Quality Sampling	38
	Discussion of Water Quality Results	39
	Results and Discussion of Flow Determinations	44
SECTION 8	CALCULATION OF REPRESENTATIVE CONDITIONS AND DISCHARGE REQUIREMENTS	49
	Methodology	49
	Sample Calculation	51
SECTION 9	PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS	55
	Preliminary Conclusions	55
	Recommendations	55

SECTION 1

INTRODUCTION

SECTION 1

INTRODUCTION

FOREWORD

This preliminary report presents data for the first seven months of a thirteen-month monitoring program together with some initial analyses and preliminary conclusions. The analysis at this time examines only data collected to date and makes no comparisons with historical records. Thus, although data for autumn and winter are complete, they have not yet been analyzed in the context of a full year nor in terms of how representative they are of typical seasonal conditions.

ACKNOWLEDGEMENTS

This report has been prepared in close coordination with Ms. Martha Rosenberg, EPA Project Officer; and Mr. W. Thomas Willingham, EPA Technical Director. The Project Manager for ES is Dr. Bahman Sheikh, who has been assisted by Ms. Joyce Hsiao, Project Engineer. The ES project team includes: Messrs. Scott Needham and Jack Laurie, Field Technicians; Dr. Luciano Meiorin, dye tracer study; Mr. Thomas Jones, Computer Support; and Messrs. Thomas Helbig and Thomas Fall, chemists. Under the direction of Leslie H. Botham, Leonard Rice Consulting Water Engineers of Denver have provided river flow determinations.

The following persons have provided valuable information:

- (1) Jim Patterson, Director of Public Work, Grand Junction;
- (2) David Crow, Town Administrator, Fruita;
- (3) Bob Demos, Colorado West Area Council of Governments, Rifle;

- (4) George Kidd, Biologist, Grand Junction;
- (5) Karl Henrichsen, Henningson, Durham & Richardson, Inc., Denver;
- (6) Timothy Carlson, C-E Maguire, Inc. Denver; and
- (7) David Langlois, Colorado Division of Wildlife, Denver.

George Kidd and David Langlois have been unavailable to date for personal interview. However, interviews will be scheduled with them in the next few months. Summaries of the interviews with the other five agency representatives are included in Appendix A.

A NOTE ABOUT TERMINOLOGY

The terminology used in this report for the chemistry of ammonia follows the convention used in Ammonia Toxicity (W. Willingham, 1976). Thus, "ionized ammonia" described the chemical species NH_4^+ , and "un-ionized ammonia" describes NH_3 . "Total ammonia" or "ammonia" describes the sum of both forms ($\text{NH}_4^+ + \text{NH}_3$).

TABLE OF CONTENTS (Continued)

LIST OF REFERENCES

APPENDIX A INTERVIEWS WITH INVOLVED AGENCIES
 APPENDIX B WEEKLY CALCULATED & RAW DATA
 APPENDIX C MONTHLY RANGES & MEDIAN OF BACKGROUND
 CONDITIONS

LIST OF TABLES

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	Colorado River Dilutions Downstream of Persigo Wash	22
2	Colorado River Dilutions Downstream of Little Salt Wash	24
3	Time-Adjust Factors for Un-Ionized Ammonia Concentrations	36
4	Monthly Ranges, Mean & Median Values for Un-Ionized Ammonia Concentrations	40
5	Gaged Flows	45
6	Discharge Flows at Grand Junction Treatment Plant	47
7	Monthly Background Conditions and Allowable Discharge Rates	53

SECTION 3

THE HISTORICAL RECORD

The ammonia toxicity problem in this reach of the Colorado River was identified in 1975 in Water Quality Management Plan, Colorado River Basin, prepared for the Colorado Department of Health. This plan was designed "to protect the quality of the Colorado River and its tributaries from point source pollution discharges" and as a result, recommendations were made for ammonia reduction in the Grand Junction area. In the same year, several alternatives for wastewater treatment facilities were evaluated in the Facilities Plan for the City of Grand Junction. These alternatives were updated in 1977 in a Predesign Report for Wastewater Treatment Facilities and Interceptor Sewers for Grand Junction and Mesa County. The latter report includes two supplements relating to seasonal ammonia-nitrogen requirements. Facility planning for the Town of Fruita was also completed in 1977.

Other documents relating specifically to this project include:

- (1) Colorado West Area 208 Plan, 1977;
- (2) U.S. Environmental Protection Agency, Region VIII, Negative Declaration for the City of Grand Junction, 1976;
- (3) U.S. Environmental Protection Agency, Region VII, Negative Declaration for the Town of Fruita, 1978;
- (4) U.S. Environmental Protection Agency, Quality Criteria for Water (Ammonia, pp. 10-13), 1976;
- (5) Willingham, W.T., Ammonia Toxicity, 1976;
- (6) Existing and Proposed Colorado Water Quality Standards and Stream Classifications;
- (7) Publications of the Colorado River Fishes Recovery Team;
- (8) Colorado State University, Grand Valley Salinity Control Demonstration Project, Basic Field Data, 1978; and
- (3) U.S. Geological Survey, Water Quality and

Flow Data for Colorado River Basin.

Reviews of these documents as well as other published literature will be presented in the final report.

LIST OF REFERENCES

- Colorado West Area Council of Governments. Colorado West Area Draft 208 Plan. Draft Main Report and Final Technical Appendices. Rifle, Colorado. December 1977.
- Henningson, Durham & Richardson. Grand Junction/Mesa County, Predesign Report for Wastewater Treatment Facilities and Interceptor Sewers. Denver, Colorado. August 1977.
- Henningson, Durham & Richardson. Predesign Report Relating to Seasonal Ammonia Nitrogen Requirements Summary of Cost Evaluations. Supplements No. 1 and 2. Denver, Colorado. November and December 1977.
- Nelson, Haley, Patterson and Quirk, Inc. Water Quality Management Plan Colorado River Basin. Volumes 1, 2 and 3. Colorado Department of Health, Water Quality Control Division. Denver, Colorado. June 1975.
- Nelson, Haley, Patterson and Quirk, Inc. 201 Wastewater Treatment Facilities Plan for Town of Fruita, Colorado. Grand Junction, Colorado. September 1977.
- U. S. Environmental Protection Agency, Technical Investigations Branch, 8S-TI. Report of the Intensive Water Quality Study on the Colorado River Near the Grand Junction Sewage Treatment Plant, October 18-21, 1976. November 1976.
- Willingham, William T. Ammonia Toxicity. Control Technology Branch, Water Division, U.S. Environmental Protection Agency, Region VIII. February 1976.

ENGINEERING-SCIENCE, INC.

JOB NO. 2957

FILE DESIGNATION Grand Junction

DATE 12 October 1978 TIME 8 AM

MEMORANDUM TO FILE

PHONE CALL FROM

PHONE NO.

PHONE CALL TO

PHONE NO.

CONFERENCE WITH Bob Demos, Director Colorado West Area Council of Govt
PLACE R.F., Colorado P.O. Box 251

SUBJECT 200 Plan and Grand Junction NPL Studies

200 plan now in draft stage. Still working on
overall management system. Most likely
County governments will purchase the plans.
Draft is waiting for County's approval.
When final plan will be released in
December - January 1978-79 - when it
will go to the State for approval.
(Followed by EPA)

Jack Sprinks former 200 director is now retired.
Bob Demos knows very little about technical aspects
of plan.

For any technical questions refer to
Dave & Durant CE Massie
who was lead consultant for data gathering.

Bob Demos lent me two reports (to be returned)
and also said he will Xerox some more information
for us - Water Quality Data Base and Water Quality Profiles

James Harris