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ERM-MIDWEST, INC., REMEDIAL INVESTIGATION & RISK ASSESSMENT REPORT, PADDYS RUN ROAD SITE, CROSBY TOWNSHIP, HAMILTON, OHIO, REV 1, VOL 3 OF 5, APPENDICES 1-B3 - (USED AS A REFERENCE IN OU 5 RI REPORT)

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ERM-MIDWEST INC
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REPORT

007359

Remedial Investigation and Risk Assessment Report

Paddys Run Road Site (PRRS)
Crosby Township, Hamilton, Ohio

Volume 3 of 5: Appendices A through B-3

Revision 1
May 27, 1994

Submitted to:

The Ohio EPA,

Southwest District Office

401 E. Fifth Street
Dayton, Ohio 45402-2911

Submitted by:

The PRRS Companies

P.O. Box 26683
Richmond, Virginia 23261-6683

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REV. 1: MAY 1994

APPENDIX A

CHRONOLOGICAL SUMMARY OF REMEDIAL INVESTIGATION/RISK ASSESSMENT ACTIVITIES PADDYS RUN ROAD SITE HAMILTON COUNTY, OHIO MAY 1989 TO MAY 1994

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CHRONOLOGICAL SUMMARY OF REMEDIAL INVESTIGATION/RISK ASSESSMENT ACTIVITIES PADDYS RUN ROAD SITE HAMILTON COUNTY, OHIO MAY 1989 TO MAY 1994

Date	Activities
5/1/89	Perimeter Air Investigation Conducted.
5/2/89	Residential Industrial Well Survey Initiated.
5/30/89	Administrative Order on Consent formally implemented.
5/89-6/89	Agency notified by PRRS Companies of access problems (intersection Paddys Run Road, CSX Railroad Line, and Buckeye Foundry Site).
6/19/89	Eleven piezometers were installed (two on Companies property and nine off).
6/26/89-6/27/89	Soils gas survey was conducted.
7/89	PRRS Companies informed the Ohio EPA of the selection of a new laboratory because of U.S. Testing Company's "voluntary exclusion" from the U.S. EPA Constant Laboratory Program (CLP) list by the United States Testing Company.
7/89	PRRS companies requested an extension based on the "force majeure" provision of Section XXI of the AOC.
7/10/89	PRRS Companies initiated an information exchange program with the DOE.
8/89	Ohio EPA granted a "force majeure" extension with respect to all RI/FS activities, contingent upon obtaining a new analytical laboratory.
8/8/89	PRRS Companies notified Ohio EPA of intentions to use CompuChem Laboratories for CLP work and NUS Corporation for non-CLP work.

Date	Activities
8/11/89	Preliminary Activities Report was submitted to Ohio EPA.
8/14/89	Preliminary Applicable or Relevant and Appropriate Requirements (ARARs), data quality objectives and operable units were submitted to Ohio EPA.
8/31/89	Revisions to Volume II of the Site Operations Plan were submitted to Ohio EPA.
8/31/89	Ohio EPA responded to 8/11/89 Preliminary Activity Report and 8/14/89 Preliminary ARARs, data quality objectives and operational units.
9/5/89	PRRS Companies submitted results of comparison of U.S. DOE and PRRS protocols for well construction, well installation and groundwater sampling.
9/89	Ohio EPA notified PRRS Companies of comments on Volume II of the Site Operations Plan, specifically, the NUS Quality Assurance Project Plan (QAPP).
10/2/89	PRRS Companies submitted response to Ohio EPA's 8/31/89 comments on the Preliminary Activities Report and ARARs, data quality objectives and operational units.
10/11/89	EPA provided written comments to Volume II of the Site Operations Plan.
10/13/89	PRRS Companies submitted revised NUS QAPP and new CompuChem Statement of Work (SOW) for CLP organics dated 7/88 to be included in Volume II of the Site Operations Plan to the Ohio EPA.
10/20/89	Ohio EPA responded to 10/2/89 Preliminary Activities Report.
10/28/89	A unilateral Administrative Order was sent to and received by Ms. Redman, owner of Buckeye Foundry property, to gain access to the site to install monitoring wells.
11/3/89	PRRS Companies submitted revisions to Sections 4, 5, and 6 of Volume II of the Site Operations Plan to the Ohio EPA.
11/20/89	Information exchange agreement between the PRRS Companies and DOE was finalized.

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Date	Activities
11/22/89	PRRS Companies submitted Revision No. 1 to the RI/FS Work Plan to the Ohio EPA. Revisions included deletion of geophysical survey program, addition of two well couplets and two shallow wells, and elimination of four piezometers on the Buckeye Foundry property.
11/30/89	Additional changes to Section 6 of Volume II of the Site Operations Plan were submitted to Ohio EPA.
12/5/89	Ohio EPA verbally agreed in concept to Revision No. 1 of the RI/FS Work Plan.
12/6/89	Ohio EPA approved the modifications to Volume II of the Site Operations Plan; "force majeure" suspended.
12/6/89	Field activities delayed until February 1990; two additional shallow monitor wells south of abandoned Route 128 were added as a result of Ohio EPA's request.
12/14/89	PRRS Companies submitted response to Ohio EPA second set of comments on Preliminary Assessment of ARARs.
1/5/90	ENSR reviewed Ohio EPA files to assess availability of information concerning spills and release to the environment.
1/6/90	Third round of groundwater level measurements were taken from PRRS piezometers and Albright & Wilson and Ruetgers-Nease production wells.
1/16/90	PRRS Companies submitted to Ohio EPA final version of Revision No. 1 for insertion to the RI/FS Work Plan.
1/17/90	Revised pages to Volume II of the Site Operations Plan submitted to Ohio EPA.
1/17/90	Ohio EPA responded to PRRS Companies 12/14/89 letter concerning preliminary identification and assessment of ARARs and TBCs.
2/12/90	ENSR submitted proposed changes of detection limits by NUS for chloride and sulfate in soil, and for chloride and MBAs in water.
2/15/90	PRRS Companies submitted revised potential ARARs/ TBCs and State Issues.
2/20/90	Locations of soil borings and monitoring wells were finalized.

Date	Activities
2/21/90-2/28/90	Field activities initiated -- installation of two shallow and one deep well on Buckeye Foundry property; installation of a shallow well on Albright & Wilson/Mobil property; drilling one borehole for installation of a deep monitoring well; drilling 11 boreholes for soil sampling.
2/22/90	Revised pages of the Preliminary Activity Report submitted to Ohio EPA.
2/23/90	Ohio EPA provided PRRS Companies with additional comments concerning the preliminary potential ARARs/TBCs and State Issues.
2/26/90	Ohio EPA approved Revision No. 1 of the RI/FS Work Plan, including new schedule.
2/27/90	EPA responded to 2/22/90 revised pages of the Preliminary Activity Report.
3/90	Soil boring and monitoring well installation program were completed.
3/12/90	PRRS Companies submitted revisions to the ARARs/TBCs and State Issues
3/14/90-3/15/90	ENSR reviewed DOE documents.
3/19/90	PRRS Companies submitted letter discussing minor revisions to the Work Plan.
3/21/90-3/22/90	Surface water and sediment samples were collected from Paddys Run, the drainage ditch running through Albright & Wilson property and the former cooling water pond on the Ruetgers-Nease Chemical Company property.
3/90	Review of Albright & Wilson/Mobil and Ruetgers-Nease Chemical Company plant operations files related to spills and releases to the environment was initiated.
4/2/90-4/11/90	Well development of the Phase I field program was completed.
4/13/90	Ohio EPA responded to 3/19/90 letter, approving most Work Plan modifications.
4/30/90	Revised copy of the Preliminary Activities Report was submitted to Ohio EPA.

Date	Activities
5/90	First round of groundwater sampling took place.
5/18/90	Ohio EPA granted conditional approval of the Preliminary Activities Report.
6/4/90 (Week)	Soil boring, surface water and sediment sample locations were surveyed; geophysical logging of the PRRS deep monitoring wells was conducted.
6/13/90-6/14/90	Two monitoring wells were installed on the Century Farm Property.
6/15/90	Groundwater elevation measurements were taken from DOE wells 2095, 3095, 2126, 3126, 2129, 2094, 3094, 3128 and all PRRS monitor wells and piezometers.
6/18/90 (Week)	In-situ aquifer tests of the PRRS monitoring wells were completed.
7/2/90	PRRS Companies submitted to the Ohio EPA Round 2 groundwater sampling parameters and added three DOE wells to their program.
7/3/90	Requested Addendum to the Preliminary Activities Report, covering Ruetgers-Nease past operations, was sent to the Ohio EPA.
7/10/90	Ohio EPA approved PRRS Companies 7/2/90 Round 2 groundwater sampling parameters
7/30/90-8/90	Second round of groundwater monitoring took place.
8/90	PRRS Companies initiated work on preliminary RI report.
10/9/90	PRRS Companies submitted a revised project schedule to the Ohio EPA.
10/17/90	Ohio EPA approved revised project schedule developed at the meeting between the Agency and the PRRS companies on 10/16/90.
11/1/90	PRRS Companies submitted the draft proposed Phase II Monitoring Well Program Work Plan to the Ohio EPA.
11/7/90	PRRS Companies submitted the Phase I data package to the Ohio EPA.
11/28/90	PRRS Companies submitted the Revised Phase II Monitoring Well Program Work Plan to the Ohio EPA.

Date	Activities
12/14/90	The PRRS Companies submitted the draft Indicator Parameters Request to the Ohio EPA.
12/21/90	Results from the monitoring well program were evaluated by ENSR, the PRRS Companies and the Ohio EPA; it was decided that four wells, in addition to those previously proposed by the PRRS companies, would be installed.
12/90	Phase II monitoring well program commenced; eight planned shallow wells and four planned intermediate wells were installed.
1/15/91	PRRS Companies submitted Phase II Work Plan to the Ohio EPA. The first draft was submitted with the assistance of ENSR.
1/28/91-2/7/91	ERM-Midwest conducted the third round of groundwater monitoring.
2/11/91	Ohio EPA responded to the Phase II Work Plan.
2/15/91	Ohio EPA provided additional comments on the Phase II Work Plan to the PRRS Companies.
2/91	In response to Ohio EPA's January 23, 1991 request for outstanding data, the Companies submitted Water-level data generated by a survey of the PRRS, DOE, domestic and industrial wells and piezometers in December 1990; actual analytical detection limits and validated data for Round II groundwater sampling; and Actual Detection Limit and Data Validation Report for Soil, Surface Water and Sediment, Phase I.
3/1/91	The revised Work Plan for Phase II Remedial Investigation and Endangerment Assessment for the Paddys Run Road Site was submitted to the Ohio EPA.
3/7/91	Representatives from the Companies and ERM-Midwest met with representatives from ASI, IT and DOE at MPC to exchange information and discuss groundwater modeling and the DOE/Westinghouse placement of the proposed wells to recover uranium-contaminated groundwater.
3/7/91	Development of the PRRS groundwater flow and transport model began.
3/8/91	At the Ohio EPA's request, the Companies submitted information concerning the Phase I and Phase II monitor well installations. ENSR supplied Ohio EPA with boring logs for well MW-1 through MW-37.

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Date	Activities
3/11/91	The Companies and ERM-Midwest received a letter from the Ohio EPA concerning well redevelopment.
3/14/91	Copies of ENSR's field notebooks covering Phase I and Phase II field activities were submitted to the Ohio EPA.
3/20/91	A teleconference was held between representatives of the Ohio EPA-Southwest District Office, the Companies and ERM-Midwest. The subject of the call involved the redevelopment of Phase I monitor wells and the installation of new wells at locations suggested by the Ohio EPA. The Agency approved substitution of a proposed PRRS monitor well on the Hausfeld property by DOE monitor well No. 2559.
3/28/91	A round of groundwater elevations were taken. ERM-Midwest measured PRRS wells; DOE measured their own wells.
4/3/91	Representatives from the Companies and ERM-Midwest met with representatives from the Ohio EPA at the Southwest District Office to discuss the Agency comments to the Phase II Work Plan. During that meeting geophysical logs acquired during the installation of Phase I deep monitoring wells were submitted by the Companies.
4/8/91-4/26/91	Well redevelopment took place with Ohio EPA personnel visiting the site on April 10, 1991.
4/17/91-4/24/91	Monitor wells, MW-38S, MW-31I, MW-39S, MW-40S and MW-41S, were installed.
4/17/91-4/19/91	Flow meter direction and velocity measurements were collected from the well bores of MW-31S, MW-14S, MW-14I, MW-10S, MW-11S, MW-30S, MW-30I, MW-16S, MW-15D, MW-15S and MW-13S. Ohio EPA representatives Donna Bohannon, Mike Proffitt and Rick Reiss were present to observe the flow meter instrument and technique.
4/19/91	The third revision to the Phase II Work Plan was submitted to the Ohio EPA by the Companies.
4/29/91-5/9/91	Round IV groundwater sampling commenced following Agency verbal approval of purging and sampling procedures to be used in the Round IV groundwater sampling, and approval reconfirmation by the Site Coordinator during an April 30, 1991 telecommunication with the Companies' Project Coordinator.

Date	Activities
5/7/91-5/8/91	Ohio EPA representatives were on-site to observe sampling techniques and to obtain split samples of groundwater.
5/13/91	Ohio EPA gave conditional approval to collect 26 surface soil samples, 16 background soil samples, 7 surface water, and 13 sediment samples from locations observed by Ohio EPA representatives during the May 8, 1991 site visit.
5/14/91-5/16/91	Surface soil samples were collected at 26 locations on-site, along with 16 surface soil background samples off-site. Seven paired surface water and sediment samples plus six sediment-only samples were collected on-site. These activities had been previously approved by the Ohio EPA.
5/21/91	Water-level elevations were obtained from PRRS wells and staff gauges along Paddys Run.
6/5/91	The fourth revision of the Phase II Work Plan was submitted to the Ohio EPA by the Companies.
6/6/91	The Companies submitted a memorandum to the Ohio EPA addressing unresolved technical issues concerning the Phase II Work Plan.
6/21/91	The Companies submitted to the Ohio EPA a technical memorandum concerning the baseline risk assessment conceptual model, except toxic criteria.
6/24/91	Validated Round III groundwater analyses data was submitted to the Ohio EPA.
6/26/91	Water-level elevations were obtained from PRRS wells and staff gauges along Paddys Run. On that same date representatives from DOE/Westinghouse sampled groundwater for analyses of uranium from PRRS piezometers 3, 4, 5, 9, 10 and 11.
6/26/91-8/5/91	The Companies submitted unvalidated Round IV groundwater analyses data to the Ohio EPA.
7/2/91	Ohio EPA sent a comment letter to the Companies on the fourth draft of the Phase II Work Plan. The letter also recommended that either a meeting or conference call be held with representatives of the Companies, their consultant, and Ohio EPA during the week of July 15 so as to resolve outstanding issues.

Date	Activities
7/17/91	The Companies, in a letter to the Ohio EPA, requested a meeting to resolve issues concerning the Phase II Work Plan.
7/23/91	The Companies submitted to the Ohio EPA a technical memorandum which addressed unresolved Phase II Work Plan issues.
8/8/91	The Companies and representatives from the Ohio EPA met in the Southwest District Office to resolve outstanding issues concerning the Phase II Work Plan.
9/3/91	Draft 5 of the Phase II RI Work Plan was submitted to Ohio EPA.
9/16/91-9/17/91	The ecological field survey was conducted at the PRRS. Ohio EPA representatives were present during the field inspection.
9/13/91-9/30/91	The Companies received approval from the Ohio EPA of the Phase II Work Plan, which included the following provisions agreed to during this period: ■ That PRRS wells 28S, 29S, 35S, 36S, 37S and DOE wells 2392 would be resampled. ■ That DOE wells 2127, 3127, 2558, 2560 and 2561 be added to this sampling round. ■ That sampling parameters for this round include CLP volatiles, CLP semivolatiles, limited CLP metals (potassium, arsenic, sodium, iron, calcium and magnesium) and the general parameters. ■ That either a piezometer be placed in the vicinity of PRRS monitor wells MW-36S and MW-37S to measure the relationship of fluctuating water levels in the wells and the Greater Miami River or obtain similar information by extrapolating U.S. Army Corps of Engineers information from a point in Hamilton, Ohio to the area adjacent to monitor wells MW-36S and MW-37S.
9/30/91	Water-level elevations were obtained from PRRS and selected DOE wells and staff gauges along Paddys Run. In addition, Free-floating hydrocarbon measurements were recorded in MW-10S, MW-12S, MW-13S and MW-41 S.
9/30/91-10/23/91	Phase II field operations were conducted.

Date	Activities
10/18/91	The Conceptual Model for the Baseline Risk Assessment, except toxic criteria, for the PRRS was submitted to the Ohio EPA for approval.
11/21/91	Results of validated Rounds III and IV groundwater data were submitted to the Ohio EPA.
11/15/92	As requested by Ohio EPA, a copy of the Phase II Work Plan was sent to the Agency's Public Interest Center.
11/20/91	Water-level elevations were obtained from PRRS and selected DOE wells and staff gauges along Paddys Run.
11/26-11/27/91	A leak test was performed on the sump located southwest of the Process Building on Ruetgers-Nease's property.
12/18/91	Water-level elevations were obtained from PRRS and selected DOE wells and staff gauges along Paddys Run. In addition, Free-floating hydrocarbon measurements were recorded in MW-10S, MW-11S, MW-12S, MW-13S, MW-34S and MW-41S. Additional DOE wells were also measured during this round of groundwater elevations. These wells were: 2551, 2557, 2395 and 3551. Groundwater elevations will continue to be measured from these wells in the future.
12/91	Approximately 50 percent of the data collected from the source identification investigation had been validated. Calibration of the regional flow model continued. Development of the localized solute transport flow model was initiated. Development of background levels for all media was initiated. Development of the fugitive dust or volatilization dispersion air modeling and ecological assessment continued.
1/30/92	Water-level elevations obtained from PRRS and selected DOE wells and staff gauges along Paddy's Run.
1/31/92	The Companies submitted the validated analytical results for the monitor wells sampled in October 1991.
1/92	Monitoring well MW-41S, which historically has recorded free hydrocarbon could not be measured due to RNC equipment blockage. Approximately 85 percent of the data collected from the source identification investigation had been validated.

Date	Activities
	Calibration of the regional flow model was 98 percent complete.
	Calibration of the local flow model was 90 percent complete.
	Statistical distributions were evaluated for the background sample results, and background comparison values were developed for all media.
	First run of the air model was completed and ecological assessment continued.
	An additional DOE well, 2398, was measured during groundwater elevations.
2/6/92	A meeting was held between the Companies and Ohio EPA regarding the status of groundwater flow and solute transport modeling.
2/12/92	RNC site's abandoned ammonium xylene sulfonate (AXS) line was plugged with concrete and was documented by Ruetgers-Nease and ERM personnel.
2/21/92	The following were transmitted to Ohio EPA: logs for three monitoring wells and one piezometer; copies of six previous monthly reports, per Ohio EPA request; and a bound copy of the Validated Summary Data Package Partial Round V Groundwater.
2/24/92	A full round of water levels was collected from all of the PRRS wells and selected DOE wells.
2/26/92	The Companies submitted a well log construction for monitoring well MW-24D.
2/28/92	The Companies submitted a bound copy of "Validated Summary Data Package Phase II Source Investigation Soil Borings (SB-35 to SB-81)" and the "Technical Memorandum on Raw Materials Investigation, Paddy's Run Road Site, Hamilton County, Ohio."
2/92	Pressure transducers were installed in two monitor wells and one piezometer to monitor water levels on an hourly basis. The values were recorded on a Thor data logger.
	Free-floating hydrocarbon level measurements were recorded in nine monitoring wells measured on 2/13/92 and eight measured on 2/24/92.
	All data collected from the Phase II source identification investigation has been validated.

Date	Activities
	Calibration of the regional flow model was completed.
	Calibration of the local flow model was 98 percent complete.
	Statistical distributions were evaluated for the background sample results, and background comparison values are being finalized for all media.
	The ecological assessment and air modeling for the baseline risk assessment are in progress.
3/92	The March round of Water-level measurements from the PRRS wells and all DOE wells in the PRRS study area; a table of all wells having measurement of apparent hydrocarbon thickness since February 1991; a graph of Water-level elevation measurements from MW-36I and PZ-12 as measured from their pressure transducers; and March field notes were submitted to Ohio EPA along with the March 1992 monthly Report.
3/10/92	The Determination of Medium-Specific Chemical Background Comparison Values at the PRRS was submitted.
3/11/92	The Technical Memorandum Baseline Risk Assessment Conceptual Model for the PRRS was submitted to the Ohio EPA.
	Free-floating hydrocarbon measurements were recorded in eight monitoring wells.
3/23/92	A teleconference was held and the Companies agreed to the following: Round IV ethylbenzene groundwater analysis would be removed from the groundwater model and incorporated into the RI/RA/FS; the Companies will sample five specific monitoring wells for CLP volatile organics plus cumene five times (twice monthly); and that the Companies would give Ohio EPA computer disks of the validated data for all work performed by ERM-Midwest.
3/24/92	Companies met with Ohio EPA to conduct a dry run for the public meeting.
3/25/92	Water-level elevations were obtained from all of the PRRS and DOE wells. Staff gauges along Paddy's Run were also measured.
3/31/92	A Public meeting was held March 31, 1992 at Ross High School in Ross, Ohio.

Date	Activities
4/2/92	Free-floating hydrocarbon measurements were recorded in MW-10S, MW-11S, MW-12S, MW-13S, MW-14S, MW-31S, MW-34S, MW-40S, and MW-41S. The first of the five samplings agreed to at the 3/23/92 teleconference, had occurred.
4/15/92	The Companies received Ohio EPA's comments to Determination of Medium-Specific Chemical Background Comparison Values at the PRRS and Technical Memorandum Baseline Risk Assessment Conceptual Model PRRS.
4/92	Water elevations were obtained from all PRRS wells and selected DOE wells. Staff gauges along Paddy's Run were also measured. Free-floating hydrocarbons were found in eight monitoring wells. The second and third of the five samplings from the monitoring wells (as agreed to with the agency on March 23, 1992) occurred. The Companies met with the Ohio EPA and discussed the April 15, 1992 comments from Ohio EPA. The Companies submitted a letter to the Ohio EPA requesting clarification of major issues in the Ohio EPA's April 15, 1992 comments on the PRRS Background Development document and Risk Assessment conceptual model.
5/20/92	Water-level elevations were obtained from all of the PRRS wells and selected DOE wells, staff gauges along Paddy's Run were measured, and Free-floating hydrocarbon measurements were recorded in seven monitoring wells.
5/15/92	The fourth of the five samplings per the agreement discussed in the March 23, 1992 meeting occurred.
5/28/92	The Companies submitted a revised schedule for the submittal of the RI/RA draft report to the Ohio EPA.
6/10/92	The Companies submitted a revised schedule for activities for the draft PRRS RI/RA report to the Ohio EPA.
6/11/92	A meeting was held between Ohio EPA and ERM-Midwest to discuss unresolved background development issues.

Date	Activities
6/16/92	The Companies received written approval from the Ohio EPA regarding the revised delivery date for the submittal of the draft RI/RA report.
6/23/92	A letter, confirming the issues discussed and agreed upon at the June 11, 1992 technical meeting, was sent to the Ohio EPA. The meeting addressed the approach for background concentrations development at the PRRS.
6/24/92	Water-level elevations were obtained from all of the PRRS wells and selected DOE wells. Staff gauges along Paddy's Run were also measured. Free-floating hydrocarbon measurements were recorded in seven monitoring wells.
6/92	Began comparing analytical data to newly-developed medium-specific background levels. A response letter dated 6/15/92 from the Companies was submitted to Ohio EPA addressing the Agency's comments on the *Technical Memorandum on the Baseline Risk Assessment Conceptual Model.* Rather than revising the Conceptual Model, revisions were incorporated into the risk assessment in the RI Report. On June 16, 1992, Ohio EPA responded to the Companies' letter on the final details of the baseline risk assessment.
7/92	The Ground Water Flow and Containment Transport Model was completed. Data Validation was completed for the five supplemental rounds of groundwater samples and the residential well samples.
7/13/92	Results of analyses of the groundwater samples collected from the residential wells along State Route 128 were distributed to those residents with copies to the Ohio EPA.
7/20/92	The Determination of Medium-Specific Chemical Background Comparison Values document was submitted to the Ohio EPA. Water-level elevations were obtained from all of the PRRS wells and selected DOE wells. Staff gauges along Paddys Run were also measured. Free-floating hydrocarbon measurements were recorded in six monitoring wells.

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Date	Activities
7/20/92 (week)	ERM-Midwest personnel were on site at the PRRS to give Westinghouse Materials Company of Ohio (WEMCO) access to some wells and piezometers. ERM collected split samples from some of the wells and piezometers and analyzed them for arsenic, sodium, and potassium.
8/18/92	Water-level elevations were obtained from all of the PRRS wells and selected DOE wells. Also, the staff gauges along Paddys Run were measured.
9/14/92	Draft RI/RA report delivered to the Ohio EPA.
9/21/92	Water-level elevations were obtained from all of the PRRS wells and selected DOE wells. Also, the staff gauges along Paddys Run were measured.
11/2/92	Water-level elevations were obtained from all of the PRRS wells and selected DOE wells. Also, the staff gauges along Paddys Run were measured.
11/23/92	Water-level elevations were obtained from all of the PRRS wells and selected DOE wells. Also, the staff gauges along Paddys Run were measured.
12/15/92	Water-level elevations were obtained from all of the PRRS wells and selected DOE wells. Also, the staff gauges along Paddys Run were measured.
1/20/93	Water-level elevations were obtained from all of the PRRS wells and selected DOE wells. Also, the staff gauges along Paddys Run were measured.
2/12/93	Ohio EPA notified the Companies by letter of its review findings concerning the RI/RA report. The Agency requested a meeting to discuss necessary revisions to the document.
2/25/93	Water-level elevations were obtained from all of the PRRS wells and selected DOE wells. Also, the staff gauges along Paddys Run were measured.
3/5/93	Ohio EPA provided additional comments by letter on the RI/RA report to the Companies.
3/23/93	Ohio EPA notified the Companies that groundwater level measurements could be suspended.

Date	Activities
4/7-8/93	The Companies and Agency met at Southwest District Office (SWDO) to discuss issues involved with revision of the RI/RA report.
5/5/93	The parties continued discussion of issues associated with revision of the RI/RA report at SWDO, leaving some issues unresolved.
5/10-11/93	The Companies and Agency collected a supplemental round of groundwater samples from selected upgradient wells for potassium-40. Also BTEX and cumene samples were collected by the Agency.
6/1/93	The Companies submitted a technical paper prepared by Mink and Associates, Inc. (MAI) evaluating potential risk associated with levels of potassium found at the PRRS.
6/14/93	The Companies submitted the screening process and subsequent chemicals of concern to be evaluated for risk at the PRRS.
6/30/93	The Companies submitted the potassium-40 results of analysis from the May 10 and 11, 1993 groundwater sampling.
7/7/93	The Companies and Agency met at SWDO to discuss future groundwater use scenario and the decision matrix for chemicals of concern at the PRRS.
7/9/93	The Ohio EPA sent the Companies a letter identifying its position with regard to resolved and unresolved issues resulting from the April 7 and 8 and May 5, 1993 meetings.
7/14/93	The Agency provided the Companies with results of analyses for BTEX and cumene from the May 10 and 11, 1993 groundwater sampling.
7/16/93	The Agency sent the Companies a summary of its position on issues discussed at the July 7, 1993 meeting.
7/20-21/93	At SWDO, the parties continued discussion of issues associated with revision of the report, leaving some issues unresolved.
8/2/93	The Companies sent the Agency their version of the July 20 and 21, 1993 meeting notes.
8/9/93	The Agency notified the Companies that the data collected by Ohio EPA from the May 10 and 11, 1993 groundwater sampling had been validated.

Date	Activities
8/23/93	The Companies submitted to Ohio EPA a Status Report that responded to Agency comments of February 12 and March 5, 1993 concerning the RI/RA report
8/27/93	The Companies received a request from FERMCO and gave verbal approval the same day for FERMCO to take water level measurements and sample groundwater from select wells as part of their South Plume groundwater uranium removal program.
9/7/93	The Companies and Ohio EPA held a teleconference and resolved the level of groundwater modeling information to be placed in the RI/RA report.
9/10/93	The Companies sent by letter to the Agency additional information, discussed in the meeting of July 20-21, 1993 and in a subsequent telephone call on September 7, concerning estimating risk for future groundwater exposure, anomalous Round IV groundwater samples, and incorporation of Appendix C - Groundwater Model information in the main body of the report.
9/17/93	The Companies sent by letter to the Agency additional information discussed in the meeting of July 20-21 concerning the presence of bis(2-ethylhexyl)phthalate and acetone in samples collected at PRRS.
9/24/93	The Ohio EPA sent the Companies a letter summarizing issues of concern to date with Agency positions stated and actions needed by both parties.
10/8/93	The Companies sent by letter to the Agency additional information concerning histograms and probability plots for organics used in background calculations.
10/13/93	The Ohio EPA responded by letter with comments concerning the Companies' Status Report of August 23, 1993.
10/20/93	The Ohio EPA responded by letter with comments concerning the Companies' letter of October 8,1993.
10/23/93	The Companies responded by letter to the Agency's positions on open issues conveyed in correspondence dated September 24, 1993.
11/3/93	The Companies responded by letter to the Agency's positions on open issues conveyed in correspondence dated October 13, 1993.
11/30/93	The Ohio EPA responded by letter to the Companies' correspondence of September 10, 1993 concerning estimating risk for future groundwater exposure and other technical issues under discussion.

Date	Activities
12/9/93	The Ohio EPA responded by letter to the Companies' correspondence of October 21, 1993 concerning open issues and positions.
12/13/93	The Ohio EPA provided the Companies a letter outlining the Agency's position on unresolved issues addressed in the Companies' letter of November 3, 1993.
12/21/93	In response to Agency correspondence of December 9 and 13, 1993, the Companies notified the Ohio EPA by letter that new information had been uncovered concerning reported levels of potassium, which would change several aspects of the report. A meeting with the Agency was requested, along with a request to reconsider a 90-day schedule for completing the RI/RA document.
12/21/93	The Companies responded by letter to the Agency's correspondence of November 30, 1993 regarding estimating risk for future groundwater exposure, anomalous Round IV groundwater samples and incorporation of Appendix C information into the main body of the report.
12/22/93	The Companies provided the Agency with *Revised Groundwater Modeling Sections of the Remedial Investigation and Risk Assessment Report*.
1/7/94	The Agency responded by letter to the Companies' correspondence of December 21, 1993 and agreed to discuss the potassium issue.
	The Companies provided the Ohio EPA with a report entitled: *Potassium-40 Investigation at the Paddys Run Road Site*, which was provided by Trinity Engineering Associates.
1/11/94	The Agency responded by letter to the Companies' correspondence of December 21, 1993 concerning future groundwater exposure scenarios and anomalous Round IV groundwater samples.
1/28/94	The Companies, in a letter to the Ohio EPA, agreed to retain potassium and potassium-40 as chemicals of concern and to use two instead of three wells for estimating the risk for future groundwater exposure for the inorganic plume.
2/4/94	The Ohio EPA provided by letter to the Companies its acceptance with comment the *Revised Groundwater Modeling Sections of the Remedial Investigation and Risk Assessment Report* of December 22, 1994.

Date	Activities
2/9/94	The Ohio EPA responded to the Companies' January 28, 1994 letter and agreed with the methods resolving remaining issues. The Agency set the RI/RA report date for May 30, 1994.
2/17/94	The Agency provided comments on the MAI report of May 28, 1993.
4/15/94	The Companies sent the Ohio EPA a report entitled: *Validity of Potassium-40 Slope Factors for Naturally Occurring Potassium*, which was prepared by Trinity Engineering Associates and MAI.
5/17/94	The Ohio EPA notified the Companies that it concurred with the Companies' position on potassium-40, as stated in the report sent to the Agency on April 15, 1994.
5/27/94	Revision 1 of the RI/RA Report was sent to the Ohio EPA.

Appendix B-1
Raw Materials Investigation

REV. 1: MAY 1994

APPENDIX B-1

TECHNICAL MEMORANDUM ON RAW MATERIALS INVESTIGATION

REV. 1: MAY 1994

APPENDIX B-1

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1 Radioactivity Associated with Phosphate Production
2 Laboratory Analyses of Phosphorus
3 Potassium-40 Levels in Potassium
4 Information Provided by Raw Materials Suppliers

APPENDIX B-1
TECHNICAL MEMORANDUM
ON
RAW MATERIALS INVESTIGATION
PADDY'S RUN ROAD SITE
HAMILTON COUNTY, OHIO

May 27, 1994

1.0 INTRODUCTION

In accordance with the September 3, 1991 Work Plan for Phase II Remedial Investigation and Baseline Risk Assessment for the Paddy's Run Road Site (PRRS), the PRRS Companies investigated the presence or absence of selected constituents in the raw materials used by Albright & Wilson Americas, Inc. (A&W) and Ruetgers-Nease Corporation (RNC). The chemicals of interest are arsenic, potassium-40, and uranium. This technical memorandum discusses the Companies' approach to the raw materials investigation and presents the results and conclusions.

2.0 INVESTIGATION APPROACH

A literature review was conducted for information about the levels of the chemicals of interest in the major raw materials. In addition, the Material Safety Data Sheets (MSDSs) for raw materials currently used by A&W and RNC and for materials used in the past were reviewed to identify the companies that manufactured the raw

materials. Those manufacturers were then contacted and interviewed to determine if they had laboratory analytical data for arsenic, potassium-40 or uranium for the raw materials supplied to A&W and RNC. If laboratory data for the chemicals of interest were not available, the manufacturers were asked if they had any reason to suspect the presence of arsenic, potassium-40, or uranium in the raw materials sold to A&W and RNC. Copies of analytical data or any other written documentation of the presence or absence of the chemicals of interest were requested from the manufacturers.

3.0 INVESTIGATION RESULTS

The chemicals of interest are components of a variety of naturally occurring materials. A&W previously used elemental phosphorus at its Hamilton County plant. Researchers at U.S. EPA's Office of Radiation Programs investigated radioactivity associated with the phosphate industry and published the results in an August 1975 report titled *Radioactivity Distribution in Phosphate Products, By-Products, Effluents, and Wastes*. A copy of this report is included in Attachment 1. Although phosphate rock in the United States normally contains 100 to 150 ppm uranium, the U.S. EPA researchers found that almost all of the radioactivity leaving the electric furnace phosphorus production process was in the waste slag, and not in the phosphorus product. An investigation reported in *Health Physics*, September 1979, titled "Uranium and Radium-226 in Florida Phosphate Materials" concluded that in production of phosphorus by electric furnace, radionuclide input in the raw phosphate rock was transferred almost in total to the waste slag (see Attachment 1).

A&W has analyzed samples of phosphorus for uranium and found the concentrations to be less than 7.4 ppb. The analytical results are in Attachment 2.

Phosphorus typically contains arsenic at levels of 100 to 400 ppm. In the process of manufacturing phosphoric acid, the arsenic was separated and managed as hazardous waste with off-site disposal.

Potassium-40 is a naturally occurring radioisotope of potassium. It is present in all potassium containing materials at approximately 0.012% of the total potassium (see Attachment 3 excerpt from *Progress in Isotope Geology*, K. Rankama, Interscience Publishers, 1963).

The results of the contacts with the suppliers of raw materials are summarized in Table 1. Copies of the written documentation provided by the manufacturers are included in Attachment 4. In some cases, the raw material suppliers did not provide verbal or written information of the presence or absence of the chemicals of interest. Two of the manufacturers, formerly but not currently used by A&W, one a supplier of copper carbonate and the other a supplier of potassium hydroxide (50%), no longer exist as the business organizations identified on the MSDSs. No further investigation of the materials from these suppliers could be made. However, as shown in Table 1, information was obtained for the same raw materials supplied by other manufacturers.

TABLE 1
SUMMARY OF INVESTIGATION OF RAW MATERIALS

RAW MATERIAL	SUPPLIER	PRRS COMPANY	RESULTS
Aluminum Trioxide	ALCOA *	A&W	No response to PRRS written request for confirmation letter.
Ammonium Hydroxide, 26Be	HVC *	A&W	Verbal assurance from supplier that raw material does not contain arsenic, potassium-40, or uranium. No response to ERM requests for confirmation letter.
Anhydrous Ammonia	HVC *	A&W/RNC	Verbal assurance from supplier that raw material does not contain arsenic, potassium-40, or uranium. No response to ERM requests for confirmation letter.
Sodium Hydroxide (50%) Rayon Grade	HVC *	A&W/RNC	Verbal assurance from supplier that raw material does not contain arsenic, potassium-40, or uranium. No response to ERM requests for confirmation letter.
Benzotriazole	PMC Specialties *	A&W	Verbal assurance from supplier that raw material does not contain potassium-40 or uranium, and that analyses show arsenic to be < 1 ppm. No response to ERM requests for confirmation letter.
Copper Carbonate	Cities Service	A&W	Raw material from this supplier not currently used, and supplier no longer exists. No further investigation.
Copper Carbonate	Tennessee Chem. Co. *	A&W	No response to ERM attempts to request confirmation letter.
Diammonium Sulfate	Heico	A&W	Letter provided by supplier stating that raw material not expected to contain any potassium-40 or uranium, and that analyses show arsenic to be < 3 ppm.
Hydrochloric Acid	Du Pont	A&W	Letter provided by supplier stating that raw material not analyzed for potassium-40 or uranium, and that analyses show arsenic to be < 0.05 ppm. Verbal assurance from supplier that raw material does not contain potassium-40 or uranium.
Sulfuric Acid	Du Pont	A&W/RNC	Letter provided by supplier stating that raw material not analyzed for potassium-40 or uranium, and that analyses show arsenic to typically be < 0.1 ppm and specified not to exceed 2.5 ppm. Verbal assurance from supplier that raw material does not contain potassium-40 or uranium.
Sulfuric Acid	Coulton Chemical *	A&W/RNC	Verbal assurance from supplier that raw material does not contain potassium 40 or uranium, and that analyses show arsenic below a fraction of a ppm. Inadequate letter provided by supplier and no response to ERM request for correction.

* - Recommend appropriate PRRS company's purchasing personnel contact supplier to request confirmation letter.

TABLE 1 (Continued)
SUMMARY OF INVESTIGATION OF RAW MATERIALS

RAW MATERIAL	SUPPLIER	PRRS COMPANY	RESULTS
Sulfuric Acid	American Cyanamid Company	RNC	Letter provided by supplier stating that raw material contains < 1 ppm of arsenic, potassium-40, and uranium.
Sulfuric Acid	El Dorado Chem. Co.	A&W	Verbal assurance from both A&W and El Dorado that A&W has not purchased sulfuric acid from El Dorado. No further investigation.
Isopropyl Benzene (Cumene)	Ashland Chemical	RNC	Letter provided by supplier stating that raw material does not contain detectable arsenic, potassium-40, or uranium.
Magnesium Oxide	Morton Chemical	A&W	Verbal assurance from A&W that magnesium oxide has not been purchased from Morton Chemical. No further investigation.
Magnesium Oxide	Aluchem *	A&W	No response to PRRS written request for confirmation letter.
Nitric Acid	BP Chemicals	A&W	Letter provided by supplier stating that raw material not expected to contain any potassium-40 or uranium, and that analyses show arsenic to be < 10 ppb.
Potassium Hydroxide (45%)	Occidental Chem.	RNC	Letter provided by supplier stating that raw material does not contain potassium-40 or uranium, and that analyses show arsenic to be < 1 ppm.
Potassium Hydroxide (50%)	Occidental Chem.	A&W	Letter provided by supplier stating that raw material does not contain potassium-40 or uranium, and that analyses show arsenic to be < 1 ppm.
Potassium Hydroxide (50%)	Vulcan Chemicals	A&W	Letter provided by supplier stating that raw material not expected to contain any potassium-40 or uranium, and that analyses show arsenic to be < 1 ppm.
Potassium Hydroxide (50%)	Diamond Shamrock	A&W	Raw material from this supplier not currently used, and supplier no longer exists. No further investigation.
Rodine #95	Parker Amchem *	A&W	Verbal assurance from supplier that raw material does not contain arsenic, potassium-40, or uranium. No response to PRRS written request for confirmation letter.
Toluene	Exxon Chemical *	RNC	No response to ERM attempts to request confirmation letter.
Xylene	Exxon Chemical *	RNC	No response to ERM attempts to request confirmation letter.

* - Recommend appropriate PRRS company's purchasing personnel contact supplier to request confirmation letter.

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REV. 1: MAY 1994

4.0 CONCLUSIONS

Published literature, available laboratory results, and manufacturers' information indicate that the raw materials investigated did not contain significant levels of potassium-40, uranium or arsenic.

ATTACHMENT 1

RADIOACTIVITY ASSOCIATED WITH PHOSPHATE PRODUCTION

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TECHNICAL NOTE
ORP/CSD-75-3

RADIOACTIVITY DISTRIBUTION IN PHOSPHATE PRODUCTS, BY-PRODUCTS, EFFLUENTS, AND WASTES

THE UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RADIATION PROGRAMS

AUGUST 1975

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Technical Note
ORP/CSD-75-3

RADIOACTIVITY DISTRIBUTION IN PHOSPHATE PRODUCTS, BY-PRODUCTS, EFFLUENTS, AND WASTES

by

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August 1975

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PREFACE

The Office of Radiation Programs of the Environmental Protection Agency carries out a national program designed to evaluate population exposure to ionizing and non-ionizing radiation, and to promote development of controls necessary to protect the public health and safety. This report was prepared in order to determine the natural radioactivity source terms associated with phosphate mining and milling products, by-products, effluents, and wastes. Readers of this report are encouraged to inform the Office of Radiation Programs of any omissions or errors. Comments or requests for further information are also invited.

William A. Mills

William A. Mills, Ph.D.
Director
Criteria & Standards Division
Office of Radiation Programs (AW-460)

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ABSTRACT

Phosphate rock throughout the world contains uranium in concentrations ranging from a few ppm to a few hundred ppm. In the United States, phosphate rock normally contains between 100-150 ppm uranium. Mining and processing of these ores redistributes much of the uranium daughters among the various products, by-products, and wastes. These materials are then widely dispersed throughout the environment. This redistribution may lead to increased exposure of the public to these naturally-occurring radionuclides. In determining the magnitude of the population exposure caused by this redistribution and in developing environmental standards and controls to prevent contamination of the biosphere from these naturally-occurring radionuclides it is necessary to determine the concentrations and total quantities of these radionuclides in the products, by-products, effluents and wastes of phosphate mining and manufacturing.

Samples of phosphate ores, products, by-products, effluents, and wastes were obtained and analyzed for their radioactivity content. Calculations were made to quantify the partitioning of the radionuclides in the processing steps from mining through the wet and thermal production techniques. Laboratory studies were made to establish the effectiveness of various treatments in controlling radioactivity in liquid effluents. Field studies were conducted to verify the laboratory results and assess liquid effluent control effectiveness in actual facility operations. Quantities of radioactivity entering the environment through various products, by-products, effluents, and wastes were estimated.

Presented at the Session on Disposal and Utilization of Wastes from Phosphate Fertilizer Production, 1975 American Chemical Society Annual Meeting, Chicago, Illinois, August 24-29, 1975.

INTRODUCTION

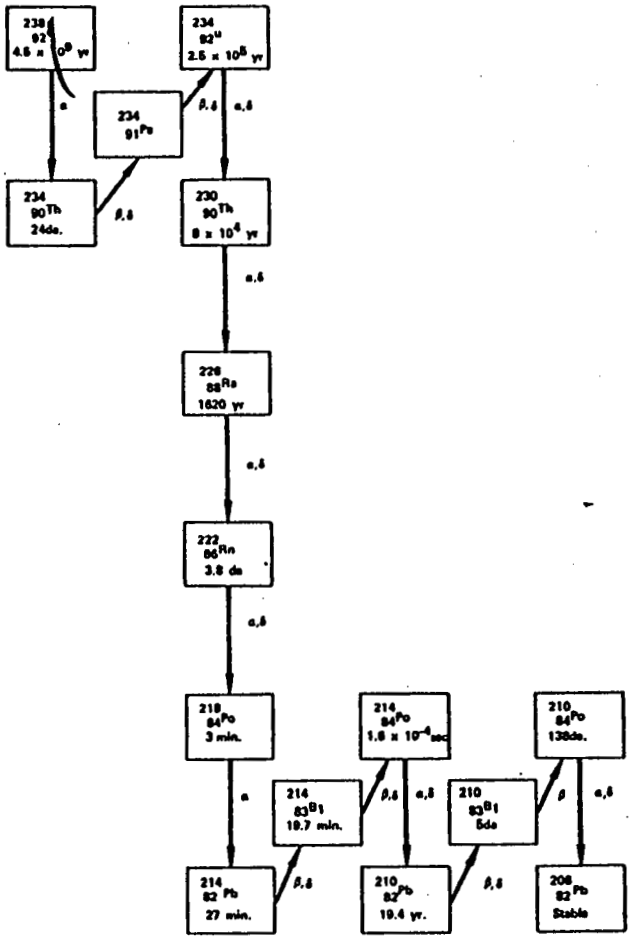
It has been recognized for several years that phosphate deposits throughout the world contain appreciable concentrations of radioactive material originating from the decay of uranium and thorium present in the ores. Previous studies of the variability of concentrations of natural uranium and thorium in the phosphate ores produced in the United States indicate that they range from 8 to 399ppm (5.4 to 267 pCi per gram) and 2 to 19 ppm (0.4 to 4 pCi per gram), respectively (1). The highest concentrations were reported in South Carolina phosphate and the lowest were in Tennessee phosphate rocks.

Generally, the uranium daughters in the ores, at least through radium-226, have been shown to be in secular equilibrium. This means that for each curie (3.7×10^{10} disintegrations/sec) of the parent radionuclide, such as uranium-238, there is one curie of each daughter radionuclide also present. Figures 1, 2, and 3 illustrate the uranium, actinium, and thorium decay series. From the figures it is readily observed that uranium-238, uranium-234, thorium-230, and radium-226 all belong to the uranium series; uranium-235 and thorium-227 are in the actinium series; and thorium-232 and thorium-228 are members of the thorium series. Consequently, when in secular equilibrium, members of the same series will display equal activity.

Mining and processing phosphate ores redistributes the uranium, thorium, and their decay products among the various products, by-products, and wastes. As a result of dispersal of the materials throughout the environment, there may be increased exposure to the public

FIGURE 1

URANIUM - 238 DECAY SERIES



1A

FIGURE 2

THORIUM - 232 DECAY SERIES

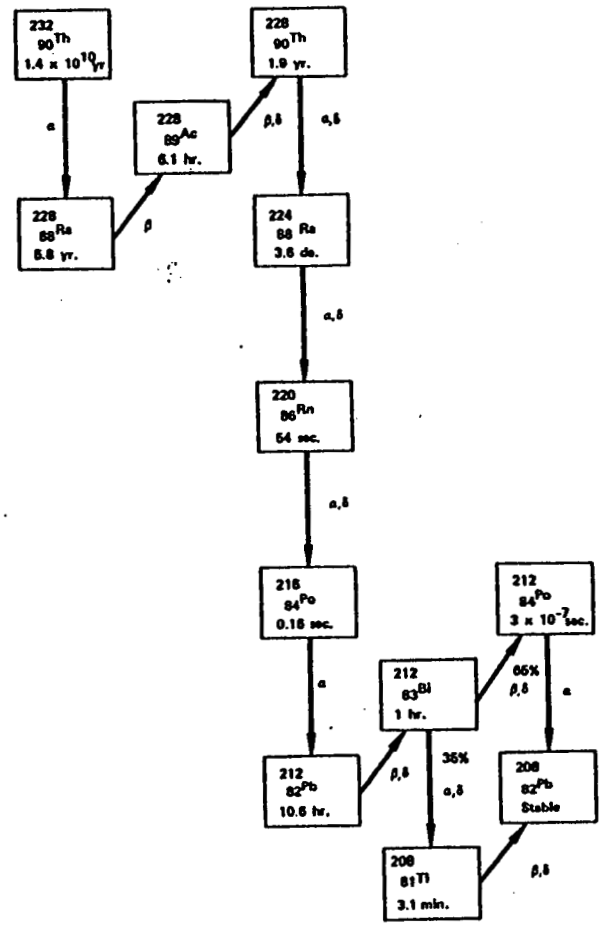


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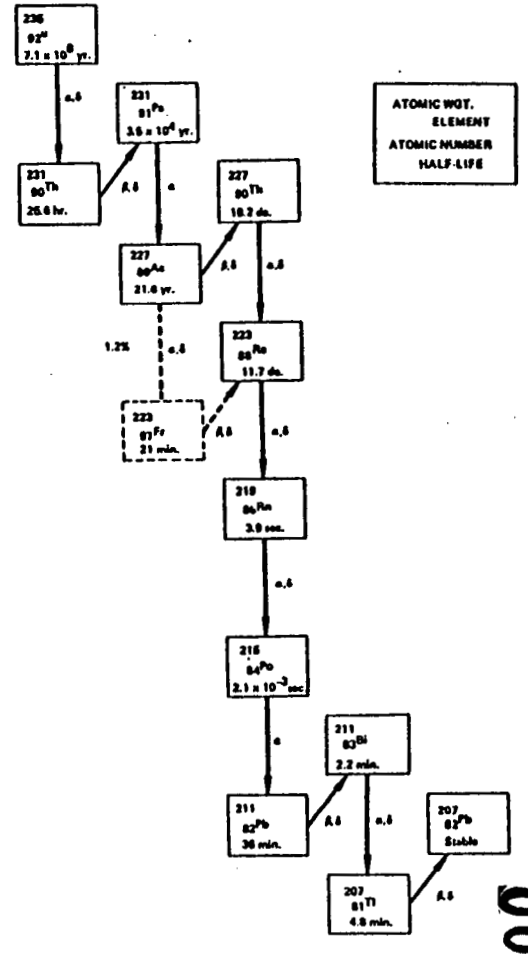
FIGURE 3

ACTINIUM (URANIUM-235) DECAY SERIES



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from these naturally-occurring radionuclides. Although some scientific work has been performed regarding radioactivity in phosphate related materials, the quantitative aspects have generally focused on determining the concentration of uranium in the various phosphate formations. These efforts have primarily been undertaken from a geological perspective. Little emphasis has been placed on the health physics or environmental radioactivity perspectives of the various industry operations. Therefore, in order to evaluate the population dose from phosphate materials and thus determine the adequacy of present standards and environmental controls, it was necessary to first quantitate the radioactivity source terms from the individual operations. This was done by analytically determining the concentrations in specific products, by-products, effluents and wastes and estimating the total activity of the various radionuclides that may be entering the environment through different materials. Establishing the concentrations in specific products, process waters, wastes, and by-products enable the estimating of local and regional impacts while estimates of total activity from annual production data will enable evaluation of national impacts as well as comparision with other industries that release natural radionuclides to the environment.

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METHODOLOGY

Samples of phosphate ores, products, by-products, effluents, and wastes were obtained from several mines, wet process phosphoric acid plants, and electric furnace facilities throughout the southern United States and analyzed for their uranium, radium-226, and thorium content. Laboratory studies were made to determine the effectiveness of various neutralization treatments in controlling radioactivity in liquid effluents from wet-process phosphoric acid plants. Field studies were conducted at several wet-process phosphoric acid plants to verify the results of the laboratory studies.

Radium-226 analyses were performed using the radon emanation method as described in the American Public Health Association's Methods for the Examination of Water and Waste Water (2). By this method, the radium was chemically separated from the samples using a barium sulfate precipitation. It was then dissolved in acid and stored in sealed glass tubing for three weeks to allow ingrowth of radon-222, the gaseous daughter of radium-226. The radon gas was then emanated into an evacuated zinc coated chamber and counted for alpha activity.

Uranium and thorium were separated from solubilized samples using liquid ion exchange procedures developed at the Environmental Protection Agency's Eastern Environmental Radiation Facility in Montgomery, Alabama. Samples were then coprecipitated and collected on a 0.2 micron pore filter and counted by alpha spectroscopy using solid state surface barrier detectors.

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PHOSPHATE ROCK MINING AND BENEFICIATION

Uranium was once thought to be very scarce, yet now it is considered to be more plentiful than many other elements including mercury, antimony, silver, and cadmium (3). It occurs in numerous minerals and ores including pitchblende, uranite, caronite, autunite, uranophane, lignite, monazite sands, and phosphate rock. Naturally-occurring uranium contains 99.28% uranium-238, 0.71% uranium-235, and 0.0058% uranium-234 (4).

Thorium is believed to be more plentiful than uranium. It occurs naturally as thorium-232. Natural thorium is frequently associated with uranium in mineral deposits. Commercial production of thorium in the United States has usually been from monazite sands.

Although uranium is present in most phosphate deposits, the higher concentrations are associated with the marine phosphate deposits (5). This is probably due to the dissolution of the uranium by the marine environment and later redeposition (6). Marine deposits comprise all of the phosphate materials presently extracted in the United States. In Florida, uranium is substituted for calcium in the extensive phosphate deposits.

All of the analytical results from the field studies have not been obtained. Table 1 presents the results of the analytical determinations for radium-226, uranium, and thorium concentrations in Florida phosphate mine products and wastes. The data indicates that in all of the mine materials, the radionuclides of uranium and actinum decay series are in equilibrium. The members of the thorium series are quite close to

TABLE 1

RADIUM-226, URANIUM AND THORIUM CONCENTRATIONS IN FLORIDA PHOSPHATE MINE PRODUCTS AND WASTES

MATERIAL	RADIUM – 226 (pCi/GRAM)	URANIUM (pCi/GRAM)			THORIUM (pCi/GRAM)			
		234	235	238	227	228	230	232
MARKETABLE ROCK	42	41	1.9	41	2.0	0.61	42.3	0.44
SLIMES	45	42	2.6	44	2.3	1.2	48	1.4
SAND TAILINGS	7.5	5.2	0.38	5.3				

equilibrium. The low activity of the thorium-232 and thorium-228, particularly in the marketable rock samples, cause an error term of about ± 30 percent in the analyses so they may be in true equilibrium. These findings both confirm previous examinations of phosphate rock and shows that the primarily physical separations of beneficiation do not significantly alter the states of equilibrium, although beneficiation does produce a redistribution of the concentrations of the radionuclides from the mine rock to the marketable rock, slimes, and sand tailings.

With respect to concentration, the marketable rock and slime contain more radium-226, uranium and thorium than does the sand tailings. This

is expected because the radioactivity is directly associated with the phosphate compound structure, and the marketable ore and slimes contain most of phosphate. One-third of the phosphate originally contained in the matrix remains in the slimes (7). The remainder is primarily in the marketable rock.

In order to estimate the total annual radium-226, uranium, and thorium activities extracted by phosphate mining, the production data from 1973 was examined. In that year, 91% of the overall mine rock production came from Florida, 3% from Tennessee, and the remainder from the Western states of Idaho, Missouri, Montana, Utah, and Wyoming (8). Eighty-two percent of the marketable rock produced was from Florida, 6% was from Tennessee, and the remainder was from the Western states. Over 99.9% of the mine production in Florida was beneficiated, whereas, about 59% of the Western mine production was beneficiated. While estimates of sand tailings and slime production indicate that they vary from mine to mine, there are approximately 3250 pounds of sand tailings and 2110 pounds of slimes produced per ton of marketable rock (9). Clearly, with 1973 marketable rock production of 42.1 million tons, a sizable quantity of slimes and sand tailings were produced.

Field investigations and sample analyses for Tennessee and Western mine materials have not been completed. Therefore, estimates of the total amounts of radium-226, uranium, and thorium extracted in phosphate mining are only for Florida. It is believed that this probably underestimates the total amounts of radioactivity extracted by about 10 to 15 percent since Tennessee rock should contain relatively low

TABLE 2

ESTIMATED TOTAL RADIUM-226, URANIUM, AND THORIUM ACTIVITIES IN FLORIDA PHOSPHATE MINE PRODUCTS AND WASTES

MATERIAL	1973 PRODUCTION ($x10^6$ TONS)	RADIUM – 226 (CURIES)	URANIUM (CURIES)			THORIUM (CURIES)			
			234	235	238	227	228	230	232
MINE ROCK	127.3								
MARKETABLE ROCK	34.4	1300	1290	59	1290	62	19	1320	14
SLIMES[a]	38.3	1480	1390	86	1460	74	39	1570	46
SAND TAILINGS[b]	55.8	380	264	19	268				
TOTAL	126.5	3160	2944	164	3020				

(a) Based on 2110 pounds of slimes produced per ton of product
(b) Based on 3250 pounds of sand tailings produced per ton of product

radioactivity concentrations and Western rock concentrations should be comparable to Florida rock. Table 2 lists the estimated total quantities of products and wastes from Florida phosphate mining in 1973 and estimates the total activities of radium-226, uranium and thorium present in the materials based on the concentrations in Table 1. Blanks in the table indicate that specific estimates for that parameter have not been made because of incomplete sample analyses. Of the total radioactivity present in the 1973 total beneficiation plant products and wastes, approximately 40% was in the marketable rock, 48% was in the slimes, and the remainder was in the sand tailings.

Several slime ponds have discharges to the environment. The discharge quantities depend upon the facility's degree of recycle, overall water consumption and, local precipitation. Since most of the radioactivity in the waste products of beneficiation is present in the slimes, this could pose potential problems to receiving streams if the radioactivity was not removed prior to discharge. To examine this aspect, the concentration of radium-226 was determined for slime discharges and effluent discharges from seven mine and beneficiation plants. This data is illustrated in Table 3. The concentration of dissolved radium-226 in slime discharges is less than 5.0 picocuries per liter at all seven facilities. The concentration of radium-226 in the undissolved fraction varies greatly and is highly dependent on the total suspended solids in the slime discharge. The radium-226 concentrations in picocuries per gram of the undissolved fraction at all seven facilities are in the same order of magnitude emphasizing the importance of the total suspended solids concentration in determining the total concentration of radium-226 in picocuries per liter in the slime discharge. Although no chemical process is used to treat the discharge from the slime ponds, low dissolved radium-226 concentrations were observed in the effluents. This is attributed to the generally low dissolved radium-226 concentrations in the slime discharges.

The total concentration of radium-226 in every effluent discharge sample analyzed was less than 3.0 picocuries per liter. Comparison of the slime discharge and effluent discharge concentrations indicate that no specific reduction in soluble radium-226 is predictable from the data

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TABLE 3

RADIUM-226 CONCENTRATIONS IN PHOSPHATE MINE EFFLUENTS

FACILITY	HEAVY SLIME DISCHARGE			EFFLUENT DISCHARGE			
	DISSOLVED	UNDISSOLVED		DISCHARGE POINT	DISSOLVED	UNDISSOLVED	
	pCi/LITER	pCi/LITER	pCi/gm		pCi/LITER	pCi/LITER	pCi/gm
1	0.82	10.2	21.3	A	0.66	0.26	17.3
				B	0.52	0.28	21.5
				C	0.68	0.28	18.7
2	4.8	1074	72.6	A	0.02 0.34	0.56 1.1	31.1 52.4
3	2.0	97.6	30.5	A	2.2	0.74	38.9
4	0.6	37.7	9.8	A	0.24	0.74	28.5
5	2.2	520	52.0	–	–	–	–
6	1	2248	33.6	–	–	–	–
7	0.95	725.5	16.0	A	1.01	0.14	7.0

obtained at the seven facilities. This is understandable since present treatment of the slimes involves only settling of solids and consequently no appreciable precipitation of soluble radium-226 would be expected. The reduction of total radium-226 from the slime discharge to the effluent discharge ranged from 92% to greater than 99.9% in the facilities studied. This was primarily due to removal of suspended solids containing large amounts of radium-226. Therefore, because of the

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significance of the contribution of the radium-226 contained in the suspended solids to the total concentration of radium-226 observed in either the slime or effluent discharge, great reductions in suspended solids levels between the slime discharge and the effluent will result in corresponding reductions in radium-226 concentrations.

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WET-PROCESS PHOSPHORIC ACID PRODUCTION

With 1973 production of 5.62 million tons P_2O_5 of phosphoric acid, that year about 20 million tons of marketable rock went to the production of phosphoric acid by the wet process method. Under the provisions of the Federal Water Pollution Control Act of 1972, as amended, the Environmental Protection Agency is required to establish effluent limitation guidelines for fertilizer and phosphate manufacturing and to issue National Pollutant Discharge Elimination System (NPDES) permits for individual fertilizer and manufacturing facilities. Because of the need to expeditiously issue permits to such facilities, interim guidelines for permits recommended a effluent limitation of 9 pCi per liter total radium-226 pending results from additional studies (10). To provide a data base for subsequent guidelines and permits, laboratory studies were conducted to investigate the reduction in radium-226 levels after various treatments. Process pond water was obtained from a Florida wet-process facility. Four bases, quick lime, limestone, hydrated lime, and dolomite were added to 4 liters of process water in different amounts to increase the pH. Other bases such as sodium hydroxide were not studied because they did not appear to be economically viable treatment alternatives if the bases studied proved satisfactory. After the bases were added, they were vigorously agitated and allowed to settle until the pH stabilized. The resultant supernatant liquids were then filtered and analyzed for their soluble radium-226 concentrations. No attempt was made to examine the undissolved radium-226 concentrations because the

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TABLE 4

LABORATORY PROCESS WATER TREATMENT STUDY

TREATMENT	AMOUNT OF BASE ADDED (GRAMS)	RESULTANT pH	DISSOLVED RADIUM - 226 pCi/LITER
UNTREATED PROCESS WATER	-	2.0	75.8 (6.7 pCi/LITER UNDISSOLVED)
CALCIUM OXIDE (QUICK LIME)	70	7.9	0.15
LIMESTONE ROCK	500	4.6	0.11
SLAKED LIME (HYDRATED LIME)	50	8.0	0.07
DOLOMITE	500	4.0	0.16

differences between laboratory settling and field settling of solids were deemed to be significant enough to make the laboratory undissolved radium fraction not representative of the field situation. The results of these studies are detailed in Table 4. In all treatment cases, soluble radium-226 was reduced by more than 99.7%. This was true even though the resultant pH of the treated wastes ranged from 4.0 to 8.0. This large reduction is attributed to the readily available amount of sulfate ions

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TABLE 5

EFFECT OF LIME TREATMENT ON RADIOACTIVITY REMOVAL FROM EFFLUENTS FROM A WET PROCESS PHOSPHORIC ACID PLANT

PLANT A – FIELD SURVEY NUMBER 1

SAMPLE I.D.	pH	TOTAL RADIUM - 226(pCi/l)	TOTAL URANIUM (pCi/l)			TOTAL THORIUM (pCi/l)		
			234	235	238	228	230	232
UNTREATED PROCESS WATER	2.0	82.3	1086	48	1045	2.5	70	4.5
OUTFALL (After double timing)	9.1	4.54	1.09	ND	0.52	0.44	0.57	0.04

PLANT A – FIELD SURVEY NUMBER 2

SAMPLE I.D.	pH	TOTAL RADIUM - 226 (pCi/l)	TOTAL URANIUM (pCi/l)			TOTAL THORIUM (pCi/l)		
			234	235	238	228	230	232
UNTREATED PROCESS WATER	1.8	55.6	411	24	394	3.4	101	3.2
LIMED ONCE	4.4	1.20						
PRIOR TO SECOND LIMING	4.3	1.5	39.7	2.2	39.5	ND	0.52	ND
OUTFALL (After second liming)	7.1	1.8	16.8	0.98	16.8	0.32	0.71	0.11

in the process water enabling large scale coprecipitation of calcium-radium sulfate.

Field studies were conducted at several wet-process facilities to verify the effectiveness of lime treatment as observed in the laboratory. Results of four of these studies are detailed in Tables 5, 6, and 7. Field studies were conducted at Plant A during different periods of the

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TABLE 6

EFFECT OF LIME TREATMENT ON RADIOACTIVITY REMOVAL FROM EFFLUENTS FROM A WET PROCESS PHOSPHORIC ACID PLANT/PLANT B - FIELD SURVEY NUMBER 1

SAMPLE I.D.	pH	TOTAL RADIUM - 226 (pCi/l)	TOTAL URANIUM (pCi/l)			TOTAL THORIUM (pCi/l)		
			234	235	238	228	230	232
UNTREATED PROCESS WATER	2	88.2	1769	98.8	1825	3.92	393	6.33
AFTER FIRST* LIMING	4.5	74.0	736	33.4	734	6.15	4.3	7.5
PRIOR TO SECOND LIMING	6	0.90	67.8	3.17	68.1	ND	1.32	ND
OUTFALL (After double-liming)	8	0.45	0.26	ND	0.33	0.1	0.13	ND
UNTREATED NON-PROCESS WATER		1.38	0.28	ND	0.39	ND	ND	ND
NON-PROCESS WATER AFTER LIMING		2.6	0.96	ND	0.75	0.13	0.79	0.07
NON-PROCESS WATER OUT-FALL		0.88	0.34	ND	0.42	ND	1.32	ND

*These concentrations are high because of the large suspended solids load of 23.5 grams per liter.

The dissolved concentrations in pico curies per liter were:

Radium - 226 - 5.2
Uranium - 234 - 12.8
Uranium - 235 - 0.52
Uranium - 238 - 12.9

TABLE 7

EFFECT OF LIME TREATMENT ON RADIOACTIVITY REMOVAL FROM EFFLUENTS FROM A WET PROCESS PHOSPHORIC ACID PLANT

PLANT C – FIELD SURVEY NUMBER 1

SAMPLE I.D.	pH	TOTAL RADIUM - 226 (pCi/l)	TOTAL URANIUM (pCi/l)			TOTAL THORIUM (pCi/l)		
			234	235	238	228	230	232
PROCESS WATER	1.9	56.2	676	35.1	661	0.86	8.6	4.1
OUTFALL (After single liming)	6.6	2.55	.26	ND	.28	ND	ND	ND

rainy season. Field survey number 1 was conducted very early in the rainy season, prior to the initiation of large scale effluent treatment. Field survey number 2 was performed late in the rainy season after almost continuous lime treatment for over two months.

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From Table 5, comparison of the process water from survey number 1 to survey number 2 shows a 32% decrease in radium-226 concentration during the second survey. This is probably due to the combination of dilution of the process water by the influx of surface rain runoff and the removal of the radioactive material by treatment and discharge of several million gallons of water per day.

The data indicate that the radionuclides are substantially out of equilibrium. This is because the uranium, and thorium are dissolved preferentially over radium-226 by the acidulation with sulfuric acid and then enter the process water. In all four process water samples, the uranium activity was a factor of 10 or more greater than the radium-226 activity. The thorium-230 activity varied greatly, ranging from .2 to 4.5 times the radium-226 activity.

As evidenced by Tables 5, 6, and 7, treatment with lime is highly efficient in removing radium-226 from the discharged process water. In all four cases, the outfall samples exhibited radium-226 reduction of greater than 94 percent. This data argrees very well with removal efficiencies observed in laboratory experiments. Lime treatment also proved to be extremely effective in removing uranium and thorium-230 from treated process water. In addition, uranium and thorium-230 removal between the process water and outfall were at least 96 and 99 percent, respectively in the four cases noted.

Therefore, although primarily designed for pH, phosphorus and flourides control and not for removal of radionuclides in the effluent, treatment with lime was observed to be highly effective in removing

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radium-226, uranium, and thorium from the effluent discharge. These results are attributed to the following factors:

1. Process water contains a large concentration of sulfate and phosphate ions to enable ready compound formation.

2. Neutralization by an agent such as lime not only allows for the reduction of solubility of several compounds but provides an ample supply of calcium ions to enable the large-scale formation of calcium sulfate.

3. The relative insolubility of radium sulfate makes its readily coprecipitate with calcium sulfate.

4. Uranium and thorium probably precipitate along with calcium sulfate and other components through substitution for calcium in formed compounds. Information Circular 8501, U.S. Department of the Interior, Bureau of Mines, 1971.

5. Settling provides the opportunity for the precipitated compounds to be removed from the effluent and not be discharged as suspended solids.

Samples of normal superphosphate, diammonium phosphate (DAP) monoammonium phosphate (MAP), triple superphosphate (TSP), phosphoric acid, animal feed supplement, sodium fluosilicate, and gypsum were obtained from several facilities using Florida phosphate rock. Radium-226, uranium, and thorium data for these samples are shown in Table 8. The uranium and thorium analyses for these samples are not all completed. For the samples completed there is significant disequilibrium between uranium-238, thorium-230, and radium-226. Although results are not available, the normal superphosphate samples probably exhibit equilibrium

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TABLE 8

RADIUM-226, URANIUM, AND THORIUM CONCENTRATIONS IN WET PROCESS PHOSPHORIC ACID PLANT PRODUCTS AND BYPRODUCTS*

MATERIAL	RADIUM - 226 (pCi/gm)	URANIUM (pCi/gm)			THORIUM (pCi/gm)			
		234	235	238	227	228	230	232
GYPSUM	33	6.2	0.32	6.0	0.97	1.4	13	0.27
NORMAL SUPER-PHOSPHATE	25							
DIAMMONIUM PHOSPHATE (DAP)	5.6	63	3.0	63	1.6	0.8	65	0.4
TRIPLE SUPER-PHOSPHATE (TSP)	21	58	2.8	58	1.2	0.9	48	1.3
MONOAMMONIUM PHOSPHATE (MAP)	5.0	55	2.9	55				
SODIUM FLOUROSILICATE	0.28							
ANIMAL FEED	5.5							
PHOSPHORIC ACID	840 pCi/l							

*PLANTS USING FLORIDA PHOSPHATE ROCK

because the production of normal superphosphate does not require the separation of gypsum from the reaction products.

Gross mass balancing of the input phosphate rock and the product phosphoric acid and phosphogypsum indicates that approximately 1 percent of the radium-226, 60 to 80 percent of the thorium-230, and 80 percent of the uranium is dissolved during the acidulating by sulfuric acid. The thorium-230 fraction appears to be the most variable. The numbers are

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quite similar to radium-226, uranium, and thorium dissolution by the acid leach process of milling uranium ore (11). This is not surprising since similar techniques and chemicals are used in both industrial processes.

Individual samples of phosphoric acid displayed a great variation of radium-226 concentration ranging from a few hundred to greater than one thousand picocuries per liter. The variation was not observed to be a function of solids content or P_2O_5 concentration. The average of seven samples was 840 pCi/liter as noted in the table. This translates to a concentration of less than 1 pCi per gram of 52% phosphoric acid.

Ammonium phosphates (DAP and MAP) were observed to have approximately the same radium-226 concentrations. Uranium concentrations were greater by a factor of about ten, although the DAP had slightly higher uranium concentrations than the MAP. The relatively low radium-226 concentration and much higher uranium concentration is attributed to the fact that production of ammonium phosphates uses only ammonia and phosphoric acid with no direct reaction with phosphate rock. Consequently, the bulk of the radioactivity introduced to the reaction comes from the phosphoric acid which is enriched with uranium and deficient in radium-226 due to the partition by removal of the phosphogypsum. Thorium-230 concentrations were about the same as the uranium concentrations which is expected because of their similarity in dissolution fractions.

Triple superphosphate (TSP) contained almost as much radium-226 as normal superphosphate fertilizer and if we assume normal superphosphate

TABLE 9

ESTIMATED TOTAL RADIUM-226 URANIUM, AND THORIUM ACTIVITY IN PHOSPHATE FERTILIZER PRODUCTS AND BYPRODUCTS BASED ON 1973 PRODUCTION DATA[a]

MATERIAL	PRODUCTION		RADIUM - 226 (CURIES)	URANIUM (CURIES)			THORIUM (CURIES)			
	($\times 10^6$ TONS)	($\times 10^6$ TON P_2O_5)		234	235	238	227	228	230	232
NORMAL SUPER-PHOSPHATE	3.4	0.62	77							
TRIPLE SUPER-PHOSPHATE	3.7	1.72	69	190	9.4	190	4	3.0	160	1.3
AMMONIUM PHOSPHATES	5.8	2.67	30	330	16	330	8.4	4.2	340	2.1
PHOSPHERIC ACID	11[c]	5.82	5.5				—			
GYPSUM[b]	25.3	–	760	140	7.3	140	22	32	300	6.2

(a) Wet Process Production
(b) Based on 4.5 tons gypsum per ton P_2O_5
(c) Assuming 50 percent P_2O_5 acid

fertilizer is in equilibrium, TSP probably contains more than twice the concentration of uranium than normal superphosphate. These observations are in accord with anticipated results because triple superphosphate is produced by acidulating phosphate rock with phosphoric acid. Therefore, the product triple superphosphate would be expected to display comprise activities of radium-226, uranium, and thorium corresponding to the activities in the reactants, phosphate rock and phosphoric acid, which display markedly different radium-226, uranium, and thorium concentrations.

The other two product samples studied were animal feed supplement which contained about the same radium-226 concentration as the ammonium phosphate samples, and sodium fluosilicate which contained very little radium-226. The low radium-226 in the sodium fluosilicate infers that by-product fluosilicic acid which is used to produce the sodium fluosilicate also contains very little radium-226. Uranium and thorium analyses have not yet been obtained for these two products.

In order to estimate the total activities of radium-226, uranium, and thorium in the wet phosphoric acid plant products, and by-products, 1973 production data was obtained and used in conjunction with the product radioactivity concentrations detailed in table 8 (12). The resulting total activity estimates are illustrated in table 9. Blanks reflect that no estimates were made because of incomplete data. It should be noted that because of the difficulty in separating production on the basis of Florida rock versus Western rock, all total estimates assume that products made with Western rock exhibit approximately the same radioactivity concentrations. Although this assumption may not be completely valid, it is anticipated that the error introduced into the estimates is within the error built into the production estimates and product radioactivity concentrations.

Approximately 80% of the product radium-226 activity is contained in the phosphogypsum. Although the radium-226 concentrations of normal superphosphate and triple superphosphate are about 70% of the phosphogypsum, the bulk magnitude of the amount of phosphogypsum produced, about 4.5 tons per ton P_2O_5 acid, is sufficient to outweigh the

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individual contributions of the other products (13). Phosphoric acid contributes a major portion of the total uranium and thorium activity. It is emphasized that the columns are not directly additive to determine the total radioactivity in the products because some of the activity reflected in the phosphoric acid is also accounted in the ammonium phosphate and triple superphosphate estimates because phosphoric acid is used to produce these products. Nevertheless, it is evident that a sizable inventory of radioactivity is present in the phosphoric acid plant products and by-products.

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ELEMENTAL PHOSPHORUS PRODUCTION

Three elemental phosphorus plants were studied, one using a blend of Florida and Tennessee rock, and two others using only Florida rock. The results of radium-226 analysis of the raw materials and products of these facilities are shown in Tables 10 and 11.

Because of the hazards associated with handling elemental phosphorus, special procedures had to be established to analyze it for radioactivity. Consequently, the early field trips omitted phosphorus samples until appropriate analytical measures were established and analytical results of their radium-226 content are not available. However, elemental phosphorus samples have been obtained during subsequent field trips to the two facilities using only Florida rock. Of all the raw materials used in the production of elemental phosphorus, only the phosphate rock and particularly the Florida rock show significantly elevated radium-226 concentrations. The slag exhibits the greatest concentration of radioactivity of the solid products. In a mass balance of radium-226 entering and leaving these elemental phosphorus plants, almost all of it can be accounted for in the input phosphate rock and in the output slag.

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TABLE 10

RADIUM-226 CONCENTRATIONS IN ELEMENTAL PHOSPHORUS PLANT RAW MATERIALS, PRODUCTS, AND BYPRODUCTS

AVERAGE OF TWO PLANTS USING FLORIDA ORE

MATERIAL	RADIUM – 226 (pCi/gm)
INPUT FEED ORE	60
COKE	1
GRAVEL	0.5
OUTPUT ELEMENTAL PHOSPHORUS	
SLAG	56
FERROPHOSPHORUS (FEP)	1.2

Table 11 shows that the other major furnace products, elemental phosphorus and ferrophosphorus contain very small concentrations of radium-226 and since the production quantities of these materials are small in comparison to slag, they account for only a very small fraction of the total radium-226 in the products.

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TABLE 11

RADIUM-226 CONCENTRATION IN ELEMENTAL PHOSPHORUS PLANT RAW MATERIALS, PRODUCTS, AND BYPRODUCTS

ONE PLANT USING A BLEND OF TENNESSEE AND FLORIDA ORES

MATERIAL	RADIUM – 226 (pCi/GRAM)
INPUT TENNESSEE MATRIX	3.8
FLORIDA PEBBLE	65.2
COKE	0.28
SILICA	0.36
ELEMENTAL PHOSPHORUS	0.63
SLAG	17.6
FERROPHOSPHORUS (FEP)	0.24
PHOSPHORIC ACID MADE FROM SLUDGE	440 pCi/LITER
PHOSPHORIC ACID MADE FROM CLEAN PHOSPHORUS	101 pCi/LITER

The plant using the blend of Florida and Tennessee rock produced two types of phosphoric acid, one from burning clean acid and another from burning sludge. Analysis of these samples showed that the phosphoric acid made from sludge contained 440 pCi/liter radium-226. Although this is not particularly high, its presence is probably due to the radium-226

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present in furnace particulates which were not removed by the furnace precipitator and consequently were scrubbed and collected in the sludge which was then burned to produce acid. It is the existence of particulates missed by the precipitator that causes the sludge material. The acid made from the clean phosphorus contained 101 pCi/liter radium-226. This is probably due to the introduction of radium-226 from the sludge acid since the "clean" acid was composed of 16% sludge acid. Uranium and thorium analyses of these samples have not yet been completed.

No estimates of total activities of radioactivity in elemental phosphorus products and by-products were made because the elemental phosphorus production from Florida rock is only a minor fraction of the total U. S. production. The bulk of this production comes from the use of Western rock. Although field studies have been initiated to examine the concentrations in products and by-products using Western rock, they are presently incomplete.

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POTENTIAL URANIUM RESOURCE

The radioactive constituents of the phosphate mining and manufacturing products and wastes have the potential for becoming environmental pollutants. However, the uranium also has the potential for becoming an energy resource if concentrated from phosphate materials and used to fuel nuclear power reactors. Table 12 compares the tons of ore extracted from the earth between the U.-S. uranium and phosphate industries in 1973 and the estimated amounts of uranium and radium-226 contained in the ores. The phosphate industry extracted about 20 times as much rock than did the uranium industry. The uranium industry processed ore averaging about 0.2 percent uranium oxide (U_3O_8), whereas the uranium content of phosphate rock averages about 0.014 per cent uranium oxide (U_3O_8). The Atomic Energy Commission (now Energy Research and Development Administration) reported that in 1973 the uranium industry extracted 13.8 thousand tons of U_3O_8. During that same period, the U_3O_8 content in Florida and Western mined phosphate rock was 18.9 thousand tons. The uranium (U_3O_8) in the marketable phosphate rock fraction was 6.2 thousand tons. Clearly, a substantial amount of uranium comparable to that extracted by the U. S. uranium industry is mined annually by the phosphate industry. Presently, the only technology being developed to recover uranium from phosphate rock is the use of solvent extraction methods to remove the uranium from phosphoric acid. While use of this technology should enable recovery of several million tons of U_3O_8 per year, the bulk of the uranium (about 70%) in the mined rock will still be lost as a resource in the slime fraction and enter the

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TABLE 12
COMPARISON OF QUANTITIES OF URANIUM AND RADIUM-226 EXTRACTED BY THE U.S. URANIUM AND PHOSPHATE MINING INDUSTRIES (1973 PRODUCTION DATA)

INDUSTRY		TONS OF ORE (x 10^6)	TONS OF U_3O_8 (x 10^3)	CURIES OF RADIUM - 226
URANIUM MINING INDUSTRY		6.77	13.8	3560[a]
PHOSPHATE MINING INDUSTRY	MINE ROCK	139.7	18.9[b][c]	4860[a]
	MARKET-ABLE ORE	42.1	6.2[c]	1590[c]

(a) Assuming equilibrium with uranium parent
(b) Assuming 120 ppm uranium in equilibrium with radium - 226
(c) No contribution was included for Tennessee ore and Western rock was also assumed to contain 120 ppm uranium.

environment as a potential pollutant. In addition to the uranium resources lost in the slimes, a substantial resource is also lost by not recovering the uranium in the leach zone that comprises a portion of the overburden in many of the Florida phosphate areas. The leach zone also contains substantial concentrations of uranium (14).

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SUMMARY AND CONCLUSIONS

The mining and milling of phosphate rock annually extracts several thousand curies of radium-226, uranium, and thorium-230. Approximately 60% of the activity extracted in mining phosphate rock in Florida remains as waste products of slime and sand tailings after beneficiation. Where mined rock is used directly, the entire amount of radioactivty present in the rock is transferred either to the electric furnace or wet-process phosphoric acid plant. The radioactivity present in the mine rock, marketable rock, slimes, and sand tailings exhibit equilibrium among members of the same decay series.

The slimes contain most of the waste product after beneficiation. Consequently, care must be taken to prevent unnecessary release of slime material to streams and rivers either as suspended solids during normal operations or through accidental slime releases. Studies at operating mine and beneficiation facilities indicate that routine releases of radium-226 from slime ponds can easily be minimized by utilizing good solids setting techniques.

Milling either by electric furnace or the wet-process phosphoric acid process significantly alters the concentration of radium-226, uranium and thorium in the resultant process streams, products and wastes. In the wet-process system, most of the radium-226 is not dissolved by acidilation with sulfuric acid and thus remains with the phosphogypsum by-product. Whereas, most of the uranium and much of the thorium does enter solution and is transferred to the phosphoric acid product. The phosphate products reflect radium-226, uranium, and thorium

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concentrations characteristic of the phosphate material from which they were derived. Where phosphoric acid is used as the sole source of phosphorus, the products exhibit relatively low radium-226 concentrations and substantially higher uranium and thorium concentrations. Where both phosphate rock and phosphoric acid are used, the products exhibit both higher radium-226 concentration characteristics of the phosphate rock, and higher uranium and thorium concentrations characteristic of phosphoric acid. In the electric furnace, almost all of the radium-226 is retained by the calcium silicate slag by-product with very little entering the other products. This concentration in the slag may not be true for other radionuclides such as polonium-210, that may be volitalized in the furnace.

Lime neutralization of wet-process effluents was observed to be highly efficient in removing radium-226, uranium and thorium-230. Removal rates of 94% or more for radium-226, uranium and thorium-230 were observed when pH was increased to 6 or more in the field and even at lower pH in the laboratory. Therefore, a properly operated liming system should be capable of minimizing radioactivity levels in wet-process facility effluent streams.

Since a large fraction of the radioactivity that enters either the electric furnace plant or the wet process facility is entrained in the by-product slag and gypsum, respectively, increased emphasis on assessing the potential impact of these materials is warranted. Existing as well as potential future application of these materials such as soil additives, aggregates, gravel and wallboard applications should be

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thoroughly investigated to estimate the magnitude of their radiological significance.

The radioactivity concentrations in raw materials, products, wastes, by products and effluents as detailed in the paper should enable individual phosphate processors to estimate the concentrations of radioactivity in their materials. Since individual processors produce varying amounts of specific products, by-products, wastes, and effluents, adaptation of this data to their own specific cases will allow them to better characterize the redistribution of radioactivity in their operations.

This paper is not intended to draw overall conclusions concerning the environmental and public health significance of the data presented. Rather, the existence of this data will enable additional work to model the migration of the radioactivity through the environment to man via the various pathways available and use these models to estimate the individual and overall population impact.

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URANIUM AND RADIUM-226 IN FLORIDA PHOSPHATE MATERIALS*

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(*Received* 24 *January* 1979; *accepted* 13 *February* 1979)

Abstract—Input materials, products and by-products from a number of Florida phosphate mines and chemical plants were analyzed for ^{226}Ra and ^{238}U by high resolution gamma spectrometry. Concentrations were distinctly lower in North Florida than in Central Florida. In the matrix, the two nuclides were essentially in radioactive equilibrium (North Florida, 8 pCi/g; Central Florida, 38 pCi/g). Following beneficiation, concentrations in rock product, waste clays and sand tailings were approx. 100–300%, 100% and 10–25%, respectively, of those in the matrix. Radioactive equilibrium is markedly disrupted in phosphoric acid production; uranium follows the phosphoric acid while ^{226}Ra appears in the by-product gypsum (North Florida, 14 pCi/g; Central Florida, 26 pCi/g) and also in sediments and scales. Ammoniated phosphate fertilizers had relatively low levels of ^{226}Ra but significant ^{238}U (North Florida, 25 pCi/g; Central Florida, 70 pCi/g). On the other hand, triple superphosphate had significant concentrations of both ^{226}Ra (North Florida, 12 pCi/g; Central Florida, 20 pCi/g) and ^{238}U (North Florida, 26 pCi/g; Central Florida, 56 pCi/g). In the electric furnace process, radioactivity is transferred to the slag (Central Florida, 61 pCi/g of each nuclide). Within either region, nearly all sample types showed a considerable range of concentrations.

INTRODUCTION

URANIUM is known to be present in association with phosphate deposits of marine origin; an average content of 0.01% is generally quoted for Central Florida phosphate matrix. Consequently, the various radionuclides of the naturally occurring uranium decay series would be expected to be present with this mineral and to be partitioned by physical and chemical means during phosphate mining and subsequent processing. The work reported in this paper is part of an industry-sponsored assessment of natural radiation; it was carried out to extensively expand the data available for Florida phosphate by examining first hand a wide variety of materials from a cross section of currently operating mines, plants and processes. Analyses were performed for ^{238}U, the parent of the decay series and for ^{226}Ra, a long-lived member of the series. Radium-226, with its half-life of 1622 yr, can exist for long periods of time after separation from the parent uranium. It is biologically significant in its own right and is the immediate precursor and source of continuing replenishment of ^{222}Rn and its short-lived decay products or progeny that have been implicated as potential inhalation hazards (US75).

Several groups of investigators have reported the natural radioactivity concentrations of a variety of products, by-products and waste products from phosphate rock production and chemical plant operations. Menzel (Me68) reviewed the uranium, radium and thorium content of phosphate rock from a number of sources worldwide, including

*Work supported by a contract from the Florida Phosphate Council.

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Florida. DeMeijer (de73) reported the presence of uranium series radionuclides in phosphate slag (a by-product of the electric furnace production of elemental phosphorus) exported from Florida to the Netherlands. U.S. Environmental Protection Agency (EPA) investigators (US74; Gu75; Gu77; Mi77) have reported concentrations of ^{226}Ra and the various isotopes of uranium and thorium from samples collected at several Florida and North Carolina phosphate rock and chemical facilities. Booth (Boo77) and EPA Investigators (US74; US77; US78) reported natural radioactivity data for Idaho phosphate. Bouwer *et al.* (Bou78) reported the uranium contents of superphosphate and several grades of commercial fertilizer of unspecified origin. Recently Reid *et al.* (Re77) reported the uranium and ^{226}Ra concentrations in livestock feed supplements commercially available in Texas, but from a variety of phosphate origins. A review of world-wide data on natural radioactivity in phosphate rock, products and by-products was presented in the 1977 report on the United Nations Scientific Committee of the Effects of Atomic Radiation (UN77).

METHODS

During the period January 1976–May 1977, samples were collected by either industry or University of Florida representatives at phosphate rock facilities (mines and beneficiation plants) and at chemical plants and submitted to the University laboratory. Here, solid samples were dried for 24 hr at 100°C and portions were then weighed into 0.5 l. molded plastic marinelli beakers. Liquid samples (phosphoric acid) were loaded into beakers as received. The loaded beakers were sealed and then stored at least two weeks to allow ingrowth of gaseous ^{222}Rn (3.8 day half-life) and its short-lived decay products to equilibrium with the long-lived ^{226}Ra precursor in the sample.

At the end of the ingrowth period, the samples were counted with a multichannel gamma spectrometer (GeLi detector); concentrations of ^{238}U were calculated from the 92.3–92.8 keV peaks of its daughter ^{234}Th and concentrations of ^{226}Ra were calculated from the 295.2, 352.0 and 609.4 keV peaks of its ^{214}Pb and ^{214}Bi progeny (Bo77).

RESULTS AND DISCUSSION

As shown in Fig. 1, present day mining in Florida is carried on in two districts, Central Florida where most of the mining occurs and North Florida with a more limited number of mining and chemical plant operations. The two districts are geographically and geologically distinct and samples of similar types from the two regions usually had significantly different radioactivity contents. Consequently data were summarized separately for the two regions (Tables 1 and 2). From the ranges presented, it can be seen that for most sample types there is considerable variation in radioactivity content within a region. Therefore, when dealing with average concentrations, usually only general statements can be made because of the associated wide variability.

Mining and rock operations

The phosphate matrix (material from the ore body) is beneficiated as indicated in Fig. 2 to produce marketable rock. In general, screening and washing produce a coarse product known as "pebble" (+14 mesh) and a fine (−150 mesh) clay or "slimes" suspension waste. The intermediate sized remaining fraction is submitted to flotation to separate out the marketable "rock concentrate" from the similar sized silica sand.

From the data tables it can be seen that the uranium and radium are in a state of radioactive equilibrium in the matrix. The data suggest a possible 10–25% enrichment in radium relative to uranium in the product rock, but there is no great disruption in the equilibrium state through the purely physical processing stages of beneficiation.

With respect to radioactivity, beneficiation in Central Florida produces pebble that has a concentration about 150% of that of the matrix, rock concentrate that is comparable to the matrix and sand tailings with concentrations only 12–14% of those in the matrix. From the small number of samples collected, it appears that Central Florida clays have

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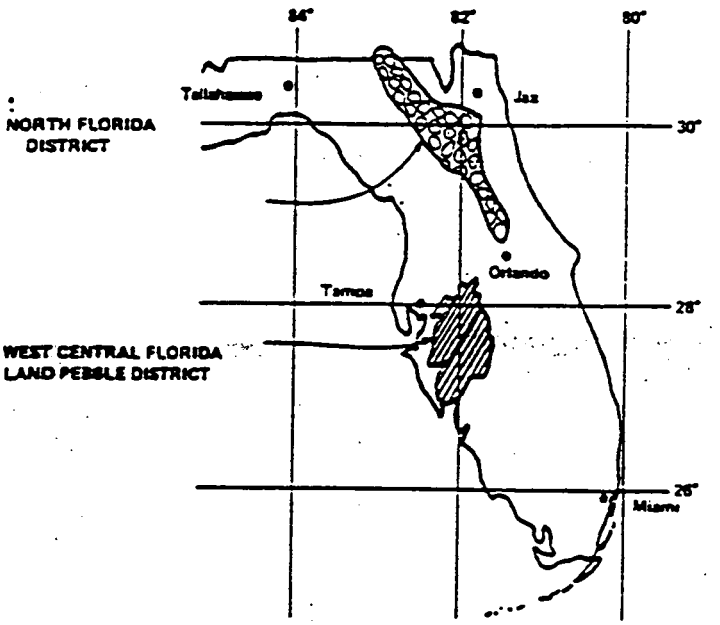

FIG. 1. Florida phosphate district (adopted from Association of Florida Phosphate Chemists, As70).

radioactivity concentrations comparable to matrix on a dry weight basis.

Average radioactivity concentrations of North Florida matrix were found to be 20–25% of those in Central Florida. However, the radioactivity concentrations of the North Florida beneficiation products, pebble, rock concentrate and sand tailings, were found to be 40–50% of those in Central Florida or about twice as high relative to matrix as in Central Florida. This difference in ratios is apparently due to off-setting differences in relative radioactivity of clays and/or differences in materials balances. No clays data are available for North Florida at the present time.

Phosphoric acid plant

In the manufacture of phosphoric acid (Fig. 3), phosphate rock (a calcium phosphate mineral) is reacted with sulfuric acid and the resulting slurry is then filtered to separate the product acid from the insoluble waste that consists primarily of gypsum ($CaSO_4 \cdot 2H_2O$).

The radionuclide concentrations and Ra/U ratios indicate that there is a substantial disruption of the radioactive equilibrium at this point, with the uranium appearing primarily in the phosphoric acid and the radium preferentially following the calcium to the gypsum. Average ^{226}Ra concentrations in the gypsum are comparable to concentrations in phosphate rock while uranium concentrations are below the detection limit of the method used.

It is interesting to note that the highest ^{226}Ra concentrations were found in tank sediments and scales; these can be as much as an order of magnitude higher than those found in rock and gypsum. The sediments in filtrate tanks consist of gypsum and other impurities that have precipitated from the acid after filtration. Although chemistry handbook values indicate that gypsum is slightly more soluble than $RaSO_4$, the radium nevertheless carries was preferentially to

Table 1. Summary of ^{226}Ra and ^{238}U analyses of phosphate materials—Central Florida

Sample Type	No. Samples	^{226}Ra, pCi/g Average (Range)	^{238}U, pCi/g Average (Range)	Ratio, Ra/U Average (Range)
Mining and Rock Operations:				
Matrix	6	37.6 (18.1-84.2)	38.5 (20.2-83.4)	0.97 (0.82-1.06)
Pebble	13	57.4 (44.5-96.6)	45.8 (36.0-68.1)	1.26 (1.03-1.63)
Rock Concentrate	22	37.1 (26.0-50.7)	31.9 (20.1-49.8)	1.18 (0.97-1.42)
Clays:				
Old settled areas	10	23.8 (12.6-43.0)	27.1 (16.0-44.2)	0.87 (0.72-1.02)
From plant	1	52.0	--	--
Tailings	24	5.2 (1.7-12.2)	4.7 (1.5-10.6)	1.11 (0.83-1.44)
Phosphoric Acid Plant:				
5% Phosphoric Acid	1	0.1	6.3	0.01
15% Phosphoric Acid	1	0.2	17.1	0.01
30% Phosphoric Acid	1	0.4	30.0	0.01
Gypsum	10	25.9 (21.1-36.8)	<0.5 (<0.4-<0.7)	>75.69 (>37.69->82.27)
Filtrate Tank Scale	1	384.8	28.1	13.69
Tank Sediment	2	74.4 (64.6-84.1)	<0.7 (<0.6-<1.0)	>127.05 (>54.10->170.0)
Fertilizer:				
Ammoniated Phosphates (MAP & DAP)	8	4.1 (1.6-12.1)	70.2 (46.0-81.3)	0.06 (0.02-0.15)
Triple Superphosphate (TSP-ROP & GTSP)	10	19.7 (15.2-32.0)	56.5 (40.1-72.7)	0.36 (0.26-0.65)
Electric Furnace:				
Coke	1	1.0	1.7	0.59
Slag	4	61.1 (51.6-66.0)	61.1 (48.6-70.9)	1.00 (0.93-1.06)
Ferro-Phos	1	1.9	40.9	0.05

calcium in the filtrate acid, possibly as complexes, and then eventually precipitates with a resulting enhancement in concentrations.

Fertilizer production

As indicated in Part B of Fig. 3, two major chemical categories of phosphate fertilizer are produced in present day practice, ammoniated phosphates (AP) and triple superphosphate (TSP). Ammonium phosphates (monoammonium phosphate or MAP and diammonium phosphate or DAP) are produced by reacting ammonia with phosphoric acid. There was no significant difference in radioactivity concentrations between MAP and DAP and therefore the data for these two products are combined in the summary. These products are low, though not entirely devoid, of radium and have uranium concentrations about twice that of rock concentrate.

Triple superphosphates are produced by

Table 2. Summary of ^{226}Ra and ^{238}U analyses of phosphate materials—North Florida

Sample Type	No. Samples	^{226}Ra, pCi/g Average (Range)	^{238}U, pCi/g Average (Range)	Ratio, Ra/U Average (Range)
Mining and Rock Operations:				
Matrix	4	8.6 (5.1-13.3)	7.6 (4.5-11.6)	1.14 (1.00-1.26)
Pebble	1	25.8	22.5	1.14
Rock Concentrate	5	17.5 (16.1-21.3)	12.8 (10.5-14.0)	1.38 (1.25-1.53)
Tailings	4	2.7 (2.0- 3.3)	1.7 (1.0- 2.5)	1.60 (1.03-1.10)
Phosphoric Acid Plant:				
40% Phosphoric Acid	1	0.2	20.7	0.01
Gypsum	6	13.5 (12.9-14.8)	<0.5 (0.4-<0.5)	>28.01 (>26.00-32.25)
Acid Reactor Scale	1	22.5	11.4	1.97
Fertilizer:				
Ammoniated Phosphates (DAP)	1	0.5	25.3	0.02
Triple Superphosphate (GTSP)	1	11.7	25.0	0.45

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reacting phosphate rock with phosphoric acid. This product is either produced in the form of a bulk, pile-cured product known as "run-of-pile" (ROP-TSP) or, alternatively processed to yield a granular product (GTSP). The radioactivity concentrations were not significantly different between these two products and data are combined in the summary. Triple superphosphates have radium concentrations about 60% of phosphate rock, uranium concentrations approaching twice those of phosphate rock (comparable to APs) and have radium/uranium ratios about 40% of equilibrium values. This is a reflection of the combining of phosphate rock (uranium/radium near equilibrium) and phosphoric acid (uranium but not radium) to produce the product.

The limited number of North Florida samples suggest that radioactivity differences in phosphate products from the two regions are similar to those observed for phosphate rock.

Electric furnace

In the thermal process for production of elemental phosphorus (Fig. 4), phosphate rock, coke and silica are treated in an electric furnace to liberate phosphorus as a vapor which is condensed to liquid phosphorus. Two by-products are slag (primarily calcium

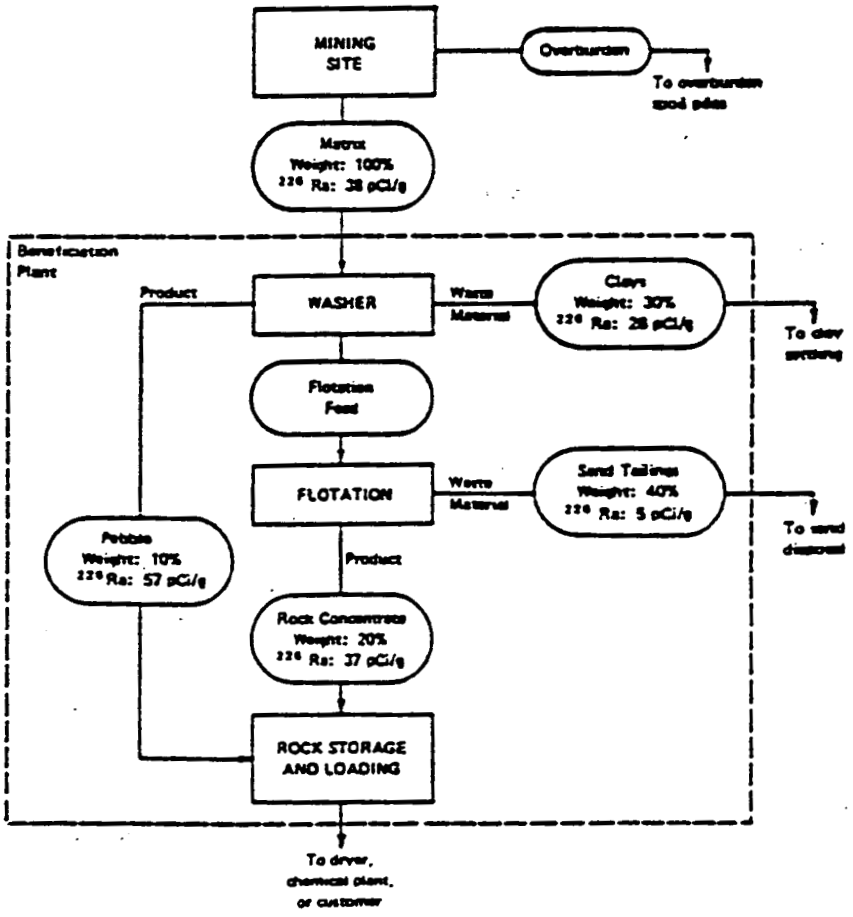

FIG. 2. Simplified flow diagram for phosphate mining and beneficiation. Radium concentrations are for Central Florida.

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silicate) which may be used as an aggregate and ferrophosphorus (or "ferro-phos", a mixture of iron phosphides) which is used in the manufacture of steel.

There are no electric furnace phosphorus plants in North Florida; the tables contain data from the Central Florida plants. The phosphate rock is the only input material contributing significant quantities of uranium and radium; these nuclides appear in radioactive equilibrium in the slag. The single ferro-phos sample was observed to have a low (2 pCi/g) ^{226}Ra content but a significant (41 pCi/g) ^{238}U content. To date, this partitioning has not been explained; however, since the mass of ferro-phos is about 1% that of the slag, the radium corresponding to this quantity of uranium can be accounted for in a very small difference in the slag analysis. No analyses were made of the product phos-

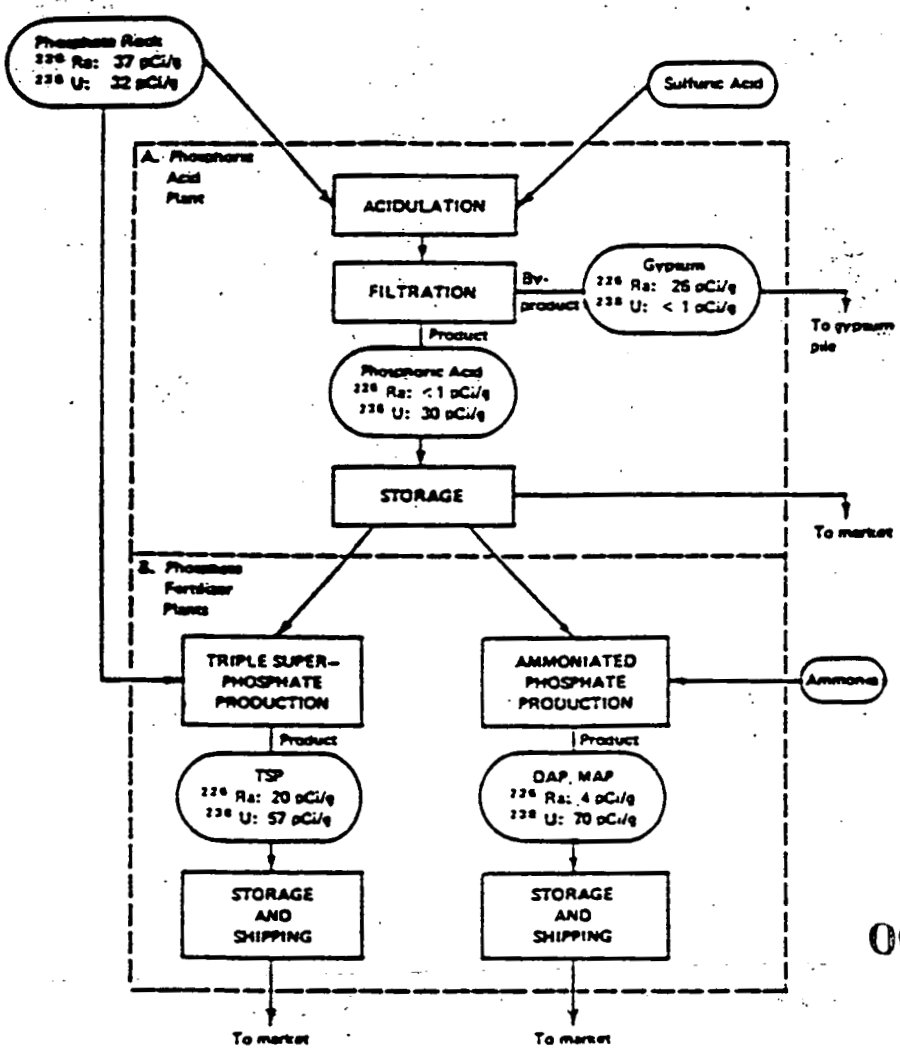

FIG. 3. Simplified flow diagram for wet-process phosphoric acid and phosphate fertilizer production. Radionuclide concentrations are for Central Florida.

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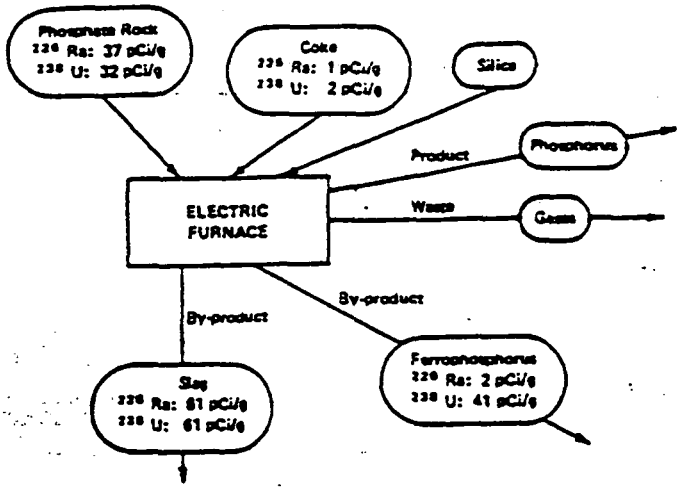

FIG. 4. Simplified flow diagram for thermal process elemental phosphorus production. Radionuclide concentrations are for Central Florida.

phorus; however, Guimond (Gu77) has reported essentially no radioactivity in phosphorus produced by this method.

SUMMARY AND CONCLUSIONS

Uranium-238 and ^{226}Ra are essentially in radioactive equilibrium in the matrix (ore). There appears to be a 10–25% enrichment of ^{226}Ra relative to uranium in beneficiation but there is no marked disruption of the equilibrium until chemical partitioning occurs in phosphoric acid production. Each nuclide averaged about 38 pCi/g in Central Florida matrix and less that one-quarter as high, about 8 pCi/g, in North Florida matrix. Within either region, all sample types examined showed a considerable range of concentrations.

The radioactivity is carried to the marketable products of beneficiation with pebble having 1.5–3 times the radioactivity concentration of matrix and rock concentrate having 1–2 times the radioactivity level of matrix. In sand tailings, the radioactivity level is down graded to about 12–30% of that in the matrix. In each case, the higher ratios correspond to North Florida data; the North Florida to Central Florida ratio increases from about rock and sand tailings. Data from Central Florida sampling in this project and by others indicate that, on a dry weight basis, clay or slimes solids have radioactivity concentrations comparable to matrix.

In phosphoric acid production, the radioactive equilibrium is disrupted with uranium appearing primarily in the phosphoric acid and radium favoring the gypsum. Uranium-238 concentrations averaged 30 pCi/g in Central Florida 30% acid and 20 pCi/g in North Florida 40% acid. Radium-226 concentrations in gypsum averaged 26 pCi/g in Central Florida and 14 pCi/g in North Florida. Radium was found in reactor scale and tank sediments at levels on the order of or slightly elevated from those in rock and gypsum and in filtrate tank scale at levels an order of magnitude higher.

Ammoniated phosphates, reflecting the fact that the sole phosphate source is phosphoric acid, had ^{238}U concentrations that averaged 70 pCi/g in Central Florida and 25 pCi/g in North Florida and ^{226}Ra concentrations about 4 pCi/g in Central Florida and less than 1 pCi/g in North Florida. Since phosphate rock and phosphoric acid are combined to form triple superphosphate, uranium is contributed to this product by both input materials while radium is contributed primarily by the

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about 60% and ^{238}U concentrations approaching 200% of those in phosphate rock from the respective regions.

In the electric furnace operations (Central Florida), the radionuclide input was essentially entirely due to phosphate rock; this was transferred almost in total to the slag which had about 61 pCi/g of each nuclide. The single sample of ferro-phos contained 41 pCi/g of ^{238}U but only 2 pCi/g of ^{226}Ra; the disequilibrium has not been explained. Product phosphorus was not sampled, but others report essentially no radioactivity in this fraction.

It should be emphasized that within either region, nearly all sample types collected in quantity showed a considerable range of concentrations. Concentrations ranged roughly −50% to +100% of the mean (×2, ÷2) in Central Florida matrix and rock and roughly −30% to +50% of the mean (+1.5, ÷1.5) in other sample-location categories.

For nearly all sample types, the Central Florida means from this study fall close to and the ranges encompass the literature values for the same region. The exception is the case of ^{238}U in gypsum, this value was below the limit of detection (i.e. >0.5 pCi/g) in each of the six samples analyzed while Guimond and Windham (Gu75) report 6 pCi/g.

Defluorinated rock and phosphate animal feed products where not sampled in this project. Reid *et al.* (Re77) reported values up to 60 pCi/g ^{238}U and 43 pCi/g ^{226}Ra for phosphate feed supplements commercially available in Texas. It would be expected that these products would have concentrations on the same order as phosphate rock; however, they should be evaluated in greater detail. Future work should also expand upon the rather limited literature reports of the partitioning of other members of the uranium decay chain in phosphate processing.

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ATTACHMENT 2

LABORATORY ANALYSES OF PHOSPHORUS

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ALBRIGHT & WILSON
Americas

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memo

Date: April 9, 1991

To: W.E.Timms - Richmond

From: G.Ryder (Toronto)

Subject: Uranium in Elemental Phosphorus

We had two samples of phosphorus analyzed for uranium and polonium 210 by IT Analytical Services of Richland, Washington.

To facilitate their handling of samples, we oxidized the P_4 in the Toronto Lab and shipped the resulting phosphoric acid and appropriate reagent blanks. The results have been calculated back to the original P_4.

		Uranium
Results:	Sample 1	3 ppb
	Sample 2	7.4 ppb

These results substantiate claims that uranium in phosphate rock (typically 200 ppm from Florida sources) remains entirely with the slag produced in the furnace. Attached is the publication which I mentioned to you. Note also that the phosphorus analyzed was dirtier than normally shipped from the Varennes plant.

G. Ryder
GR/pr
GRTIMMS.MEM

ATTACHMENT 3

POTASSIUM-40 LEVELS IN POTASSIUM

007359

PROGRESS IN ISOTOPE GEOLOGY

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1963
INTERSCIENCE PUBLISHERS
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CHAPTER 26

POTASSIUM

26.1—POTASSIUM ISOTOPES

WHITE, COLLINS, and ROURKE (1956) searched for possible naturally occurring potassium isotopes of low abundance but found no new isotopes and placed very low upper limits on the possible abundance of the isotopes with the mass numbers 36, 37, 38, 42, and 43.

The $^{39}K/^{41}K$ and $^{39}K/^{40}K$ ratios reported for some potassium compounds are presented in Table 26.1. The ratios given for the standard potassium carbonate differ

TABLE 26.1—*Isotopic constitution of potassium in meteoritic and terrestrial materials*

Material investigated	$^{39}K/^{40}K$	$^{39}K/^{41}K$	^{40}K, %	Reference[a]
Meteorites				
Achondrite (eukrite), Andronishkis (Padvarninkyai), Lithuanian S.S.R.		14.4	0.011	3
Chondrites, Elenovka, Ukraine, U.S.S.R., and Okhansk, U.S.S.R.		14.3		3
Terrestrial samples				
Sylvite, New Mexico, U.S.A.	7822	13.47	0.0119	1
	7800	13.48		4
		14.4		3
Muscovite, Karelia, U.S.S.R.		14.25		6
Leucite, Mount Vesuvius, Italy		13.96; 14.17		6
Leucite		14.07		6
Orthoclase		14.20		6
Leucites and orthoclase, average		14.06		6
Sea water, Gulf of Bothnia				
Kelp, *Macrocystis pyrifera*, Pacific Ocean, San Francisco, Calif., U.S.A.		13.67		6
water extraction		13.94[b]		6
perchloric acid extraction				
Potassium carbonate, intercomparison laboratory standard, National Bureau of Standards, U.S.A.	8140	13.70		4
Potassium orthophosphate, made from potassium chloride	7935	13.57		6
		13.5		5
Aluminosilicate, synthetic	8100	13.96		4
All results in 1935–55, weighted average			0.0118	2
Terrestrial potassium				

[a] Sources used: 1. A. O. NIER (see *Isotope Geology*, p. 302). 2. REUTERSWÄRD, 1951. 3. RIK and SHUKOLYUKOV, 1954. 4. D. GREENEWALT, quoted in HERZOG (1956). 5. PANCHENKOV and others, 1956. 6. REUTERSWÄRD, 1956.

[b] Accepted value.

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ATTACHMENT 4

INFORMATION PROVIDED BY RAW MATERIALS SUPPLIERS

HEICO CHEMICALS, INC.
CAMBREX Fine Chemicals Group

007359

ROUTE 611, POST OFFICE BOX 160
DELAWARE WATER GAP, PA 18327-0160
Tele: (717) 420-3900
FAX: (717) 421-9012

RECEIVED
FEB 27 1992
ERM

February 20, 1992

Mr. Dennis DeNiro
Vice President
ERM Midwest, Inc.
450 West Wilson Bridge Road
Columbus, OH 43085

Dear Dennis:

Heico Chemicals, Inc. produces three different grades of Diammonium Sulfate (Ammonium Sulfate) (NH4)2SO4, A.C.S, FCC, and Tech grade. The maximum amount of Arsenic in the Ammonium Sulfate is: 0.2 ppm for A.C.S., 3 ppm for F.C.C. and 3 ppm for Tech grade. The Arsenic result for Tech grade is not recorded on the Certificate of Analysis. Potassium 40 and Uranium are not stored, handled or used in the manufacturing of any products at Heico Chemicals, Inc. The suppliers of the raw materials for Ammonium Sulfate do not store, use, or handle Potassium 40 or Uranium either.

Based on this information, I feel there is no potential for contamination of Ammonium Sulfate by radioactive Potassium or Uranium.

If you have any questions, or need additional information, you may contact me at (717) 420-3913.

Sincerely,

Kevinn P. Kramer

Kevinn P. Kramer
Q.C. Supervisor

KPK/amq

DU PONT

DU PONT CHEMICALS
Chestnut Run Plaza
P.O. Box 80709
Wilmington, DE 19880-0709
Fax (302) 999-4396
Telex 650 339 6061 MCIUW

FEB 10 1992
ERM

February 6, 1992

Mr. Dennis DeNiro
ERM Midwest
450 W. Wilson Bridge Road
Columbus OH 43085

Dear Mr. DeNiro:

Ref: Your questions on HCl and H_2SO_4

We do not, nor have we, analyzed our material for uranium and K_{40}.

Our specification for arsenic in our HCl is 0.05 ppm and typically none is detected.

We have an arsenic spec for 66 degree H_2SO_4 of 2.5 ppm with a typical analysis of less than 0.1 ppm. This is for acid produced by DuPont.

Very truly yours,

Paul A. Larson

Paul A. Larson
Market Development Manager

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All technical information and designs are rendered by the Du Pont Company free of charge. The information contained is believed to be reliable by Du Pont and is intended for use by persons having skill and know-how. It may not be all-inclusive and suitability to local codes and practices should be confirmed by the user. The information is given and accepted at the user's risk and Du Pont makes no guarantee of results and assumes no responsibility for results obtained or damages incurred from use of the information in whole or in part. Any recommendations or statements not contained herein shall not be binding upon Du Pont unless specifically agreed to in writing. Nothing herein shall be construed as a recommendation to violate any law or infringe any patent. Any procedures referred to herein are intended to be illustrative only and not all-inclusive.

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Ashland Chemical

IC&S Division
(614) 889-3844

Ashland Chemical, Inc.
Subsidiary of
Ashland Oil, Inc.

Address Reply:
P.O. Box 2219
Columbus, Ohio 43216

RECEIVED FEB 13 1992 ERM

February 12, 1992

Dennis DeNiro
ERM Midwest
450 West Wilson Bridge Road
Columbus, OH 43085

Re: Cumene

Dear Mr. DeNiro:

This letter will confirm that Ashland produced Cumene does not contain any detectable Arsenic, Uranium or Potassium-40.

If we can be of further service, please do not hesitate to contact us.

Sincerely,

W. E. Whitlock

W.E. Whitlock, Supervisor
Division Customer Service Laboratories

WEW/ckb

cc: John Baker
Ashland Chemical, Inc.
Columbus, OH

000111

Headquarters
5200 Blazer Parkway
Dublin, Ohio 43017

Cable Address: Aroplaz OH
Telex: 245385
Answerback: ASHCHEM
Fax: (614) 889-3465

QUALITY

Ashland Chemical's
Commitment to
Quality and Productivity

BP CHEMICALS

BP Chemicals Inc.
Ft. Amanda Road
P.O. Box 628
Lima, Ohio 45802-0628
(419) 226-1200

RECEIVED
FEB 10 1992
ERM

Mr. Dennis P. DeNiro, P. E.
Vice President
ERM - Midwest, Inc.
450 W. Wilson Bridge Road
Columbus, Ohio 43085

February 7, 1992

Dear Mr. DeNiro:

In response to your letter of January 30, 1992, this is to certify that the Nitric Acid produced by BP Chemicals at Lima, Ohio would not be expected to contain any arsenic, uranium or potassium 40. The only one of these that we have any data on is arsenic. This element has been looked for by the BP research department in our Nitric Acid and none was found. The detection limit on this test was 10 ppb. In regards to uranium and potassium 40, while we have no data, there is no reason to feel that these elements would be in our product.

If you have any questions, please advise.

Sincerely,

Tom Say ksw

Tom R. Say
Nitrogen Lab Control Supervisor

ksw
ERM.doc/LAB92

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OxyChem®

007359

RECEIVED
FEB 5 1992
ERM

February 3, 1992

Mr. Dennis DeNiro
ERM Midwest Inc.
450 West Wilson Bridge Road
Columbus, OH 43085

Dear Mr. DeNiro:

Mike Haufey requested that I send you a statement about arsenic, uranium, and potassium 40 in Occidental Chemical Corporation's Potassium Hydroxide - 45% sold to Ruetgers Nease, Cincinnati, Ohio. Occidental Chemical Corporation offers the following comments about its 45% Potassium Hydroxide:

Arsenic is typically found at levels less than 1 ppm by weight.

Uranium and Potassium 40 are not found at levels detectable by industrial analytical procedures.

I hope this takes care of your interest in this matter.

Sincerely,

Michael A. Snug

Michael A. Snug
Technical Service Engineer
Electrochemicals
MAS008

Occidental Chemical Corporation
Basic Chemicals Group
Development Center
P.O. Box 344, Niagara Falls, NY 14302-0344
1-800-733-1165

000113

Vulcan CHEMICALS

A DIVISION OF
VULCAN MATERIALS COMPANY

P.O. BOX 530390
BIRMINGHAM, ALABAMA 35253-0390
(9[illegible] 277-3000

RECEIVED
FEB 27 1992
ERM

February 20, 1992

Mr. Dennis DeNiro
ERM Midwest
450 West Wilson Bridge Road
Columbus, OH 43085

Dear Mr. DeNiro:

I am writing to confirm the information our salesman, Mr. Rob Schmidt, provided to you concerning contaminants in Vulcan's Caustic Potash. As was discussed on the phone, we have tested for arsenic but have not for K_{40} or uranium.

Arsenic is part of our semi-annual analysis program for trace metals. The detection limit of our test method is one part per billion (1 ppb), and we have not detected the presence of arsenic. The potassium isotope and uranium are not metals we expect in our products, so they have never been included in our analysis schedule.

I hope this information is satisfactory. If you have any additional questions, please feel free to contact either Rob or me.

Sincerely,

Rod Kremer

Rod Kremer
Technical Service
Representative

c: Rob Schmidt

Appendix B-2
Decontamination and Sampling Methodologies

REV. 1: MAY 1994

APPENDIX B-2

DECONTAMINATION AND FIELD SAMPLING METHODOLOGIES

APPENDIX B-2

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APPENDIX B-2
DECONTAMINATION AND FIELD SAMPLING METHODOLOGIES

1.0 DECONTAMINATION METHODOLOGY

Decontamination of field equipment is done to avoid contamination of individual samples and to avoid cross contamination between sampling locations. During the PRRS site investigation, two separate decontamination procedures were followed. The first was followed during Phase I field activities and included the following steps:

- Steam cleaning (where appropriate)
- Remove excess soil from equipment using a wire brush (as necessary)
- Rinse with distilled water
- Scrub with an industrial strength, phosphate-free surfactant fluid
- Rinse with distilled water
- Rinse with a ten percent (by volume) reagent grade methanol mixed with distilled water
- Final rinse with deionized water
- Allow to completely air dry

The second decontamination procedure that was used was initiated during Phase II site activities and included the following steps:

- Steam Cleaning (where appropriate)
- Non-phosphate detergent wash
- Deionized or tap water rinse
- Rinse with 10% HCL solution
- Two rinses with deionized water
- Hexane rinse
- Methanol rinse
- Triple rinse with deionized water
- Allow to air dry

Purge pumps that were used during field activites did not follow this decontamination process. They were steam cleaned and then distilled/deionized water was pumped through the system before reuse.

2.0 FIELD SAMPLING METHODOLGIES

The purpose of this section is to identify the sample collection methodologies that were followed during the Phase I and Phase II field activities for the RI. Sample collection methodologies are provided for the following activities:

- Groundwater sampling
- Free-floating hydrocarbon sampling
- Split-spoon soil sampling
- Surface soil and background soil sampling
- Surface water and sediment sampling

The combined purpose of these tasks was to gather sufficient information to define the source(s), as well as the lateral and vertical extent, of contamination based on analytical results.

2.1 Groundwater Samples

Groundwater samples were collected two ways: from groundwater monitoring wells and from the Hydropunch II sampler.

2.1.1 Groundwater Monitoring Wells

Sample collection from the groundwater monitoring wells consisted of four rounds of quarterly sampling and seven rounds of supplemental sampling. Rounds I, II, and III followed the methodology outlined in the Site Specific Sampling Plan prepared by ENSR. These three rounds of sampling were conducted during Phase I activities. Round IV and the seven supplemental sample rounds followed the methodology outlined in the Work Plan prepared by ERM. This sampling was completed during Phase II activities.

Prior to sampling the groundwater monitoring wells during Rounds I, II, and III, each well was purged a minimum of three well volumes with a dedicated stainless steel bailer. As the water from each well was being purged, the temperature, pH, and conductivity (Ec) of the purged water was monitored by placing the groundwater in a clean beaker with the probes of the meters. When successive pH measurements were within +/- 0.2 units, temperature measurements were within

+/- 1°C, and Ec was within +/- 10% of each other, the sample was collected. In the event a well was purged dry, it was sampled after it recharged with enough groundwater to obtain a sample.

The samples were collected using a dedicated stainless steel bailer or, in the case of existing wells equipped with fixed pumps, the existing system was utilized.

During sample collection, the bailer was carefully lowered into the well to avoid excessive agitation. The bailer was then pulled from the well and the groundwater was transferred into the appropriate sample containers with minimum agitation. Where appropriate, the sample was allowed to overflow the sample container to assure that no air bubbles were present in the sample. Appropriately sized sample containers with preservative (where applicable), were obtained from the analytical laboratories. Samples requiring preservative were not permitted to overflow the sample containers. Also, those samples requiring filtering were field filtered (using filters with 0.45 micron pore openings) at the sampling collection point.

Samples from domestic and industrial wells were collected at spigots which bypassed any treatment system.

Quality assurance/quality control samples were also collected during the sample rounds. One trip blank consisting of deionized water accompanied the groundwater samples to the laboratory during each day of groundwater sampling. One field blank consisting of deionized water was brought to the Site in a sealed container. It was opened and run through or over the decontaminated sampling device and then emptied into appropriate sample containers. Field blanks for metals analysis were collected by passing deionized water through the sampling apparatus and filtration system. As part of the QA/QC program, field blanks and duplicate samples were collected at a frequency of 10% or one per day, whichever was greater. Also, a matrix spike/matrix spike duplicate (MS/MSD) sample was collected every 20th sample.

As previously stated, the fourth round of groundwater samples and the seven supplemental rounds of groundwater water samples were collected during Phase II activities and followed the Work Plan prepared by ERM. The Work Plan included a modified purge and sampling method that was approved by the Ohio EPA during a teleconference on April 16, 1991 involving the Companies, Ohio EPA, and ERM. The modified purge and sample methodology that was followed included:

- Prior to sampling, all PRRS 2-inch monitor wells were purged using a 2-inch submersible pump.

- Those wells were purged until the turbid water cleared to provide the best possible sample. Not less that three well volumes were removed no matter how clear the sample was.

- During the purging sequence, pH, specific conductance, temperature, and dissolved oxygen were recorded at intervals of either 5 or 10 gallons, depending on the rapidity of water color change. Samples were collected until the well stabilized for pH, specific conductance and temperature. Stabilization occurred long before the upper limit of 100 gallons was purged.

- After sufficient purging, the properly decontaminated stainless steel dedicated bailer was carefully lowered into the well so as not to unduly agitate the formation water. Parameters were sampled in the following order:

  - Volatile Organics
  - Semivolatile Organics
  - PCB's (Polychlorinate Biphenyls) and Pesticides where sampled)
  - MBAS (Methylene Blue Active Substance)
  - Chloride
  - Sulfate
  - Total Dissolved Solids

- After sample collection with the bailer was complete, a peristaltic pump with a decontaminated dry supply line was used for additional sample collection. The supply line was lowered into the well, the pump started and purged, and fluids were pumped into a bucket while the person collecting the sample made sure that any agitation caused by the bailer had settled down and had cleared in the supply line.

- The peristaltic pump was used to sample:

  - Filtered metals and Phosphorus using an in-line 0.45 micron filter

  - Unfiltered metals

  - General Parameters: Ammonia, Chemical Oxygen Demand, Potassium-40, Total Alpha Radiation, Total Beta Radiation, Uranium

This purge and sample technique was also followed during the second supplemental round of sampling. During the first supplemental round, the same purging technique was followed, however, only samples requiring VOC analysis were collected. Likewise, only samples requiring VOC analysis were collected during the

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last five supplemental rounds of sampling, however, these wells were purged with bailers because of low water volumes in the wells.

2.1.2 Collection of In-Situ Field Measurements From Monitoring Wells

The Companies modified the method of collecting in-situ field measurements for pH, specific conductance and temperature. The modification involved collecting four samples at each of the prescribed volume intervals, and pouring the water into four glass beakers and measuring pH, specific conductance, and temperature. Attainment of stabilization parameters of pH (+/- 0.2 units), specific conductance (+/-10%), and temperature (+/- 1°C) were determined as per the Phase I Work Plan.

In addition, the Companies added in-situ field measurement of dissolved oxygen to the parameter list. The method of collection was to pour the groundwater into four glass beakers and measure the dissolved oxygen. Dissolved oxygen readings were not used as part of the determination of groundwater stabilization.

QA/QC samples were collected in a manner identical to those collected during the first three rounds of groundwater samples. Likewise, sample handling procedures were identical.

2.1.3 Groundwater Collected With the Hydropunch II Sampler

The second way that groundwater samples were collected was with the Hydropunch II sampler. This was utilized during Phase II drilling activities during the source identification phase of the field investigation.

The Hydropunch II sampler consists of a stainless steel, shielded wellpoint and sample barrel assembly. It was deployed using the heavy wall drill rod of the drilling rig and advanced the sampler into the ground through the hollow stem augers to a depth of approximately 5 to 7 feet into the aquifer. The shield prevented cross-contamination of the sampler while penetrating shallower soils above the sampling depth. Next, the shield was retracted approximately 3 feet exposing the polypropylene screen and groundwater flowed under in-situ pressure conditions into the sample barrel.

To collect the groundwater samples, a small stainless steel bladder pump with polyethylene lines was placed inside the sample barrel allowing for continuous sampling of the aquifer. The bladder pump was operated by connecting it to a canister of compressed nitrogen gas which was regulated by a "logic controller". This allowed the sampling teams to regulate the flow of the groundwater coming out of the bladder pump assembly which aided them during sample collection.

After the samples were collected, the appropriate preservatives were added and the samples were placed in a cooler with ice packs to cool the temperature of the samples to 4°C. Values for pH, specific conductance, dissolved oxygen, and temperature were measured in quadruplicate in the field. These values were obtained by placing the probes of the meters into clean beakers containing the sample water, waiting for the readings to stabilize, and then recording the values.

As part of the QA/QC program, field blanks and duplicate samples were collected at a frequency of 10% or one per day, whichever was greater and MS/MSD samples were collected every 20th sample. Field blanks were filtered where appropriate. One trip blank consisting of deionized water accompanied the groundwater samples to the laboratory during each day of groundwater sampling with the Hydropunch II.

2.2 Collection of Free-Floating Hydrocarbons

Samples of free-floating hydrocarbons were collected to determine its chemical make-up and concentration. It was necessary to collect this information in developing the appropriate concentration levels for soils beneath the process building, raw product tank farm, and hydrotrope tank farm.

The method of collection, as suggested in U.S. EPA's 1986 *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*, was by using a peristaltic pump. The peristaltic pump is effective where the floating layer is less than 2 feet thick and less than 25 feet below the surface. Sampling with the peristaltic pump reduces the potential for mixing of free-floating hydrocarbons with the underlying water.

The samples were collected by siphoning the free-floating hydrocarbons off of the top of the water table via silicone tubing that was connected to the peristaltic pump. The free hydrocarbons were then collected in appropriate sample containers as it was discharged from the other end of the silicone tubing. New silicone sampling lines were used on each well sampled.

After the free hydrocarbons were siphoned off of the top of the water table with the peristaltic pump, a disposable bailer was lowered into the well and additional free hydrocarbons (with groundwater) was brought to the surface. This purged liquid was placed in clear containers and allowed to set so that the free hydrocarbons could separate from the groundwater. After separation had occured, the free hydrocarbons were transferred into the appropriate sample containers.

2.3 Split-Spoon Soil Sampling

During the various drilling phases throughout Phase I and Phase II of the RI, a number of soil borings were drilled to characterize the nature of the soils, geology, and the groundwater within the PRRS. Each of the boreholes was sampled by using a split-spoon sampler. The methodology for advancing the split-spoon soil sampler was as follows:

- Lower the clean split-spoon sampler to the bottom of a cleaned-out borehole.
- Mark the drill rods in 6-inch increments above a fixed datum.
- Drive the sampler downward with blows from a 140-pound hammer falling approximately 30 inches onto the drill rod collar.
- Record the number of blows required to drive the sampler each 6-inch increment. The "blow count" is the total number of blows required to drive the sampler the last foot.

The split-spoon sampler was then removed from the borehole, opened and handed to the field geologist. Clean, chemical-resistant gloves were worn throughout this process.

After the split spoon had been opened, it was scanned with either an OVA or an HNu to indicate zones of volatile organics. The sample was then described. This included:

- Recording the depth and interval sampled
- Recording the total length of the recovered sample
- Describing the sample or all major sediment zones
- Noting the approximate moisture content (dry, moist, very moist, wet) of sample or major zones in sample
- Noting presence of any permeating liquids other than water (e.g., oily substances, etc.)

After the sample was described, it was transfered into the appropriate sample containers (as necessary).

The QA/QC samples consisted of duplicate samples, field, blanks, MS/MSD's, and trip blanks. Duplicate and field blank samples were each collected at a frequency of at least 10% or one sample per day, whichever was greater and MS/MSD samples were collected every 20th sample. Field blanks were filtered where appropriate.

Trip blanks were sent to the analytical laboratory at a frequency of one sample per day of shipment. They were prepared by the lab and were contained in the sample shipment to and from the site. Trip blanks consisted of deionized water.

2.4 Surface Soil and Background Soil Samples

Surface soil and background soil samples were collected during Phase II activities. This involved advancing a decontaminated bucket auger from the ground surface to a depth of 12 inches at selected sample locations. The collected samples were screened with an HNu-101 to detect the presence of VOC's and each sample was classified according to the United States Department of Agriculture's (USDA) *Soil Survey Manual* for color, texture, and structure.

Samples were placed in a properly decontaminated stainless steel mixing bowl prior to placing the thoroughly mixed sample in the appropriate sample jars supplied by the laboratory. Samples for volatile organic analysis were not mixed prior to placement in the sample jar.

Field blank and duplicate samples were collected at a frequency of 10% or one sample per day, whichever was greater and a MS/MSD was collected every 20th sample. Trip blanks were sent to the analytical laboratory with the shipment. They consisted of deionized water.

2.5 Surface Water and Sediment Samples

Two rounds of surface water and sediment samples were collected during the RI. One round was collected during Phase I activites and a second round was collected during Phase II activities.

To eliminate the potential for disturbed sediment to be carried downstream and potentially affect the surface water quality, the following techniques were used during the sampling events: surface water samples were collected starting with the farthest downstream location and progressing upstream; surface water samples were collected prior to any sediment collection thus reducing sediment agitation; and the samplers stood directly downstream from where surface water was collected.

The Paddys Run surface water samples were collected with dedicated stainless steel beakers about 3 feet from shore, just above the sediment during the first sampling event. Glass laboratory beakers were use during the second sampling event. The Work Plan allowed for either stainless steel or laboratory glass beakers to be used. The water that was collected was described and carefully transferred into the appropriate sample containers.

The surface water samples collected from the pond were collected by using dedicated bailers. The water collected in the bailers was then transferred into the appropriate sample containers. A small row boat, which was held in place by bow and stern ropes, was used to maneuver around the pond to the three sample locations.

After all of the samples were collected, the appropriate preservatives were added (as required in the Work Plan) and the samples were placed in a cooler with ice to bring the temperature of the samples to 4°C. Values for pH, specific conductance (Ec), dissolved oxygen, and temperature were measured in the field. These values were obtained by placing the probes of the meters into the clean sampling containers containing the sample water, waiting for the readings to stabilize, and then recording the values. Between each set of readings, each probe was rinsed with DI water.

Duplicate surface water samples were collected at a frequency of greater than 10% during the two rounds of surface water sampling. The duplicate surface water samples were collected at the same location as the original sample and in the same manner. The duplicate samples were taken by splitting equal volumes of water from the water sampling device into the laboratory sample containers constituting the "original" and "duplicate" samples.

The field blank samples were collected at a frequency of 10% during each of the two day surface water sampling events. The field blank was prepared in the field by passing deionized water over/through the decontaminated sampling equipment and filtration system and collecting it in the field blank sample containers.

Laboratory-prepared trip blank samples consisting of deionized water accompanied the surface water samples to the laboratory during each day of surface water sampling.

One MS/MSD sample was also collected during the surface water investigation and was analyzed for the same parameters as listed above. The MS/MSD surface water sample was collected at the same location as the original sample. The MS/MSD sample was taken by splitting equal volumes of water from the water sampling device into the laboratory sample containers constituting the "original" and "MS/MSD" sample.

The sediment samples in Paddys Run were collected starting at the farthest downstream location and progressing upstream thus reducing the potential for disturbed sediment to be carried downstream and potentially affect the quality of other samples. Another method used to reduce sediment agitation included having the sampling team stand directly downstream from where they collected the sediment samples.

Sediment samples from areas other than Paddys Run were not collected in any special order because ditch samples contained no water, and in the case of the cooling pond, water was not moving, therefore, turbidity was not considered to be a problem.

The Paddys Run sediment samples were collected with stainless steel scoops about three feet from shore. The sediment that was collected was described and carefully transferred into the appropriate sample containers.

The sediment samples collected during Phase I activities from the pond were collected by using stainless steel "clamshells". The sediment was collected immediately below the water column, described, and carefully transferred into the appropriate sample containers. A small row boat, which was held in place by bow and stern ropes, was used to maneuver around the pond to the sample locations. Sample handling procedures for the pond sediment samples were the same as those of the Paddys Run sediment samples.

Sample containers designated for CLP volatile organics were filled immediately upon collection of the sediment sample. The remaining sediment was placed in a properly decontaminated stainless steel mixing bowl where it was composited before being transferred into the remaining sample containers.

All samples were placed in a cooler with ice to bring the temperature of the samples to 4°C.

Duplicate sediment samples were collected at a frequency of greater than 10% for the sediment sampling events. The duplicate sediment samples were collected at the same location as the original sample by placing the sediment in a clean container, gently mixing the sample then placing the sediment in appropriate sample jars. Duplicate VOC sediment samples were collected directly from the sampling location and placed in appropriate laboratory jars.

The field blank samples were collected at a frequency of 10% during the sediment sampling events. The field blank was prepared in the field by passing deionized water over/through the decontaminated sampling equipment and filtration system and collecting it in the field blank sample container.

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Laboratory-prepared trip blank samples consisting of deionized water accompanied the sediment samples to the laboratory during each day of sediment sampling.

One MS/MSD sample was also collected during the sediment investigation and was analyzed for the same parameters as listed above. The MS/MSD sediment sample was collected at the same location as the original sample by placing the sediment in a stainless steel mixing bowl, gently mixing the sample, then placing the sediment in the appropriate sample jars. The MS/MSD volatile organic sediment samples were collected directly from the sampling location and placed in appropriate laboratory jars.

During each of the sampling events just described, it should be pointed out that upon sample collection, all sample containers were placed in an insulated cooler, chilled to 4°C with ice packs along with the chain-of custody forms, pertinent field records, and analysis request forms as needed.

Further, all sample containers were labeled in permanent ink and the labels were covered with clear tape to preserve the label integrety. The following information was also entered in the project log book during the sampling events:

- Time and date of sampling
- Sample location
- Name of responsible field personnel
- Weather conditions
- Equipment used
- Well data (i.e., total depth, depth to water, volume of purged water, method of purging)
- Sample description (type, volume, container, preservative)
- Sampling method
- Sample appearance (i.e., color, turbidity)
- Time elapsed between obtaining samples and shipment
- Name of shipper and shipping method
- Other significant observations and information

REV. 1: MAY 1994

APPENDIX B-3

DETERMINATION OF MEDIUM-SPECIFIC CHEMICAL BACKGROUND COMPARISON VALUES AT THE PADDYS RUN ROAD SITE HAMILTON COUNTY, OHIO

REV. 1: MAY 1994

DETERMINATION OF MEDIUM-SPECIFIC CHEMICAL BACKGROUND COMPARISON VALUES AT THE PADDYS RUN ROAD SITE HAMILTON COUNTY, OHIO

Prepared for

The Ohio Environmental Protection Agency
Southwest District Office
Division of Emergency and Remedial Response

May 27, 1994

Prepared by

Albright & Wilson Americas, Inc.
Mobil Mining and Minerals Company
Ruetgers-Nease Corporation

and

ERM-Midwest, Inc.
450 West Wilson Bridge Road
Columbus, Ohio 43085

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DETERMINATION OF MEDIUM-SPECIFIC CHEMICAL BACKGROUND COMPARISON VALUES AT THE PADDYS RUN ROAD SITE HAMILTON COUNTY, OHIO

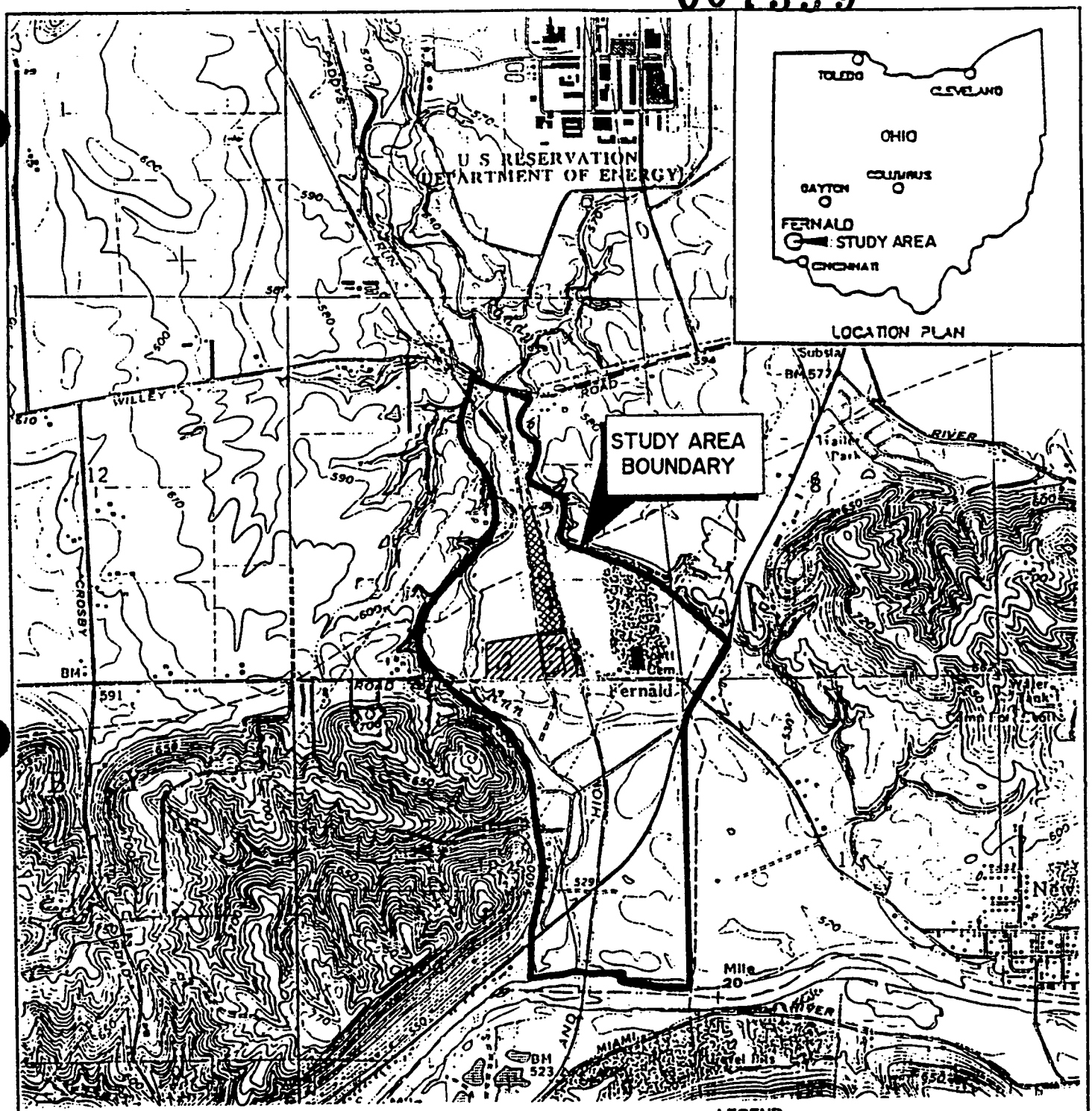
May 30, 1994

1.0 INTRODUCTION

In accordance with an Administrative Order on Consent (AOC) with the Ohio Environmental Protection Agency (Ohio EPA), a Remedial Investigation/Feasibility Study (RI/FS) began in May 1989 at the Paddys Run Road Site (PRRS or Study Area), located approximately 15 miles northwest of Cincinnati. The PRRS encompasses the Albright & Wilson Americas, Inc. (A&W) facility and the Ruetgers-Nease Corporation (RNC) facility, and areas adjacent to and south of the Department of Energy's (DOE) Fernald Environmental Management Project (FEMP), formerly the Feed Materials Production Center (FMPC). A&W, Mobil Mining and Minerals Company (prior owner of the A&W property) and RNC are referred to throughout this document as the Companies. Figure 1-1 illustrates the location of the PRRS Study Area.

1.1 Purpose

The accurate determination of representative concentrations (i.e., background) of chemicals associated with the unaffected areas at a site is paramount to the successful characterization of potential contamination related to the site. Inorganic, radiological, and organic chemicals may be: (1) naturally occurring, (2) due to off-site conditions and/or (3) a sampling and laboratory artifact. Thus it is essential to identify which levels of a site's chemical concentrations are related to site activities compared to non-site or background activities.



LEGEND

A&W PROPERTY

RNC PROPERTY

SCALE

2000' 0 2000 FT.

QUADRANGLE LOCATION

SOURCE: USGS SHARON, OHIO QUADRANGLE

STUDY AREA LOCATION MAP PADDYS RUN ROAD SITE HAMILTON COUNTY, OHIO	FIGURE 1-1

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This document provides the basis for determining representative background concentrations of the chemicals being evaluated for the PRRS Remedial Investigation/Risk Assessment (RI/RA). The document covers all of the potentially affected media at the Study Area, including unsaturated zone soils (hereafter referred to as "soils"), groundwater, surface water, and stream sediments. The background comparison concentrations presented here have been and will be used primarily for the following purposes:

1. To identify the extent of Study Area-related chemicals during the RI,

2. To identify the chemicals of concern by comparing on-site results with background levels during the RA,

3. As potential chemical-specific applicable or relevant and appropriate requirements (ARAR) to be considered during the development of remedial alternatives in the FS

4. As appropriate, for potential clean-up standards during the Remedial Design/Remedial Action.

The background comparison levels for PRRS as presented herein were developed based upon the procedures in the Ohio EPA, Division of Emergency and Remedial Response (DERR) policy guidance, *How Clean is Clean Policy, Final,* July 26, 1991. However, the Ohio EPA guidance does not address certain issues related to background determination (e.g., below detection limit evaluation, distribution determination, and groundwater statistical evaluation). Ohio EPA and the Companies discussed and agreed upon the approach to be used for issues not covered by policy guidance.

A draft of this report was first submitted to the Ohio EPA on March 10, 1992. The Agency responded with formal comments to that report on April 15, 1992. A July 20, 1992 revised report addressed all relevant Ohio EPA comments from that response letter and subsequent meetings and correspondence.

1.2 Background

This final report includes: changes to the background concentrations resulting from additional sampling; incorporation of validated data from the U.S. Department of Energy (DOE) from the FEMP; and resolved Agency comments.

As required by the AOC, the Companies began Phase I field activities on June 19, 1989. Based upon the Phase I results, a Phase II program was initiated in May 1991. The scope of the Phase II investigation is outlined in the Ohio EPA-approved, *Work Plan for Phase II Remedial Investigation and Baseline Risk Assessment*, September 3, 1991. As stated in the Work Plan, the purpose of the Phase II investigation was to

> ...fill existing data gaps by gathering further analytical information to more fully define the nature and extent of both on-site and off-site contamination, and to identify and characterize source areas.

This document has been prepared to assist in accomplishing that goal.

1.3 Published Information

Due to the location of PRRS south of the FEMP and to the "sole-source" designation of the underlying groundwater aquifer system, much research has been conducted in the general vicinity of the Study Area. This section summarizes the results of chemical analyses from previous area investigations. The published information is presented to provide an historical perspective and a basis for comparison to the statistically developed PRRS background concentrations.

The primary studies in the area have been associated with the former activities at the FEMP. Currently, a major Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) site investigation is being conducted under the guidance of the U. S. EPA. This study has provided a large amount of background information for the regional groundwater. In addition to the information collected by the U.S. DOE, additional studies have been conducted by the U.S. Geological Survey (USGS), the Miami Conservancy District, and the Ohio-

Kentucky-Indiana (OKI) Regional Council of Governments. The representative groundwater quality upgradient of PRRS as identified by these organizations is summarized in Table 1-1.

Although not as extensive as the groundwater data, similar data exist for surface soils and sediments near PRRS. A summary of the range of reported values found in soils and sediments for various chemicals is presented in Table 1-2. A similar summary is also provided for surface water in Table 1-3.

The historical values presented in Table 1-1 through 1-3 represent samples that were collected at various times and by various methods, and were analyzed by various laboratory procedures. The concentrations provide an indication of the chemical condition of media in the vicinity of the PRRS. These values can thus be used for historical comparison purposes in relation to the Study Area-specific background values.

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TABLE 1-1
SUMMARY OF HISTORICAL RANGE OF
BACKGROUND GROUNDWATER QUALITY*

Chemical	U.S. DOE (October 1990) Range of Averages (1)	U.S. DOE Environmental Impact Statement (May 1990) (2)	WEMCO Annual Report For 1988 (3)	Plummer (1982)
Dissolved Metals (mg/l)				
Aluminum	<0.10 - 0.11			
Antimony		0.019		
Arsenic	<0.002 - 0.021		0.001 - 0.08	0.00 - 0.012
Barium	0.038 - 0.638	0.3	0.04 - 0.078	
Beryllium				
Cadmium	<0.005 - 0.005		<0.001	0.000
Calcium	74.55 - 104.42	5.9 - 110	83.1 - 120	51-110
Chromium	0.021-0.024		<0.001	0.000 - 0.03
Cobalt				
Copper	<0.01 - 0.016	0.08	0.007 - 0.176	0.000 - 0.043
Iron	0.015 - 2.272	0.08-3.1	0.212 - 6.09	0.00 - 3.1
Lead	0.002 - 0.005	0.018	<0.001	0.002 - 0.074
Magnesium	23.2 - 28.33	22	22.6 - 300	19 - 33
Manganese	0.047-0.201	0.28 - 25.4	0.001 - 0.313	0.01 - 0.7
Mercury	<0.20 - 0.33		<0.002	
Nickel	<0.02 - 0.021		<0.001 - 0.002	0.000 - 0.01
Potassium	1.28 - 2.56	1.5 - 5.0	2.06 - 4.15	2.5 - 3.3
Selenium	<0.002 - 0.002		0.002 - 0.009	
Silver	0.01-0.012		<0.001	
Sodium	3.23 - 41.09	16 - 43	7.04 - 32.8	12 - 25
Thallium				
Vanadium	<0.01 - 0.014			
Zinc	0.03 - 0.17	0.26	0.01 - 0.262	0.000 - 0.55

Notes:

* All groundwater data are unvalidated
(1) From Table A-1 for 2000 series wells
(2) Based on wells upgradient of FEMP (B-3, GT-3, D)
(3) Wells 11, 12, 13, 26, 29, P1, P2, P3
(4) Appendix 2 - based on 0S-10, 0S-15, 0S-16 and 0S-17
(5) Wells 2013, 2106, 2060, and 2095
(6) Highest values as identified for site locations 51, 60, 61, and 63

TABLE 1-1 (Continued)
SUMMARY OF HISTORICAL RANGE OF
BACKGROUND GROUNDWATER QUALITY*

Chemical	Miami Conserv. District (1973) Average from USGS Wells (Hamilton Co.)	OKI (1990) Identified Site Locations 51, 60, 61, 63 Highest Values	U.S. DOE FEMP Developed Background Values (Internal Commun.)	Sedam (1984)
Dissolved Metals (mg/l)				
Aluminum			0.143	
Antimony				
Arsenic	0.0001	0.015 - 0.30	0.042	0.001 - 0.002
Barium		0.105 - 0.159	0.8	0.053 - 0.057
Beryllium				<0.001
Cadmium	0.0003	0.006 - 0.020	0.006	<0.001 - 0.002
Calcium	95.59		99.4	93-110
Chromium		0.026 - 0.260	0.03	0.02
Cobalt	0.022			<0.003
Copper	0.0176		0.033	<0.01
Iron	0.136		3.55	<0.003 - 1.5
Lead	0.012	0.002 - 0.259	0.015	<0.01
Magnesium	31.94		31.3	23 - 30
Manganese	0.029		0.48	<0.001 - 0.39
Mercury		0.0003 - 0.013	0.2u	0.001 - 0.002
Nickel		<0.002 - 0.006	0.02	
Potassium	3.106		2.0	0.7 - 3.1
Selenium		0.002 - 0.006	0.002u	
Silver		0.012 - 0.077	0.034	
Sodium	24.0		48	6.8 - 18
Thallium				
Vanadium			0.017	<0.006
Zinc	0.025		0.17	0.004 - 0.130

Notes:

* All groundwater data are unvalidated
(1) From Table A-1 for 2000 series wells
(2) Based on wells upgradient of FEMP (B-3, GT-3, D)
(3) Wells 11, 12, 13, 26, 29, P1, P2, P3
(4) Appendix 2 - based on 0S-10, 0S-15, 0S-16 and 0S-17
(5) Wells 2013, 2106, 2060, and 2095
(6) Highest values as identified for site locations 51, 60, 61, and 63

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TABLE 1-1 (Continued)
SUMMARY OF HISTORICAL RANGE OF
BACKGROUND GROUNDWATER QUALITY*

Chemical	U.S. DOE (October 1990) Range of Averages (1)	Dames & Moore (1985) (4)	U.S. DOE EE/CA (November, 1990) 2000 Series	U.S. DOE Environmental Impact Statement (May 1990) (2)	WEMCO Annual Report For 1988 (3)	Plummer (1982)
Radiological Parameters						
Total Uranium (ug/l)	<1.0 - 43.9		<1 - 850	0.0	<0.07 - 3.8 PCi/	
Alpha Particles (PCi/l)		<1 - 86		3	0.5 - 4.0	
Beta Particles (PCi/l)		<2 - 39		5	0.2 - 7	
General Parameters						
Alkalinity	322.2 - 387.0			317		204 - 290
Ammonia	0.11 - 3.15			5.12		
Chloride	9.2 - 61.01	27 - 46		36 - 73	13 - 21	7.5 - 50
Conduct. (umhos/cm)	535.0 - 624.2					52 - 850
Flouride	0.19 - 0.85			0.2 - 0.37		
Nitrate	0.10 - 4.64	0.0 - 4.99		0.1	BDL - 2.4	0.1 - 4.1
Total Phosphorus	0.08 - 0.74			0.18		
Sulfate	3.66 - 78.62	71 - 98		0.6 - 79.9	16 - 159	0.6 - 121
pH	6.91 - 7.23	7.4		7.6 - 8.4	7.4 - 8.8	6.95 - 8.7
Total Diss. Solids				144 - 428	360 - 604	95 - 504
Hardness (CaCO3)				105 - 350		60 - 383
Volatile Organics (ug/l)						
Benzene (Well 2094)			BDL - 160			
Ethylbenzene (Well 2015)			BDL - 2.3			
Toluene (Well 2011)			BDL - 5			
Total xylenes (Well 2094)			BDL - 189			

Notes:
- * All groundwater data are unvalidated
- (1) From Table A-1 for 2000 series wells
- (2) Based on wells upgradient of FEMP (B-3, GT-3, D)
- (3) Wells 11, 12, 13, 26, 29, P1, P2, P3
- (4) Appendix 2 - based on 0S-10, 0S-15, 0S-16 and 0S-17
- (5) Wells 2013, 2106, 2060, and 2095
- (6) Highest values as identified for site locations 51, 60, 61, and 63

TABLE 1-1 (Continued)
SUMMARY OF HISTORICAL RANGE OF
BACKGROUND GROUNDWATER QUALITY

Chemical	Miami Conserv. District (1973) Average from USGS Wells (Hamilton Co.)	WEMCO Annual Report for 1990 Wells (5)	U.S. DOE FEMP Dev. Background (Internal Comm.)	Sedam (1984)	OKI (1990) (6)
Radiological Parameters					
Total Uranium (ug/l)		34 - 154 PCi/l	1 pCi/l	<0.04 - 430 PCi/l	
Alpha Particles (PCi/l)					
Beta Particles (PCi/l)					
General Parameters					
Alkalinity					
Ammonia			4.22		
Chloride	38.68		78.9	14 - 42	
Conduct. (umhos/cm)	786.4		850	585 - 1300	
Flouride	0.226		0.25	0.2 - 0.3	0.2 - 1.8
Nitrate	0.977	11	11.4		0.35 - 17.5
Total Phosphorus			0.195	0.01 - 0.05	
Sulfate	101.68		39.9	62 - 83	
pH	7.5		6.0 - 7.6	7.3 - 7.8	
Total Diss. Solids	486.5		691.77	414 - 461	
Hardness (CaCO3)	377.9			310 - 399	

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Notes:

- * All groundwater data are unvalidated
- (1) From Table A-1 for 2000 series wells
- (2) Based on wells upgradient of FEMP (B-3, GT-3, D)
- (3) Wells 11, 12, 13, 26, 29, P1, P2, P3
- (4) Appendix 2 - based on 0S-10, 0S-15, 0S-16 and 0S-17
- (5) Wells 2013, 2106, 2060, and 2095
- (6) Highest values as identified for site locations 51, 60, 61, and 63

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TABLE 1-2
SUMMARY OF HISTORICAL RANGE OF
BACKGROUND DATA FOR SOILS AND SEDIMENTS

Chemical	Surface Soils		Sediments	
	U.S. DOE (January 1992) (1)	WEMCO Annual Report	U.S. DOE (January 1992)	U.S. DOE (October 1990) (2)
Total Metals (mg/kg)				
Aluminum	57000		1970	2480
Antimony			<0.1	ND
Arsenic	7.4		7.0	7.0
Barium	420		21.0	21.2
Beryllium	0.85		0.5	0.5
Cadmium	1.7		3.7	5.5
Calcium				
Chromium	52		18.1	18.3
Cobalt	9.2		4.9	5.2
Copper	22		10.8	11.5
Iron				
Lead	17		9.3	9.3
Magnesium	4600		18700	35900
Manganese	640		411.0	411.0
Mercury	0.12		<0.1	ND
Nickel	18		13.7	17.9
Potassium				
Selenium	0.45		<0.4	ND
Silver	2.8		<0.1	ND
Sodium				
Thallium				
Vanadium	66		12.4	15.4
Zinc	52		13.5	15.3
Miscellaneous (mg/kg)				
Uranium	4.2	1.4 - 26 PCi/g	1.7 ug/kg	
bis(2-Ethylhexyl)phthalate			0.46	0.46
2-Butanone				0.015
Di-n-butyl phthalate				0.039
2-Hexanone				0.011
Methylene Chloride				0.007
Acetone (2-propanone)				0.018

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Notes:
(1) Values as identified in Table 3-2 for FEMP Background
(2) Based on Sample W-7 at Willey Road and Background Sample W-5.

TABLE 1-3
SUMMARY OF HISTORICAL RANGE OF
BACKGROUND DATA FOR SURFACE WATER

Chemical	WEMCO Annual Report (1988)	WEMCO Annual Report (1990)	U.S. DOE (October 1992) (1)	IT Corp. (1991) (2)
Dissolved Metals (mg/l)				
Aluminum			0.076 - 0.451	<0.06
Antimony			0.003	
Arsenic			0.019	<0.002
Barium			0.027 - 0.066	0.037
Beryllium			0.001	
Cadmium			0.002 - 0.003	<0.002
Calcium				84.7
Chromium			0.014 - 0.024	<0.01
Cobalt			ND	
Copper			0.008 - 0.015	<0.01
Iron				0.029
Lead			0.002 - 0.009	<0.009
Magnesium			9.97 - 21.4	21.4
Manganese			0.010 - 0.046	0.015
Mercury			0.0002 - 0.0008	0.0002
Nickel			0.008	<0.02
Potassium				1.55
Selenium			0.017	<0.002
Silver			ND	<0.01
Sodium				9.93
Thallium				
Vanadium			0.014 - 0.018	<0.01
Zinc			0.011 - 0.037	
Miscellaneous (mg/l)				
Nitrate	<0.1 - 39	<0.1 - 5.7		11.95
Flouride	0.1 - 0.8	0.2 - 2.5		0.21
Chloride	8 - 46	17 - 28		18.19
pH	7.7 - 8.5	7.5 - 8.8		8.38
Phosphorus				0.032
Sulfate				57.36
bis(2-Ethylhexyl)phthalate			0.005	
Radiological				
				0.015 mg/l
Uranium	0.27 - 812 PCi/l			
Alpha	BDL - 824 PCi/l			
Beta	2.7 - 369 PCi/l			

Notes:

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(1) Range as reported from W7, W10, W11, ASIT-3, and ASIT-9.

(2) Based on results for W-07 (5/14/89).

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2.0 SAMPLING AND ANALYSIS

This section identifies the background sampling locations for the PRRS and summarizes the sampling and analysis methodologies used.

2.1 Sampling Locations and Procedures

The PRRS background sampling locations and procedures followed the Phase I and Phase II Work Plans. This section discusses background sampling and analysis for all relevant Study Area media.

2.1.1 Soils

Based upon the Phase II Work Plan, and with the approval of Ohio EPA, 16 background soil samples were collected in May 1991. Figure 2-1 illustrates the approximate locations and the sample identification for the background samples. With reference to Figure 2-1, background soil samples were collected from a range of soil types characterized by the Soil Conservation Survey (SCS) as being present on the facilities' properties.

Samples were collected from a depth of 0 to 12 inches using a decontaminated bucket auger. Upon collection, the soil sample was placed in a decontaminated stainless steel mixing bowl and thoroughly homogenized prior to being placed into the sampling jar. For samples that required volatile organic analysis, the collected soil was not homogenized but was placed directly into the sampling jar. All samples were preserved in accordance with the PRRS Phase II Work Plan and the PRRS Site Operations Plan - Site Specific Quality Assurance/Quality Control (QA/QC) Plan.

Both field blanks and duplicates for background samples were collected at a frequency of 10% or one sample per day, whichever was greater. The field blanks, matrix spikes and duplicates were analyzed for the same parameters as the background soil samples. Trip blanks, prepared with deionized water by the analytical laboratory, were also utilized.

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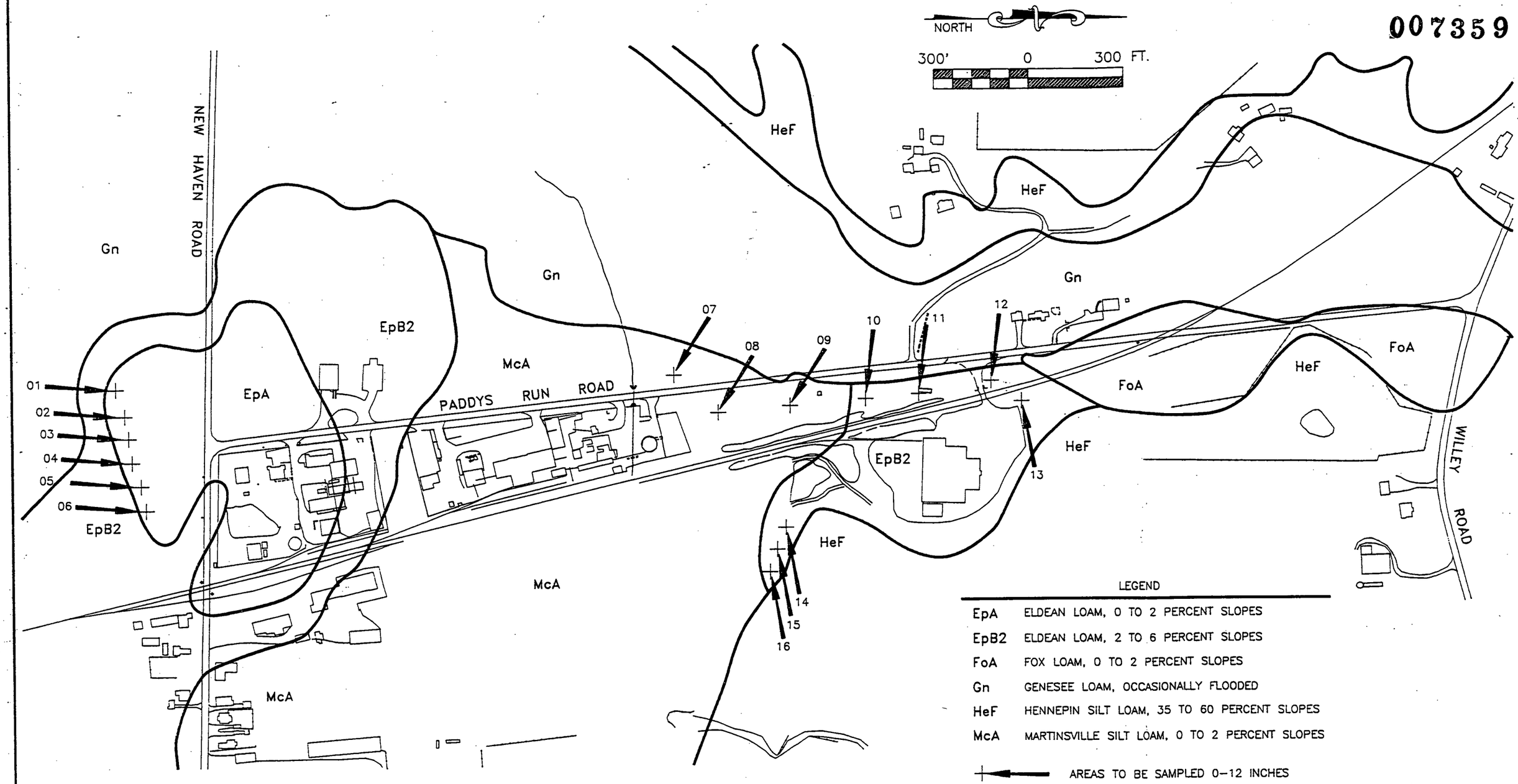

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LOCATIONS OF SAMPLES COLLECTED
FOR BACKGROUND DETERMINATION
PADDYS RUN ROAD SITE
HAMILTON COUNTY, OHIO

FIGURE 2–1

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2.1.2 Groundwater

Neither the Phase I nor Phase II Work Plan specifically identified background groundwater monitoring wells for monitoring and evaluation. Therefore, based upon an evaluation of the type and locations of activities conducted at PRRS, background wells were identified for comparison purposes. The following criteria were used to identify appropriate background wells:

1) Data availability (e.g., Are analytical results from historical sampling available?)

2) Location (e.g., Are the wells located hydraulically upgradient?)

3) Sampling interval (e.g., Are the well screens completed at depths which accurately represent the valley-fill aquifer?)

4) Collection and analysis protocol (e.g., Was the data obtained under an approved QA/QC plan?)

The wells identified as potentially applicable for the background determination at PRRS were:

MW-01S	Estes	DOE 2015	DOE 2017
MW-01D	DOE 2095	DOE 3015	DOE 3017
AW-1	DOE 3093	DOE 4095	DOE 4015
AW-2	DOE 2093	DOE 2002	DOE 2125
DOE 2060	DOE 2061	DOE 2096	DOE 4096
DOE 2396	DOE 3062	DOE 3125	DOE 3096

The locations of these selected background wells relative to the PRRS Companies' properties are illustrated in Figure 2-2.

Because of the potential variability in the results from these wells, the laboratory results were statistically evaluated to identify potential outliers (e.g., values that do not belong to the data set) that may have resulted from differences in well construction, screen interval, or sampling and analysis techniques. As detailed in Section 3.2.2, identified outliers were subsequently removed from the statistical evaluation for background determination.

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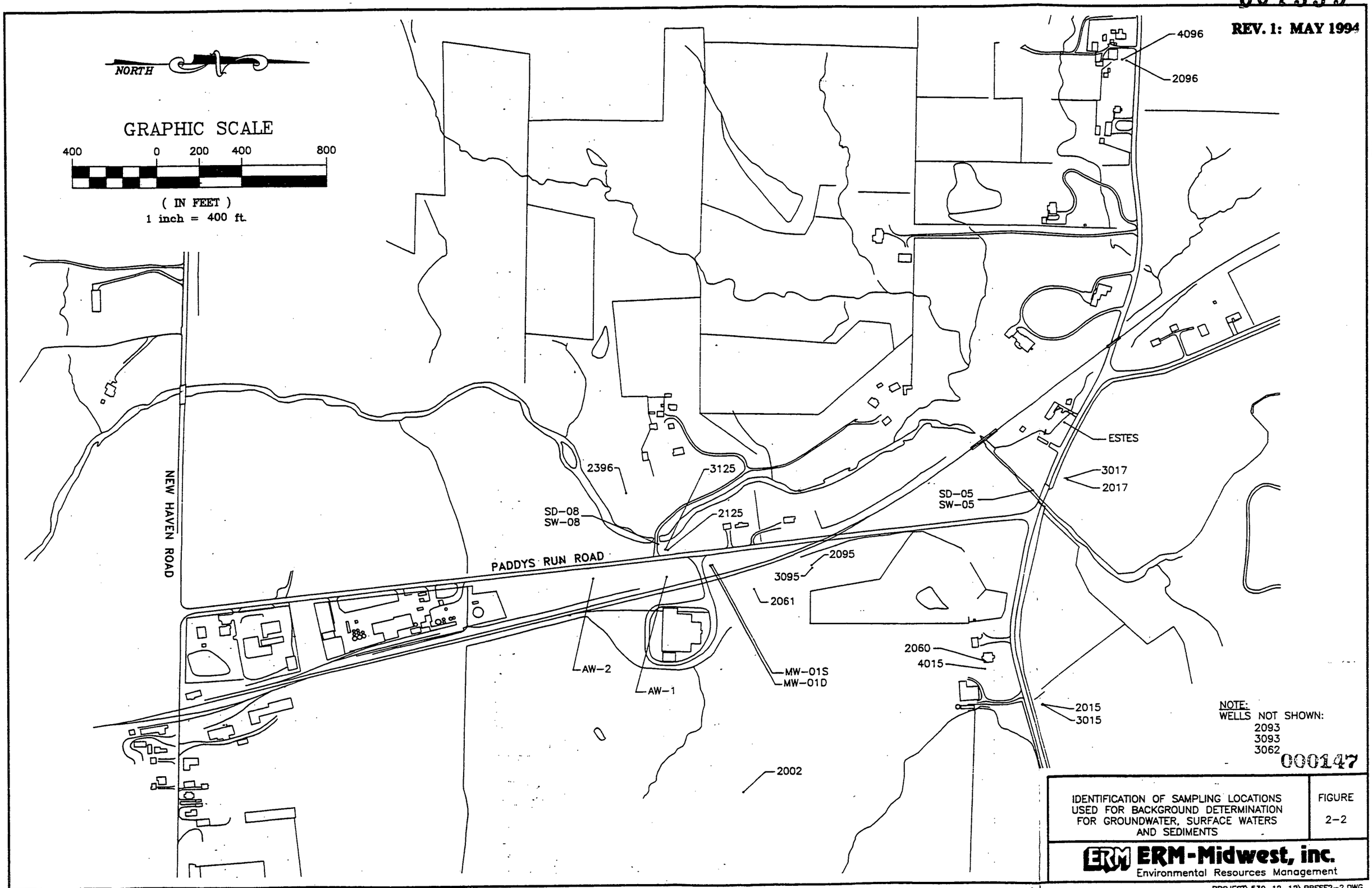

IDENTIFICATION OF SAMPLING LOCATIONS USED FOR BACKGROUND DETERMINATION FOR GROUNDWATER, SURFACE WATERS AND SEDIMENTS

FIGURE 2-2

ERM-Midwest, inc.
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Groundwater samples from the PRRS wells were collected in accordance with the approved Work Plans for the site. Collection included purging the wells until the apparent water quality stabilized and sampling the wells with dedicated bailers and a peristallic pump. Proper decontamination procedures were followed for all sampling equipment. The specific sampling and decontamination procedures are detailed in the Work Plans.

The identified background wells include wells sampled for the PRRS RI/FS and additional wells sampled by the U.S. DOE. The incorporation of the U.S. DOE wells allowed for the development of a larger chemical database for statistical analysis. The sampling and analysis of the U.S. DOE wells was conducted consistent with U.S. DOE's approved sampling and analysis protocol.

2.1.3 Surface Water

Neither the Phase I nor the Phase II Work Plan specifically identified background surface water sampling locations for monitoring and evaluation. Therefore, based upon an evaluation of the types and locations of activities conducted at the Study Area, background locations were identified for comparison purposes. The following criteria were used to identify appropriate background locations:

1) Location (e.g., Upstream of the PRRS industrial activity)

2) Data availability (e.g., Are analytical results from historical sampling available?)

3) Collection and analysis protocol (e.g., Was the data obtained under an approved QA/QC plan?)

The sample location designations utilized for the surface water background determination were as follows:

PRRS	U.S. DOE
SW-05	ASIT-3
SW-08	W-10
	W-11
	W-7

The PRRS background surface water locations relative to the Companies' properties are also illustrated in Figure 2-2.

The surface water samples were collected by obtaining a grab sample in a clean, decontaminated laboratory beaker and then filling the appropriate laboratory jars with the water from the beaker. The sampling and decontamination procedures utilized for the collection of the background surface water samples were consistent with the methodologies presented in the Phase I and Phase II PRRS Work Plans. Similar to the groundwater evaluation, the background surface water database includes samples collected by the U.S. DOE for its RI/FS. The sampling and analysis of the U.S. DOE surface water locations were conducted consistent with U.S. DOE's approved sampling and analysis protocol. Results were validated.

2.1.4 Sediment

The PRRS work plans also did not specifically identify background sediment sampling locations for monitoring and evaluation. Therefore, based upon the same evaluation criteria identified in Section 2.1.3 for surface water, the following background locations were utilized for sediment background:

PRRS	U.S. DOE
SD-05	ASIT-7
SD-08	ASIT-10
	W-10
	W-11
	W-7
	W-5

The PRRS background sediment locations relative to the Companies' properties are illustrated in Figure 2-2.

The sediment samples from the stream bottom were collected as grab samples with a decontaminated, stainless-steel scoop and placed immediately into the laboratory sampling jars. The sampling and decontamination procedures utilized for the collection of the background sediment samples were consistent with the methodologies presented in the Phase I and Phase II PRRS Work Plans. Additionally, the sampling and analysis of the U.S. DOE sediment samples followed U.S. DOE's approved protocol. Results were validated.

2.2 Field and Laboratory Analysis

The collection and analysis of all PRRS samples followed strict quality assurance/quality control procedures identified in the *PRRS Site Operations Plan - Site Specific QA/QC Plan* and the Phase II Work Plan. This section details the specific field and laboratory analyses conducted on samples from each medium. The U.S. DOE did not consistently analyze for the same suite of chemicals as the PRRS Companies. Therefore, only relevant analyses from DOE samples were utilized to support background development.

2.2.1 Soils

Upon collection of the background soil sample, the field geologist classified the soil according to the U.S. Department of Agriculture's (USDA) *Soil Survey Manual* for color, texture, and structure. The samples were analyzed in a laboratory for the following parameters:

- CLP Volatiles (including isopropylbenzene [also called cumene in the RI/RA Report])
- CLP Semi-volatiles
- CLP Inorganics
- CLP Pesticides
- CLP PCBs
- General Parameters (ammonia, chloride, total phosphorus, sulfate, pH)
- Radiological Parameters (potassium-40, total alpha, total beta, and total uranium).

The data from the laboratory analyses of the soil samples were validated in accordance with CLP protocol. The validated result of the laboratory analyses for the background samples are summarized in tabular form in Appendix A. Note that the appendix does not distinguish between results above the Contract Required Quantification Limit (CRQL) and those reported below the CRQL. Results reported as less than the CRQL have been included in Appendix A as a value of one-half the CRQL.

2.2.2 Groundwater

The analysis of the PRRS groundwater samples followed the procedures outlined in the *PRRS Site Operations Plan - Site Specific QA/QC Plan* and the Phase II Work Plan. During sample collection, field analysis was conducted for dissolved oxygen, temperature, pH, and specific conductance. Laboratory analysis consisted of the following parameters:

- CLP Volatiles (including isopropylbenzene [also called cumene in the RI/RA Report])
- CLP Semi-volatiles
- CLP Inorganics (total and dissolved)
- CLP Pesticides
- CLP PCBs
- General Parameters (ammonia, chloride, COD, MBAS, total and dissolved phosphorus, sulfate, TDS, TOC, density, hardness)
- Radiological Parameters (potassium-40, total alpha, total beta, and total uranium).

As stated in Section 2.1.2, additional groundwater results provided by the U.S. DOE were used during the groundwater background determination to increase the database for statistical analysis. The U.S. DOE wells were analyzed in accordance with an Agency-approved QA/QC program. All of the PRRS groundwater results were subjected to comprehensive CLP validation. However, the DOE data have not been CLP validated and were used as reported by the analytical laboratory.

A sensitivity analysis was performed to evaluate the effects of the U.S. DOE groundwater data on the calculated background concentrations. As discussed in Section 3.4, the groundwater background levels are relatively insensitive to the U.S.

DOE data. In addition, because the background evaluation included statistical evaluation for outliers, which eliminated inappropriate data, the data are directly usable for background determination. A summary of the groundwater quality data used for this background evaluation is enclosed in Appendix B. Consistent with the soils results, values reported as below the CRQL have been incorporated as a value of one-half the CRQL.

2.2.3 Surface Water

The analysis of the PRRS surface water samples followed the procedures outlined in the *PRRS Site Operations Plan - Site Specific QA/QC Plan* and the Phase II Work Plan. During sample collection field analysis was conducted for dissolved oxygen, temperature, pH, and specific conductance. Laboratory analysis consisted of the following parameters:

- CLP Volatiles (including isopropylbenzene [also called cumene in the RI/RA Report])
- CLP Semi-volatiles
- CLP Inorganics (total and dissolved)
- CLP Pesticides
- CLP PCBs
- General Parameters (ammonia, chloride, COD, MBAS, total and dissolved phosphorus, sulfate, TDS, TOC, density, hardness)
- Radiological Parameters (potassium-40, total alpha, total beta, and total uranium).

A comprehensive CLP data validation was conducted on the laboratory results from the PRRS samples. As stated in Section 2.1.3, additional surface water results provided by the U.S. DOE were used for the background determination. The U.S. DOE samples were analyzed in accordance with an Agency-approved QA/QC program for various parameters and were validated by U.S. DOE. The results of the laboratory analyses are summarized in tabular form in Appendix C.

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2.2.4 Sediment

The analysis of the PRRS sediment samples followed the procedures outlined in the *PRRS Site Operations Plan - Site Specific QA/QC Plan* and the Phase II Work Plan. Laboratory analysis consisted of the following parameters:

- CLP Volatiles (including isopropylbenzene [also called cumene in the RI/RA Report])
- CLP Semi-volatiles
- CLP Inorganics
- CLP Pesticides
- CLP PCBs
- General Parameters (ammonia, chloride, total phosphorus, sulfate, TOC)
- Radiological Parameters (potassium-40, total alpha, total beta, and total uranium).

A comprehensive CLP data validation was performed on the laboratory results from the PRRS sediment samples.

As stated in Section 2.1.4, additional sediment results provided by the U.S. DOE were used for the background determination. The U.S. DOE samples were analyzed in accordance with an Agency-approved QA/QC program for various parameters and were validated by U.S. DOE. The results of the laboratory analyses are summarized in tabular form in Appendix D.

3.0 STATISTICAL EVALUATION

Once background samples have been collected and analyzed, the laboratory results are statistically evaluated to define an appropriate background comparison concentration for each chemical. The background concentration is estimated to be a value representing the upper range of the natural population distribution of the background data. The background (upper range) value is determined such that a 95% probability exists that the analysis of a random sample from the background population would result in a value less than or equal to the background concentration. The Ohio EPA (1991) has provided guidance on the statistical evaluation of background samples. This section details the statistical evaluation of the designated background samples.

3.1 Sample Frequency Confirmation

Prior to the statistical evaluation of the background data set, the statistician must confirm that an adequate number of background samples have been identified to properly characterize the natural background population. The Ohio EPA (1991) states that the following equation should be utilized to determine the number of samples required to "accurately reflect background conditions:"

$$N = (t' a/B)^2 \qquad \text{(Equation 3-1)}$$

Where:

- N = Number of samples to be collected
- t = Student's t-value associated with a 95% confidence level and a given degrees of freedom (e.g., N-1)
- a = Estimate of "relative standard deviation"
- B = Estimate of "relative desired confidence"

The Student's t-value is the value that corresponds to the associated critical area under a normal curve and a specific value for degrees of freedom. The "t-table" utilized for the statistical calculation for the PRRS is presented in Table 3-1.

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TABLE 3-1
STUDENT'S t CRITICAL VALUES

Degrees of Freedom	t Value Associated With 95% Confidence
1	12.71
2	4.30
3	3.18
4	2.78
5	2.57
6	2.45
7	2.37
8	2.31
9	2.26
10	2.23
11	2.20
12	2.18
13	2.16
14	2.15
15	2.13
16	2.12
17	2.11
18	2.10
19	2.09
20	2.09
21	2.08
22	2.07
23	2.07
24	2.06
25	2.06
26	2.06
27	2.05
28	2.05
29	2.05
30	2.04
35	2.04
36	2.04
37	2.03
38	2.03
39	2.03
40	2.02

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The Ohio EPA identifies two methods for determining the relative standard deviation,

1) statistical evaluation of collected data, or
2) estimating using the Practical Quantitation Limit (PQL).

The Ohio EPA (1991) defines the *relative desired confidence* as a "value judgment arrived at by a consensus of the technical and administrative personnel participating in the project." The Ohio EPA guidance indicates that when little background information is available, the "*relative desired confidence...* can be safely estimated to equal the relative standard deviation".

If the relative desired confidence is equated to the relative standard deviation, the two terms cancel in Equation 3-1 and the following equation results:

$$N = t^2 \qquad \text{(Equation 3-2)}$$

The Ohio EPA (1991) indicates that by evaluating various student-t values (Table 3-1) with relative sample numbers, the appropriate number of samples required to describe background in a specific medium is seven. This is demonstrated by the Ohio EPA as follows:

1) Assume N = 7
2) n = N-1 = 7-1 =6 degrees of freedom
3) t(n=6) = 2.45 (From Table 3-1)
4) The t^2 value +1 equals the estimated number of samples required. Substituting, n = $(2.45)^2$ + 1 ~ 6 + 1 ~ 7 (From equation 3-2)

Therefore, the assumed number of required background samples (e.g., 7) is confirmed by the t^2 evaluation.

By incorporating relevant and usable U.S. DOE data, on average, the number of background samples for media chemicals exceeded seven. However, depending upon chemical analyzed, the number of available background samples varies. The following summarizes the maximum amount of available information for each medium:

Medium	Maximum Number of Background Samples
Soils	16
Groundwater	91
Surface Water	9
Stream Sediments	8

In addition, Equation 3-1 was used to calculate the relative desired confidence (B), knowing the values of N, t, and a. The upper limit value of 0.5 for (B/Mean) is typical for similar statistical analyses for environmental media.

From the Tables in Appendix I, the data sufficiency results for each medium are as follows:

- **SOIL:** A large majority of the evaluated chemicals (91/94) met the criteria for data sufficiency, indicating that sufficient soil samples have been collected.
- **GROUNDWATER**: A large majority of the evaluated chemicals (79/83) met the criteria for data sufficiency, indicating that sufficient soil samples have been collected.
- **SURFACE WATER**: Approximately half of the evaluated chemicals (12/26) met the criteria for data sufficiency. This result indicates that a sufficient number of samples have been collected, though additional samples could improve the data coverage of background surface waters.
- **SEDIMENT**: A majority of the evaluated chemicals (36/49) met the criteria for data sufficiency, indicating that sufficient soil samples have been collected.

The identified, available information, and data sufficiency calculations, indicate that an adequate number of background samples exist for the PRRS and, thus, the Ohio EPA (1991) approach to determine background can be utilized.

3.2 Distribution Determination

Ohio EPA guidance (1991) discusses the importance of properly determining the statistical distribution of the background population. The guidance cautions that "...non-normally distributed concentrations used with a t-confidence interval may be quite misleading." Thus the first detail that needs to be addressed in the development of background concentration values is the determination as to whether the data is normally distributed.

The Ohio EPA (1991) recommends the use of probability plots to determine the normality of a statistical distribution. A similar comparative method is to develop a histogram for the data of each constituent. A histogram of a normal distribution will follow the familiar shape of the bell shaped curve. Both methods are equally applicable and both have been utilized for the evaluation of the PRRS background data.

In addition to Ohio EPA's recommendation for normal distribution determination, the U.S. EPA (1989) identified the following procedures as potentially applicable:

1. Literature citation
2. Coefficient of Variation (COV) test
3. Probability plots
4. Chi-Squared test (for greater than 20 sample results)
5. Kolmogorov-Smirnov Test (for greater than 50 sample results)

Because the COV test is simple and commonly used (e.g., was formerly required by 40 CFR Part 264 Subpart F regulations), it was used for the PRRS to complement the probability plot and histogram method. The COV test is conducted by determining the ratio of the standard deviation to the sample mean. As stated by the U.S. EPA (1989), "If this ratio exceeds 1.00, there is evidence that the data are not normal and the normal distribution should not be used for those data."

For the PRRS statistical background evaluation, a six-step process to determine the proper statistical distribution of the background data for each medium was utilized:

Step 1 - Assume data is normally distributed (default distribution)

Step 2 - Evaluate normal deviate statistics (e.g., the mean and standard deviation) by the following means:

- Probability plot
- Histogram
- COV test

Step 3 - Look for data points outside the bell shaped curve of the histogram plots (identified as outliers).

Step 4 - If one of the following situations occur, transform the data to a Log Base 10 distribution

- COV is greater than 1.0
- Data does not "fit" normal probability plot or histogram (e.g., outlier(s) were present)

Step 5 - Repeat steps 2 and 3 for the transformed data

Step 6 - Compare both the normal and log 10 distributions to determine "best fit." The default distribution is always considered to be normal.

The statistical software package CSS: Statistica, developed by Statsoft (1991) was utilized for the univariate statistics analysis (e.g., sample mean and standard deviation) and for the development of the probability plots and histograms. The following sections describe the statistical evaluation of the previously identified background data for potentially affected media. The evaluation of the data is summarized and the appropriate distributions are identified.

3.2.1 Soils

The background soil results were evaluated on a chemical-specific basis. Even though 16 samples were collected and analyzed, not all chemicals consistently had concentrations greater than the Contract Required Quantification Level (CRQL). However, a statistical evaluation was performed for every chemical in each medium that showed a positive detection. If a concentration was reported as below the CRQL, a value of one-half the CRQL was used in the statistical evaluation.

The statistical evaluation for soils is presented in Appendix E. The appendix includes a summary of the statistical evaluation (e.g., the mean and standard

deviation of the distribution) and the histograms and probability plots for each chemical. Table 3-2 summarizes what distribution best represented the background soil data for each chemical. The representative distribution was then utilized for the statistical calculation of background.

An additional note of clarification is required concerning the radiological parameters. The analytical laboratory reports the radiological parameter concentration as a value plus or minus another value (e.g., 180 ± 20 pCi/g). The "plus or minus" value represents the 95% confidence interval for the measured concentration. For this distribution determination, only the first reported value or the "mean" was used and evaluated.

3.2.2 Groundwater

The analytical results from the groundwater background samples were evaluated in a similar manner as described above for the soils. If a concentration was reported as below the CRQL, a value of one-half the CRQL was used in the statistical evaluation. A difference in the statistical evaluation of groundwater data in comparison to the soil data is that if outliers were identified and could not be incorporated into a representative distribution by transforming the data, the data point (e.g., well location result) was removed from the statistical data set for the analyte group. This was only conducted with the groundwater data because (1) sufficient data were available to make identification of outliers accurate, and (2) the selected background wells were not pre-approved locations. A summary of the wells identified as outliers and removed from statistical evaluation is presented in Table 3-3.

A summary of the statistical evaluation for the groundwater background samples is enclosed in Appendix F. The appendix also includes the probability plots and histograms for the background data. The distribution that best fits the data for each constituent is summarized in Table 3-4.

TABLE 3-2
BACKGROUND DETERMINATION IN SOILS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distribution	Log10 Distribution	NOTES
Dissolved Metals			
Antimony (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Arsenic (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Beryllium (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Cadmium (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Chromium (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Copper (Dis)	N/A	N/A	Chemical Not Analyzed in the Medium
Lead (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Mercury (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Nickel (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Selenium (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Silver (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Thallium (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Zinc (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Barium (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Iron (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Manganese (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Vanadium (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Aluminum (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Cobalt (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Magnesium (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Calcium (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Sodium (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Potassium (Dis.)	N/A	N/A	Chemical Not Analyzed in the Medium
Total Metals (mg/kg)			
Antimony (Tot.)	X		
Arsenic (Tot.)	X		Log 10 Did Not Provide Better Fit - Use Default
Beryllium (Tot.)	X		
Cadmium (Tot.)	X		Log 10 does not incorporate Outlier - Use Default
Chromium (Tot.)	X		
Copper (Tot.)	X		
Lead (Tot.)		X	Log 10 Provides "Tighter" Fit of Probability Plot
Mercury (Tot.)	X		Log 10 Does Not Incorporate Outlier - Use Default
Nickel (Tot.)	X		
Selenium (Tot.)	X		Log 10 Does Not Incorporate Outlier - Use Default
Silver (Tot.)			Distribution Not Evaluated
Thallium (Tot.)			Distribution Not Evaluated
Zinc (Tot.)		X	Log 10 Provides "Tighter" Fit of Probability Plot
Barium (Tot.)	X		
Iron (Tot.)	X		
Manganese (Tot.)	X		
Vanadium (Tot.)	X		
Aluminum (Tot.)	X		
Cobalt (Tot.)	X		
Magnesium (Tot.)		X	Log 10 Incorporates Spread and Eliminates Outlier
Calcium (Tot.)		X	Log 10 Incorporates Spread and Eliminates Outlier
Sodium (Tot.)	X		Log 10 Did Not Provide Better Fit - Use Default
Potassium (Tot.)	X		

TABLE 3-2 (Continued)
BACKGROUND DETERMINATION IN SOILS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
Volatile Organics (mg/kg)			
Acrolein			Distribution Not Evaluated
Acrylonitrile			Distribution Not Evaluated
Benzene	X		
Bromoform			Distribution Not Evaluated
Carbon tetrachloride			Distribution Not Evaluated
Chlorobenzene			Distribution Not Evaluated
Dibromochloromethane			Distribution Not Evaluated
Chloroethane			Distribution Not Evaluated
Chloroform	X		
Bromodichloromethane			Distribution Not Evaluated
1,1-Dichloroethane			Distribution Not Evaluated
1,2-Dichloroethane			Distribution Not Evaluated
1,1-Dichloroethene			Distribution Not Evaluated
1,2-Dichloropropane			Distribution Not Evaluated
Cis-1,3-Dichloropropene			Distribution Not Evaluated
Ethylbenzene	X		
Bromomethane	X		
Chloromethane	X		
Methylene chloride		X	Log 10 Better Incorporates Spread of Data and Outlier
1,1,2,2-Tetrachloroethane			Distribution Not Evaluated
Tetrachloroethene	X		
Toluene	X		
1,1,1-Trichloroethane			Distribution Not Evaluated
1,1,2-Trichloroethane			Distribution Not Evaluated
Trichloroethene			Distribution Not Evaluated
Vinyl chloride			Distribution Not Evaluated
Trans-1,3-Dichloropropene	X		
Styrene	X		
Acetone		X	Log 10 Better Incorporates Spread of Data and Outlier
2-Butanone	X		
Carbon disulfide			Distribution Not Evaluated
2-Hexanone			Distribution Not Evaluated
4-Methyl-2-pentanone			Distribution Not Evaluated
Vinyl acetate			Distribution Not Evaluated
Xylenes (Total)	X		
1,2-Dichloroethene(Total)	X		
Isopropylbenzene	X		

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TABLE 3-2 (Continued)
BACKGROUND DETERMINATION IN SOILS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
Semi-Volatile Organics (mg/kg)			
Acenaphthene		X	Incorporates Apparent Outlier
Acenaphthylene		X	Incorporates Apparent Outlier
Anthracene	X		
Benzo(a)anthracene		X	Log 10 Better Incorp. Spread of Data and Incorp. Apparent Outlie
Benzo(a)pyrene		X	Log 10 Better Incorp. Spread of Data and Incorp. Apparent Outlie
Benzo(b)fluoranthene		X	Log 10 Better Incorp. Spread of Data and Incorp. Apparent Outlie
Benzo(g,h,i)perylene		X	Log 10 Better Incorp. Spread of Data and Incorp. Apparent Outlie
Benzo(k)fluoranthene		X	Log 10 Better Incorp. Spread of Data and Incorp. Apparent Outlie
bis(2-Chloroethoxy)methane			Distribution Not Determined
bis(2-Chloroethyl)ether			Distribution Not Determined
bis(2-Chloroisopropyl)ether			Distribution Not Determined
bis(2-Ethylhexyl)phthalate	X		
4-Bromophenyl phenyl ether			Distribution Not Determined
Butyl benzyl phthalate		X	Log 10 Better Incorporates Spread of Data
2-Chloronaphthalene			Distribution Not Determined
4-Chlorophenyl phenyl ether			Distribution Not Determined
Chrysene		X	Log 10 Better Incorp. Spread of Data and Incorp. Apparent Outlie
Dibenzo(a,h)anthracene	X		
1,2-Dichlorobenzene			Distribution Not Determined
1,3-Dichlorobenzene			Distribution Not Determined
1,4-Dichlorobenzene			Distribution Not Determined
3-3-Dichlorobenzidine			Distribution Not Determined
Diethyl phthalate			Distribution Not Determined
Dimethyl phthalate		X	Incorporates Apparent Outlier
Di-n-butyl phthalate		X	Incorporates Apparent Outlier
2,4-Dinitrotoluene		X	Incorporates Apparent Outlier
2,6-Dinitrotoluene			Distribution Not Determined
Di-n-octyl phthalate		X	Incorporates Apparent Outlier
Fluoranthene	X		
Fluorene		X	Incorporates Apparent Outlier
Hexachlorobenzene			Distribution Not Determined
Hexachlorobutadiene			Distribution Not Determined
Hexachlorocyclopentadiene			Distribution Not Determined
Hexachloroethane			Distribution Not Determined

TABLE 3-2 (Continued)
BACKGROUND DETERMINATION IN SOILS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
Semi-Volatile Organics (Con't)			
Indeno(1,2,3-cd)pyrene		X	Log 10 Better Incorp. Spread of Data & Incorp. Apparent Outlier
Isophorone			Distribution Not Determined
Naphthalene		X	Incorporates Apparent Outlier
Nitrobenzene			Distribution Not Determined
N-Nitroso-di-n-propylamine			Distribution Not Determined
N-Nitrosodiphenylamine(1)			Distribution Not Determined
Phenanthrene	X		
Pyrene	X		
1,2,4-Trichlorobenzene			Distribution Not Determined
Benzyl alcohol		X	Log 10 Better Incorp. Spread of Data & Incorp. Apparent Outlier
4-Chloroaniline			Distribution Not Determined
Dibenzofuran		X	Log 10 Better Incorp. Spread of Data & Incorp. Apparent Outlier
2-Methylnaphthalene		X	Log 10 Better Incorp. Spread of Data & Incorp. Apparent Outlier
2-Nitroaniline			Distribution Not Determined
3-Nitroaniline			Distribution Not Determined
4-Nitroaniline			Distribution Not Determined
2-Chlorophenol			Distribution Not Determined
2,4-Dichlorophenol			Distribution Not Determined
2,4-Dimethylphenol		X	Log 10 Better Incorp. Spread of Data & Incorp. Apparent Outlier
4,6-Dinitro-2-methylphenol	X		
2,4-Dinitrophenol	X		
2-Nitrophenol			Distribution Not Determined
4-Nitrophenol	X		
4-Chloro-3-methylphenol		X	Log 10 Better Incorp. Spread of Data & Incorp. Apparent Outlier
Pentachlorophenol	X		
Phenol		X	Log 10 Better Incorp. Spread of Data & Incorp. Apparent Outlier
2,4,6-Trichlorophenol			Distribution Not Determined
2-Methylphenol		X	Log 10 Better Incorp. Spread of Data & Incorp. Apparent Outlier
4-Methylphenol		X	Log 10 Better Incorp. Spread of Data & Incorp. Apparent Outlier
Benzoic acid	X		
2,4,5-Trichlorophenol	X		

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TABLE 3-2 (Continued)
BACKGROUND DETERMINATION IN SOILS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
Pesticides (mg/kg)			
Aldrin			Distribution Not Evaluated
Alpha-BHC			Distribution Not Evaluated
Beta-BHC	X		
Gamma-BHC (Lindane)			Distribution Not Evaluated
Delta-BHC			Distribution Not Evaluated
4,4'-DDT	X		
4,4'-DDE	X		
4,4'-DDD	X		
Dieldrin	X		
Endosulfan I	X		
Endosulfan II			Distribution Not Evaluated
Endosulfan sulfate	X		
Endrin	X		
Heptachlor			Distribution Not Evaluated
Heptachlor epoxide	X		
PCB-1242			Distribution Not Evaluated
PCB-1254			Distribution Not Evaluated
PCB-1221			Distribution Not Evaluated
PCB-1232			Distribution Not Evaluated
PCB-1248			Distribution Not Evaluated
PCB-1260	X		
PCB-1016	X		
Toxaphene			Distribution Not Evaluated
p,p'-Methoxychlor	X		
Endrin ketone	X		
Alpha chlordane			Distribution Not Evaluated
Gamma chlordane			Distribution Not Evaluated

TABLE 3-2 (Continued)
BACKGROUND DETERMINATION IN SOILS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
General Parameters (mg/kg)			
Cyanide			Distribution Not Evaluated
Ammonia (N), Distillation		X	Log 10 Provides Tighter Fit of Data
BOD(O2) - 5 day			Distribution Not Evaluated
Carbon, Total Organic (C)			Distribution Not Evaluated
COD(O2)			Distribution Not Evaluated
Chloride (Cl)	X		
Hardness, Total (as CaCO3)			Distribution Not Evaluated
Nitrate (as N)			Distribution Not Evaluated
Nitrogen, Kjeldahl (N)			Distribution Not Evaluated
pH	X		
Phosphorus, Dissolved			Distribution Not Evaluated
Solids, Dissolved at 180C			Distribution Not Evaluated
Solids, Suspended at 103C			Distribution Not Evaluated
Oil and Grease			Distribution Not Evaluated
Petroleum Hydrocarbons			Distribution Not Evaluated
Sulfate, Turbid		X	Log 10 Provides Better Fit and Incorporates Apparent Outlier
Surfactants (MBAS)			Distribution Not Evaluated
Phosphorus, Total		X	Log 10 Provides Better Fit and Incorporates Apparent Outlier
Radiological Parameters (pCi/g)			
Gross Alpha	X		
Gross Beta	X		
Uranium, Total	X		
Potassium-40	X		
Miscellaneous			
Specific Conductivity			Distribution Not Evaluated
Oxygen, Dissolved			Distribution Not Evaluated
Temperature			Distribution Not Evaluated

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TABLE 3-3
OUTLIER ELIMINATION FOR GROUNDWATER DATA EVALUATION
PADDYS RUN ROAD SITE

Constituent Group	Wells Removed	Comment
Total CLP Metals	MW-1D (Third Round)	☑ elevated concentrations (Pb, Ni, Zn, As)
Dissolved CLP Metals	2 DOE 2095 A&W2 (Third Round) MW-1D (Third Round)	☑ elevated concentrations (Pb) ☑ elevated concentrations (K) ☑ elevated concentrations (Na)
CLP Volatile Organics	MW-1D (Fourth Round)	☑ elevated concentrations for several constituents
CLP Semivolatile Organics	NONE	
CLP Pesticides	NONE	
CLP PCBs	NONE	
General Parameters	11-91 DOE2096 11-90 DOE2125	☑ elevated concentrations (Dis. Phos.) ☑ elevated concentrations (Sulfate)
Radiological Parameters	NONE	

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TABLE 3-4
BACKGROUND DETERMINATION IN GROUNDWATER - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distribut.	Log 10 Distribut.	NOTES
Dissolved Metals (mg/l)			
Antimony (Dis.)	x		
Arsenic (Dis.)	x		
Beryllium (Dis.)	x		Log 10 Does Not Provide Better Fit
Cadmium (Dis.)	x		
Chromium (Dis.)	x		
Copper (Dis)		x	Log 10 Provides Best Fit & Incorporates Apparent Outlier
Lead (Dis.)		x	Provides Tighter Fit of Data
Mercury (Dis.)	x		Log 10 Does Not Provide Better Fit
Nickel (Dis.)	x		Log 10 Does Not Provide Better Fit
Selenium (Dis.)	x		Log 10 Does Not Provide Better Fit
Silver (Dis.)		x	Log 10 Provides Best Fit & Incorporates Apparent Outlier
Thallium (Dis.)	x		Log 10 Does Not Provide Better Fit
Zinc (Dis.)		x	Log 10 Provides Best Fit & Incorporates Apparent Outlier
Barium (Dis.)	x		
Iron (Dis.)		x	Log 10 Provides Best Fit & Incorporates Apparent Outlier
Manganese (Dis.)	x		Log 10 Does Not Provide Better Fit
Vanadium (Dis.)	x		
Aluminum (Dis.)		x	Log 10 Provides Best Fit & Incorporates Apparent Outlier
Cobalt (Dis.)	x		Log 10 Does Not Provide Better Fit
Magnesium (Dis.)	x		
Calcium (Dis.)	x		
Sodium (Dis.)		x	Log 10 Provides Best Fit & Incorporates Apparent Outlier
Potassium (Dis.)		x	Log 10 Provides Best Fit & Incorporates Apparent Outlier
Total Metals (mg/l)			
Antimony (Tot.)	X		
Arsenic (Tot.)		X	Provides Tighter Fit of Data
Beryllium (Tot.)	X		
Cadmium (Tot.)	X		
Chromium (Tot.)		X	Log 10 Provides Best Fit & Incorporates Apparent Outlier
Copper (Tot.)		X	Provides Tighter Fit of Data
Lead (Tot.)		X	Log 10 Provides Best Fit & Incorporates Apparent Outlier
Mercury (Tot.)	NA		No variability to determine distribution
Nickel (Tot.)		X	Log 10 Provides Best Fit & Incorporates Apparent Outlier
Selenium (Tot.)			Distribution Not Evaluated
Silver (Tot.)			Distribution Not Evaluated
Thallium (Tot.)			Distribution Not Evaluated
Zinc (Tot.)		X	Log 10 Provides Best Fit & Incorporates Apparent Outlier
Barium (Tot.)	X		
Iron (Tot.)		X	Log 10 Provides Best Fit & Incorporates Apparent Outlier
Manganese (Tot.)		X	Log 10 Provides Best Fit & Incorporates Apparent Outlier
Vanadium (Tot.)	X		
Aluminum (Tot.)		X	Log 10 Provides Best Fit & Incorporates Apparent Outlier
Cobalt (Tot.)	X		
Magnesium (Tot.)	X		Log 10 Does Not Incorporate Lower Values
Calcium (Tot.)	X		Log 10 Does Not Incorporate Lower Values
Sodium (Tot.)		X	Log 10 Provides Best Fit & Incorporates Apparent Outlier
Potassium (Tot.)	X		Log 10 Does Not Incorporate Lower Values

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TABLE 3-4 (Continued)
BACKGROUND DETERMINATION IN GROUNDWATER - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
Volatile Organics (mg/l)			
Acrolein	X		Default Distribution
Acrylonitrile	X		Default Distribution
Benzene	X		Default Distribution
Bromoform	X		Default Distribution
Carbon tetrachloride			Distribution Not Evaluated
Chlorobenzene			Distribution Not Evaluated
Dibromochloromethane			Distribution Not Evaluated
Chloroethane			Distribution Not Evaluated
Chloroform	X		Default Distribution
Bromodichloromethane			Distribution Not Evaluated
1,1-Dichloroethane	X		Default Distribution
1,2-Dichloroethane	X		Default Distribution
1,1-Dichloroethene			Distribution Not Evaluated
1,2-Dichloropropane			Distribution Not Evaluated
Cis-1,3-Dichloropropene			Distribution Not Evaluated
Ethylbenzene	X		Default Distribution
Bromomethane	X		Default Distribution
Chloromethane	X		Default Distribution
Methylene chloride		X	Provided Tighter Fit & Incorporates Apparent Outlier
1,1,2,2-Tetrachloroethane			Distribution Not Evaluated
Tetrachloroethene	X		Default Distribution
Toluene	X		Default Distribution
1,1,1-Trichloroethane	X		Default Distribution
1,1,2-Trichloroethane			Distribution Not Evaluated
Trichloroethene	X		Default Distribution
Vinyl chloride	X		Default Distribution
Trans-1,3-Dichloropropene			Distribution Not Evaluated
Styrene			Distribution Not Evaluated
Acetone	X		Default Distribution
2-Butanone			Distribution Not Evaluated
Carbon disulfide			Distribution Not Evaluated
2-Hexanone	X		Default Distribution
4-Methyl-2-pentanone			Distribution Not Evaluated
Vinyl acetate			Distribution Not Evaluated
Xylenes (Total)	X		Default Distribution
1,2-Dichloroethene(Total)	X		Default Distribution
Isopropylbenzene	X		Default Distribution

TABLE 3-4 (Continued)
BACKGROUND DETERMINATION IN GROUNDWATER - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
Semi-Volatile Organics (mg/l)			
Acenaphthene	N/A		No Variability to determine distribution
Acenaphthylene	N/A		No Variability to determine distribution
Anthracene	X		
Benzo(a)anthracene			Distribution Not Evaluated
Benzo(a)pyrene	N/A		No Variability to determine distribution
Benzo(b)fluoranthene	N/A		No Variability to determine distribution
Benzo(g,h,i)perylene			Distribution Not Evaluated
Benzo(k)fluoranthene	N/A		No Variability to determine distribution
bis(2-Chloroethoxy)methane			Distribution Not Evaluated
bis(2-Chloroethyl)ether			Distribution Not Evaluated
bis(2-Chloroisopropyl)ether	X		
bis(2-Ethylhexyl)phthalate		X	Provides Greater Spread of Data
4-Bromophenyl phenyl ether			Distribution Not Evaluated
Butyl benzyl phthalate			Distribution Not Evaluated
2-Chloronaphthalene			Distribution Not Evaluated
4-Chlorophenyl phenyl ether			Distribution Not Evaluated
Chrysene			Distribution Not Evaluated
Dibenzo(a,h)anthracene	X		
1,2-Dichlorobenzene	X		
1,3-Dichlorobenzene	N/A		No Variability to determine distribution
1,4-Dichlorobenzene	X		
3-3-Dichlorobenzidine			Distribution Not Evaluated
Diethyl phthalate	N/A		No Variability to determine distribution
Dimethyl phthalate	N/A		No Variability to determine distribution
Di-n-butyl phthalate	N/A		No Variability to determine distribution
2,4-Dinitrotoluene	X		
2,6-Dinitrotoluene			Distribution Not Evaluated
Di-n-octyl phthalate	X		
Fluoranthene	N/A		No Variability to determine distribution
Fluorene	N/A		No Variability to determine distribution
Hexachlorobenzene	X		
Hexachlorobutadiene			Distribution Not Evaluated
Hexachlorocyclopentadiene			Distribution Not Evaluated
Hexachloroethane			Distribution Not Evaluated

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TABLE 3-4 (Continued)
BACKGROUND DETERMINATION IN GROUNDWATER - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
Semi-Volatile Organics (Con't)			
Indeno(1,2,3-cd)pyrene			Distribution Not Evaluated
Isophorone	X		
Naphthalene	N/A		No Variability to determine distribution
Nitrobenzene			Distribution Not Evaluated
N-Nitroso-di-n-propylamine			Distribution Not Evaluated
N-Nitrosodiphenylamine(1)			Distribution Not Evaluated
Phenanthrene	N/A		No Variability to determine distribution
Pyrene	N/A		No Variability to determine distribution
1,2,4-Trichlorobenzene			Distribution Not Evaluated
Benzyl alcohol	N/A		No Variability to determine distribution
4-Chloroaniline			Distribution Not Evaluated
Dibenzofuran	N/A		No Variability to determine distribution
2-Methylnaphthalene	N/A		No Variability to determine distribution
2-Nitroaniline			Distribution Not Evaluated
3-Nitroaniline	X		
4-Nitroaniline	N/A		No Variability to determine distribution
2-Chlorophenol			Distribution Not Evaluated
2,4-Dichlorophenol			Distribution Not Evaluated
2,4-Dimethylphenol	N/A		No Variability to determine distribution
4,6-Dinitro-2-methylphenol			Distribution Not Evaluated
2,4-Dinitrophenol			Distribution Not Evaluated
2-Nitrophenol			Distribution Not Evaluated
4-Nitrophenol	N/A		No Variability to determine distribution
4-Chloro-3-methylphenol	N/A		No Variability to determine distribution
Pentachlorophenol	N/A		No Variability to determine distribution
Phenol	N/A		No Variability to determine distribution
2,4,6-Trichlorophenol			Distribution Not Evaluated
2-Methylphenol	N/A		No Variability to determine distribution
4-Methylphenol	N/A		No Variability to determine distribution
Benzoic acid	N/A		No Variability to determine distribution
2,4,5-Trichlorophenol			Distribution Not Evaluated

TABLE 3-4 (Continued)
BACKGROUND DETERMINATION IN GROUNDWATER - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log 10 Distr.	NOTES
Pesticides (mg/l)			
Aldrin	N/A		No Variability to determine distribution
Alpha-BHC	N/A		No Variability to determine distribution
Beta-BHC			Distribution Not Evaluated
Gamma-BHC (Lindane)			Distribution Not Evaluated
Delta-BHC	N/A		No Variability to determine distribution
4,4'-DDT	N/A		No Variability to determine distribution
4,4'-DDE	N/A		No Variability to determine distribution
4,4'-DDD	N/A		No Variability to determine distribution
Dieldrin	N/A		No Variability to determine distribution
Endosulfan I			Distribution Not Evaluated
Endosulfan II	N/A		No Variability to determine distribution
Endosulfan sulfate	N/A		No Variability to determine distribution
Endrin	N/A		No Variability to determine distribution
Heptachlor	N/A		No Variability to determine distribution
Heptachlor epoxide	N/A		No Variability to determine distribution
PCB-1242			Distribution Not Evaluated
PCB-1254			Distribution Not Evaluated
PCB-1221			Distribution Not Evaluated
PCB-1232	N/A		No Variability to determine distribution
PCB-1248			Distribution Not Evaluated
PCB-1260			Distribution No Evaluated
PCB-1016			Distribution Not Evaluated
Toxaphene			Distirbution Not Evaluated
p,p'-Methoxychlor	N/A		No Variability to determine distribution
Endrin ketone	N/A		No Variability to determine distribution
Alpha chlordane			Distribution Not Evaluated
Gamma chlordane			Distribution Not Evaluated

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TABLE 3-4 (Continued)
BACKGROUND DETERMINATION IN GROUNDWATER - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
General Parameters (mg/l)			
Cyanide			Distribution Not Evaluated
Ammonia (N), Distillation		X	Log 10 Provides Better Fit and Incorporates Apparent Outlier
BOD(O2) - 5 day			Distribution Not Evaluated
Carbon, Total Organic (C)		X	Log 10 Provides Better Fit and Incorporates Apparent Outlier
COD(O2)			Distribution Not Evaluated
Chloride (Cl)		X	Log 10 Provides Better Fit and Incorporates Apparent Outlier
Hardness, Total (as CaCO3)			Distribution Not Evaluated
Nitrate (as N)		X	Log 10 Provides Better Fit and Incorporates Apparent Outlier
Nitrogen, Kjeldahl (N)	X		
pH	X		
Phosphorus, Dissolved		X	Log 10 Provides Better Fit and Incorporates Apparent Outlier
Solids, Dissolved at 180C	X		
Solids, Suspended at 103C			Distribution Not Evaluated
Oil and Grease			Distribution Not Evaluated
Petroleum Hydrocarbons			Distribution Not Evalauted
Sulfate, Turbid	X		Log 10 Did Not Incorporate Lower Concentrations
Surfactants (MBAS)	X		
Phosphorus, Total		X	Log 10 Provides Better Fit and Incorporates Apparent Outlier
Radiological Parameters (pCi/l)			
Gross Alpha		X	Log 10 Provides Better Fit and Incorporates Apparent Outlier
Gross Beta		X	Log 10 Provides Better Fit and Incorporates Apparent Outlier
Uranium, Total		X	Log 10 Provides Better Fit and Incorporates Apparent Outlier
Potassium-40		X	Log 10 Provides Better Fit and Incorporates Apparent Outlier
Miscellaneous			
Specific Conductivity	X		
Oxygen, Dissolved			Distribution Not Evaluated
Temperature			Distribution Not Evaluated

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3.2.3 Surface Water and Sediment

The analytical results from the surface water and sediment background samples were evaluated in a similar manner as described above for the soils and groundwater. Again, if a concentration was reported as below the CRQL, a value of one-half the CRQL was used in the statistical evaluation.

A summary of the statistical evaluation for the surface water background samples is enclosed in Appendix G. The selected representative distribution for the surface water data set is summarized in Table 3-5. A similar evaluation for the sediment is enclosed in Appendix H and the distribution summary is presented in Table 3-6.

A final note on the surface water and sediment samples is warranted. For certain chemicals, less than three samples (the number identified by Ohio EPA as required to conduct a statistical evaluation) were available. For these chemicals, a distribution determination was not conducted.

3.3 Statistical Background Development

The Ohio EPA guidance (1991) indicates that once the appropriate distribution has been identified the following equation should be utilized to obtain the background comparison levels and to determine if on-site chemical concentrations are statistically greater than background:

$$BG = X + k\,(a) \qquad \text{(Equation 3-3)}$$

Where,

- BG = Background concentration
- X = Mean of the background chemical
- k = Tolerance factor (obtained from Table 3-7)
- a = Relative standard deviation

Both the mean and the relative standard deviation were previously determined in Section 3.2 during the distribution evaluation.

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TABLE 3-5
BACKGROUND DETERMINATION IN SURFACE WATERS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log 10 Distr.	NOTES
Dissolved Metals (mg/l)			
Antimony (Dis.)	X		
Arsenic (Dis.)			Distribution Not Evaluated
Beryllium (Dis.)	X		
Cadmium (Dis.)			Distribution Not Evaluated
Chromium (Dis.)	X		
Copper (Dis)	X		
Lead (Dis.)	X		
Mercury (Dis.)			Distribution Not Evaluated
Nickel (Dis.)			Distribution Not Evaluated
Selenium (Dis.)			Distribution Not Evaluated
Silver (Dis.)			Distribution Not Evaluated
Thallium (Dis.)			Distribution Not Evaluated
Zinc (Dis.)			Distribution Not Evaluated
Barium (Dis.)	X		
Iron (Dis.)		X	Provides Tighter Fit of Data
Manganese (Dis.)	X		
Vanadium (Dis.)	N/A	N/A	
Aluminum (Dis.)		X	Incorporates Apparent Outlier
Cobalt (Dis.)	X		
Magnesium (Dis.)	X		
Calcium (Dis.)	X		
Sodium (Dis.)	X		
Potassium (Dis.)	X		
Total Metals (mg/l)			
Antimony (Tot.)			Distribution Not Evaluated
Arsenic (Tot.)			Distribution Not Evaluated
Beryllium (Tot.)			Distribution Not Evaluated
Cadmium (Tot.)			Distribution Not Evaluated
Chromium (Tot.)			Distribution Not Evaluated
Copper (Tot.)			Distribution Not Evaluated
Lead (Tot.)			Distribution Not Evaluated
Mercury (Tot.)			Distribution Not Evaluated
Nickel (Tot.)			Distribution Not Evaluated
Selenium (Tot.)			Distribution Not Evaluated
Silver (Tot.)			Distribution Not Evaluated
Thallium (Tot.)			Distribution Not Evaluated
Zinc (Tot.)			Distribution Not Evaluated
Barium (Tot.)			Distribution Not Evaluated
Iron (Tot.)			Distribution Not Evaluated
Manganese (Tot.)			Distribution Not Evaluated
Vanadium (Tot.)			Distribution Not Evaluated
Aluminum (Tot.)			Distribution Not Evaluated
Cobalt (Tot.)			Distribution Not Evaluated
Magnesium (Tot.)			Distribution Not Evaluated
Calcium (Tot.)			Distribution Not Evaluated
Sodium (Tot.)			Distribution Not Evaluated
Potassium (Tot.)			Distribution Not Evaluated

TABLE 3-5 (Continued)
BACKGROUND DETERMINATION IN SURFACE WATERS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
Volatile Organics (mg/l)			
Acrolein			Distribution Not Evaluated
Acrylonitrile	N/A	N/A	
Benzene			Distribution Not Evaluated
Bromoform			Distribution Not Evaluated
Carbon tetrachloride			Distribution Not Evaluated
Chlorobenzene			Distribution Not Evaluated
Dibromochloromethane			Distribution Not Evaluated
Chloroethane			Distribution Not Evaluated
Chloroform			Distribution Not Evaluated
Bromodichloromethane			Distribution Not Evaluated
1,1-Dichloroethane			Distribution Not Evaluated
1,2-Dichloroethane	X		
1,1-Dichloroethene			Distribution Not Evaluated
1,2-Dichloropropane			Distribution Not Evaluated
Cis-1,3-Dichloropropene			Distribution Not Evaluated
Ethylbenzene			Distribution Not Evaluated
Bromomethane			Distribution Not Evaluated
Chloromethane	X		
Methylene chloride	X		
1,1,2,2-Tetrachloroethane			Distribution Not Evaluated
Tetrachloroethene			Distribution Not Evaluated
Toluene			Distribution Not Evaluated
1,1,1-Trichloroethane			Distribution Not Evaluated
1,1,2-Trichloroethane			Distribution Not Evaluated
Trichloroethene			Distribution Not Evaluated
Vinyl chloride			Distribution Not Evaluated
Trans-1,3-Dichloropropene			Distribution Not Evaluated
Styrene			Distribution Not Evaluated
Acetone	X		
2-Butanone			Distribution Not Evaluated
Carbon disulfide			Distribution Not Evaluated
2-Hexanone			Distribution Not Evaluated
4-Methyl-2-pentanone			Distribution Not Evaluated
Vinyl acetate			Distribution Not Evaluated
Xylenes (Total)			Distribution Not Evaluated
1,2-Dichloroethene(Total)			Distribution Not Evaluated
Isopropylbenzene			Distribution Not Evaluated

TABLE 3-5 (Continued)
BACKGROUND DETERMINATION IN SURFACE WATERS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
Semi-Volatile Organics (mg/l)			
Acenaphthene			Distribution Not Evaluated
Acenaphthylene			Distribution Not Evaluated
Anthracene			Distribution Not Evaluated
Benzo(a)anthracene			Distribution Not Evaluated
Benzo(a)pyrene			Distribution Not Evaluated
Benzo(b)fluoranthene			Distribution Not Evaluated
Benzo(g,h,i)perylene			Distribution Not Evaluated
Benzo(k)fluoranthene			Distribution Not Evaluated
bis(2-Chloroethoxy)methane			Distribution Not Evaluated
bis(2-Chloroethyl)ether			Distribution Not Evaluated
bis(2-Chloroisopropyl)ether			Distribution Not Evaluated
bis(2-Ethylhexyl)phthalate	X		
4-Bromophenyl phenyl ether			Distribution Not Evaluated
Butyl benzyl phthalate			Distribution Not Evaluated
2-Chloronaphthalene			Distribution Not Evaluated
4-Chlorophenyl phenyl ether			Distribution Not Evaluated
Chrysene			Distribution Not Evaluated
Dibenzo(a,h)anthracene			Distribution Not Evaluated
1,2-Dichlorobenzene			Distribution Not Evaluated
1,3-Dichlorobenzene			Distribution Not Evaluated
1,4-Dichlorobenzene			Distribution Not Evaluated
3-3-Dichlorobenzidine			Distribution Not Evaluated
Diethyl phthalate			Distribution Not Evaluated
Dimethyl phthalate			Distribution Not Evaluated
Di-n-butyl phthalate			Distribution Not Evaluated
2,4-Dinitrotoluene			Distribution Not Evaluated
2,6-Dinitrotoluene			Distribution Not Evaluated
Di-n-octyl phthalate			Distribution Not Evaluated
Flouranthene			Distribution Not Evaluated
Fluorene			Distribution Not Evaluated
Hexachlorobenzene			Distribution Not Evaluated
Hexachlorobutadiene			Distribution Not Evaluated
Hexachlorocyclopentadiene			Distribution Not Evaluated
Hexachloroethane			Distribution Not Evaluated

TABLE 3-5 (Continued)
BACKGROUND DETERMINATION IN SURFACE WATERS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
Semi-Volatile Organics (Con't)			
Indeno(1,2,3-cd)pyrene			Distribution Not Evaluated
Isophorone			Distribution Not Evaluated
Naphthalene			Distribution Not Evaluated
Nitrobenzene			Distribution Not Evaluated
N-Nitroso-di-n-propylamine			Distribution Not Evaluated
N-Nitrosodiphenylamine(1)			Distribution Not Evaluated
Phenanthrene			Distribution Not Evaluated
Pyrene			Distribution Not Evaluated
1,2,4-Trichlorobenzene			Distribution Not Evaluated
Benzyl alcohol			Distribution Not Evaluated
4-Chloroaniline			Distribution Not Evaluated
Dibenzofuran			Distribution Not Evaluated
2-Methylnaphthalene			Distribution Not Evaluated
2-Nitroaniline			Distribution Not Evaluated
3-Nitroaniline			Distribution Not Evaluated
4-Nitroaniline			Distribution Not Evaluated
2-Chlorophenol			Distribution Not Evaluated
2,4-Dichlorophenol			Distribution Not Evaluated
2,4-Dimethylphenol			Distribution Not Evaluated
4,6-Dinitro-2-methylphenol			Distribution Not Evaluated
2,4-Dinitrophenol			Distribution Not Evaluated
2-Nitrophenol			Distribution Not Evaluated
4-Nitrophenol			Distribution Not Evaluated
4-Chloro-3-methylphenol			Distribution Not Evaluated
Pentachlorophenol			Distribution Not Evaluated
Phenol			Distribution Not Evaluated
2,4,6-Trichlorophenol			Distribution Not Evaluated
2-Methylphenol			Distribution Not Evaluated
4-Methylphenol			Distribution Not Evaluated
Benzoic acid			Distribution Not Evaluated
2,4,5-Trichlorophenol			Distribution Not Evaluated

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TABLE 3-5 (Continued)
BACKGROUND DETERMINATION IN SURFACE WATERS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
Pesticides (mg/l)			
Aldrin			Distribution Not Evaluated
Alpha-BHC			Distribution Not Evaluated
Beta-BHC			Distribution Not Evaluated
Gamma-BHC (Lindane)			Distribution Not Evaluated
Delta-BHC			Distribution Not Evaluated
4,4'-DDT			Distribution Not Evaluated
4,4'-DDE			Distribution Not Evaluated
4,4'-DDD			Distribution Not Evaluated
Dieldrin			Distribution Not Evaluated
Endosulfan I			Distribution Not Evaluated
Endosulfan II			Distribution Not Evaluated
Endosulfan sulfate			Distribution Not Evaluated
Endrin			Distribution Not Evaluated
Heptachlor			Distribution Not Evaluated
Heptachlor epoxide			Distribution Not Evaluated
PCB-1242			Distribution Not Evaluated
PCB-1254			Distribution Not Evaluated
PCB-1221			Distribution Not Evaluated
PCB-1232			Distribution Not Evaluated
PCB-1248			Distribution Not Evaluated
PCB-1260			Distribution Not Evaluated
PCB-1016			Distribution Not Evaluated
Toxaphene	X		
p,p'-Methoxychlor			Distribution Not Evaluated
Endrin ketone			Distribution Not Evaluated
Alpha chlordane			Distribution Not Evaluated
Gamma chlordane			Distribution Not Evaluated

TABLE 3-5 (Continued)
BACKGROUND DETERMINATION IN SURFACE WATERS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
General Parameters (mg/l)			
Cyanide			Distribution Not Evaluated
Ammonia (N), Distillation		X	Provides best fit
BOD(O2) - 5 day			Distribution Not Evaluated
Carbon, Total Organic (C)			Distribution Not Evaluated
COD(O2)			Distribution Not Evaluated
Chloride (Cl)	X		
Hardness, Total (as CaCO3)	N/A	N/A	
Nitrate (as N)			Distribution Not Evaluated
Nitrogen, Kjeldahl (N)			Distribution Not Evaluated
pH			Distribution Not Evaluated
Phosphorus, Dissolved			Distribution Not Evaluated
Solids, Dissolved at 180C			Distribution Not Evaluated
Solids, Suspended at 103C			Distribution Not Evaluated
Oil and Grease			Distribution Not Evaluated
Petroleum Hydrocarbons			Distribution Not Evaluated
Sulfate, Turbid	X		
Surfactants (MBAS)			Distribution Not Evaluated
Phosphorus, Total			Distribution Not Evaluated
Radiological Parameters (pCi/l)			
Gross Alpha			Distribution Not Evaluated
Gross Beta			Distribution Not Evaluated
Uranium, Total	X		
Potassium-40			Distribution Not Evaluated
Miscellaneous			
Specific Conductivity			Distribution Not Evaluated
Oxygen, Dissolved			Distribution Not Evaluated
Temperature			Distribution Not Evaluated

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TABLE 3-6
BACKGROUND DETERMINATION IN SEDIMENTS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
Dissolved Metals			
Antimony (Dis.)	N/A	N/A	Chemical Not Analyzed
Arsenic (Dis.)	N/A	N/A	Chemical Not Analyzed
Beryllium (Dis.)	N/A	N/A	Chemical Not Analyzed
Cadmium (Dis.)	N/A	N/A	Chemical Not Analyzed
Chromium (Dis.)	N/A	N/A	Chemical Not Analyzed
Copper (Dis)	N/A	N/A	Chemical Not Analyzed
Lead (Dis.)	N/A	N/A	Chemical Not Analyzed
Mercury (Dis.)	N/A	N/A	Chemical Not Analyzed
Nickel (Dis.)	N/A	N/A	Chemical Not Analyzed
Selenium (Dis.)	N/A	N/A	Chemical Not Analyzed
Silver (Dis.)	N/A	N/A	Chemical Not Analyzed
Thallium (Dis.)	N/A	N/A	Chemical Not Analyzed
Zinc (Dis.)	N/A	N/A	Chemical Not Analyzed
Barium (Dis.)	N/A	N/A	Chemical Not Analyzed
Iron (Dis.)	N/A	N/A	Chemical Not Analyzed
Manganese (Dis.)	N/A	N/A	Chemical Not Analyzed
Vanadium (Dis.)	N/A	N/A	Chemical Not Analyzed
Aluminum (Dis.)	N/A	N/A	Chemical Not Analyzed
Cobalt (Dis.)	N/A	N/A	Chemical Not Analyzed
Magnesium (Dis.)	N/A	N/A	Chemical Not Analyzed
Calcium (Dis.)	N/A	N/A	Chemical Not Analyzed
Sodium (Dis.)	N/A	N/A	Chemical Not Analyzed
Potassium (Dis.)	N/A	N/A	Chemical Not Analyzed
Total Metals (mg/kg)			
Antimony (Tot.)	X		
Arsenic (Tot.)	X		
Beryllium (Tot.)	X		
Cadmium (Tot.)	X		
Chromium (Tot.)	X		
Copper (Tot.)	X		
Lead (Tot.)	X		
Mercury (Tot.)	X		
Nickel (Tot.)	X		
Selenium (Tot.)		X	Better spread of data
Silver (Tot.)			Distribution Not Evaluated
Thallium (Tot.)			Distribution Not Evaluated
Zinc (Tot.)	N/A	N/A	
Barium (Tot.)	X		
Iron (Tot.)		X	Better fit of data set
Manganese (Tot.)	X		
Vanadium (Tot.)	N/A	N/A	
Aluminum (Tot.)	X		
Cobalt (Tot.)	X		
Magnesium (Tot.)	X		
Calcium (Tot.)	X		
Sodium (Tot.)		X	Incorporates apparent outlier
Potassium (Tot.)	X		

TABLE 3-6 (Continued)
BACKGROUND DETERMINATION IN SEDIMENTS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
Volatile Organics (mg/kg)			
Acrolein			Distribution Not Evaluated
Acrylonitrile			Distribution Not Evaluated
Benzene			Distribution Not Evaluated
Bromoform			Distribution Not Evaluated
Carbon tetrachloride			Distribution Not Evaluated
Chlorobenzene			Distribution Not Evaluated
Dibromochloromethane			Distribution Not Evaluated
Chloroethane			Distribution Not Evaluated
Chloroform			Distribution Not Evaluated
Bromodichloromethane			Distribution Not Evaluated
1,1-Dichloroethane			Distribution Not Evaluated
1,2-Dichloroethane			Distribution Not Evaluated
1,1-Dichloroethene			Distribution Not Evaluated
1,2-Dichloropropane			Distribution Not Evaluated
Cis-1,3-Dichloropropene			Distribution Not Evaluated
Ethylbenzene			Distribution Not Evaluated
Bromomethane			Distribution Not Evaluated
Chloromethane			Distribution Not Evaluated
Methylene chloride	X		
1,1,2,2-Tetrachloroethane			Distribution Not Evaluated
Tetrachloroethene			Distribution Not Evaluated
Toluene			Distribution Not Evaluated
1,1,1-Trichloroethane			Distribution Not Evaluated
1,1,2-Trichloroethane			Distribution Not Evaluated
Trichloroethene			Distribution Not Evaluated
Vinyl chloride			Distribution Not Evaluated
Trans-1,3-Dichloropropene			Distribution Not Evaluated
Styrene			Distribution Not Evaluated
Acetone		X	Better spread of data
2-Butanone			Distribution Not Evaluated
Carbon disulfide			Distribution Not Evaluated
2-Hexanone			Distribution Not Evaluated
4-Methyl-2-pentanone			Distribution Not Evaluated
Vinyl acetate			Distribution Not Evaluated
Xylenes (Total)			
1,2-Dichloroethene(Total)			Distribution Not Evaluated
Isopropylbenzene			

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TABLE 3-6 (Continued)
BACKGROUND DETERMINATION IN SEDIMENTS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
Semi-Volatile Organics (mg/kg)			
Acenaphthene	X		
Acenaphthylene	X		
Anthracene	X		
Benzo(a)anthracene	X		
Benzo(a)pyrene	X		
Benzo(b)fluoranthene	X		
Benzo(g,h,i)perylene	X		
Benzo(k)fluoranthene	X		
bis(2-Chloroethoxy)methane			Distribution Not Evaluated
bis(2-Chloroethyl)ether			Distribution Not Evaluated
bis(2-Chloroisopropyl)ether			Distribution Not Evaluated
bis(2-Ethylhexyl)phthalate	X		
4-Bromophenyl phenyl ether			Distribution Not Evaluated
Butyl benzyl phthalate			Distribution Not Evaluated
2-Chloronaphthalene			Distribution Not Evaluated
4-Chlorophenyl phenyl ether			Distribution Not Evaluated
Chrysene	X		
Dibenzo(a,h)anthracene	X		
1,2-Dichlorobenzene			Distribution Not Evaluated
1,3-Dichlorobenzene			Distribution Not Evaluated
1,4-Dichlorobenzene			Distribution Not Evaluated
3-3-Dichlorobenzidine			Distribution Not Evaluated
Diethyl phthalate			Distribution Not Evaluated
Dimethyl phthalate			Distribution Not Evaluated
Di-n-butyl phthalate	X		
2,4-Dinitrotoluene			Distribution Not Evaluated
2,6-Dinitrotoluene			Distribution Not Evaluated
Di-n-octyl phthalate			Distribution Not Evaluated
Flouranthene	X		
Fluorene	X		
Hexachlorobenzene			Chemical not Found on Site
Hexachlorobutadiene			Chemical not Found on Site
Hexachlorocyclopentadiene			Distribution Not Evaluated
Hexachloroethane			Distribution Not Evaluated

TABLE 3-6 (Continued)
BACKGROUND DETERMINATION IN SEDIMENTS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
Semi-Volatile Organics (Con't)			
Indeno(1,2,3-cd)pyrene	X		
Isophorone			Distribution Not Evaluated
Naphthalene	X		
Nitrobenzene			Distribution Not Evaluated
N-Nitroso-di-n-propylamine			Distribution Not Evaluated
N-Nitrosodiphenylamine(1)			
Phenanthrene	X		
Pyrene	X		
1,2,4-Trichlorobenzene			Distribution Not Evaluated
Benzyl alcohol			Distribution Not Evaluated
4-Chloroaniline			Distribution Not Evaluated
Dibenzofuran	X		
2-Methylnaphthalene	X		
2-Nitroaniline			Distribution Not Evaluated
3-Nitroaniline			Distribution Not Evaluated
4-Nitroaniline			Distribution Not Evaluated
2-Chlorophenol			Distribution Not Evaluated
2,4-Dichlorophenol			Distribution Not Evaluated
2,4-Dimethylphenol			Distribution Not Evaluated
4,6-Dinitro-2-methylphenol			Distribution Not Evaluated
2,4-Dinitrophenol			Distribution Not Evaluated
2-Nitrophenol			Distribution Not Evaluated
4-Nitrophenol			Distribution Not Evaluated
4-Chloro-3-methylphenol			Distribution Not Evaluated
Pentachlorophenol			Distribution Not Evaluated
Phenol			Distribution Not Evaluated
2,4,6-Trichlorophenol			Distribution Not Evaluated
2-Methylphenol			Distribution Not Evaluated
4-Methylphenol	N/A	N/A	
Benzoic acid	X		
2,4,5-Trichlorophenol			Distribution Not Evaluated

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TABLE 3-6 (Continued)
BACKGROUND DETERMINATION IN SEDIMENTS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
Pesticides (mg/kg)			
Aldrin			Distribution Not Evaluated
Alpha-BHC			Distribution Not Evaluated
Beta-BHC			Distribution Not Evaluated
Gamma-BHC (Lindane)			Distribution Not Evaluated
Delta-BHC			Distribution Not Evaluated
4,4'-DDT			Distribution Not Evaluated
4,4'-DDE			Distribution Not Evaluated
4,4'-DDD			Distribution Not Evaluated
Dieldrin			Distribution Not Evaluated
Endosulfan I			Distribution Not Evaluated
Endosulfan II			Distribution Not Evaluated
Endosulfan sulfate			Distribution Not Evaluated
Endrin			Distribution Not Evaluated
Heptachlor			Distribution Not Evaluated
Heptachlor epoxide			Distribution Not Evaluated
PCB-1242			Distribution Not Evaluated
PCB-1254			Distribution Not Evaluated
PCB-1221			Distribution Not Evaluated
PCB-1232			Distribution Not Evaluated
PCB-1248			Distribution Not Evaluated
PCB-1260			Distribution Not Evaluated
PCB-1016			Distribution Not Evaluated
Toxaphene			Distribution Not Evaluated
p,p'-Methoxychlor			Distribution Not Evaluated
Endrin ketone			Distribution Not Evaluated
Alpha chlordane			Distribution Not Evaluated
Gamma chlordane			Distribution Not Evaluated

TABLE 3-6 (Continued)
BACKGROUND DETERMINATION IN SEDIMENTS - DISTRIBUTION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Normal Distr.	Log10 Distr.	NOTES
General Parameters (mg/kg)			
Cyanide			Distribution Not Evaluated
Ammonia (N), Distillation	X		
BOD(O2) - 5 day			Distribution Not Evaluated
Carbon, Total Organic (C)			Distribution Not Evaluated
COD(O2)			Distribution Not Evaluated
Chloride (Cl)	X		
Hardness, Total (as CaCO3)			Distribution Not Evaluated
Nitrate (as N)			Distribution Not Evaluated
Nitrogen, Kjeldahl (N)			Distribution Not Evaluated
pH	N/A	N/A	
Phosphorus, Dissolved			Distribution Not Evaluated
Solids, Dissolved at 180C			Distribution Not Evaluated
Solids, Suspended at 103C			Distribution Not Evaluated
Oil and Grease			Distribution Not Evaluated
Petroleum Hydrocarbons			Distribution Not Evaluated
Sulfate, Turbid	X		
Surfactants (MBAS)			Distribution Not Evaluated
Phosphorus, Total	N/A	N/A	
Radiological Parameters (pCi/g)			
Gross Alpha	N/A	N/A	
Gross Beta	N/A	N/A	
Uranium, Total		X	
Potassium-40	N/A	N/A	
Miscellaneous			
Specific Conductivity			Distribution Not Evaluated
Oxygen, Dissolved			Distribution Not Evaluated
Temperature			Distribution Not Evaluated

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Table 3-7
Tolerance Factors for One-Sided Normal Tolerance Intervals

n	K	n	K	n	K	n	K	n	K
		11	2.815	21	2.371	31	2.209	45	2.092
		12	2.736	22	2.350	32	2.198	50	2.065
3	7.65	13	2.670	23	2.329	33	2.188	55	2.035
4	5.145	14	2.614	24	2.309	34	2.177	60	2.006
5	4.202	15	2.566	25	2.292	35	2.166		
6	3.707	16	2.523	26	2.278	36	2.158		
7	3.399	17	2.486	27	2.263	37	2.150		
8	3.188	18	2.543	28	2.249	38	2.141		
9	3.031	19	2.423	29	2.234	39	2.133		
10	2.911	20	2.396	30	2.220	40	2.125		

From Lieberman (1958). Values given such that 95% probability exists that the interval [$\bar{x}$, x + Ks] includes at least 95% of the distribution.

The guidance also indicates that the user is "... to treat the on-site data the same as the background data when applying the method of transformation." In other words, if certain chemicals required the Log_{10} transformation during the distribution determination, then the "on-site" data must also be transformed. Such a transformation process can be used effectively when a comparison for extent is being applied. However, the background values that are developed also need to be used during the baseline RA to assess the potential risk of identified chemicals. Because the risk factors (e.g., reference doses and slope factors) and the exposure equations require a concentration in "non-transformed" units, such an "across the board" transformation is not practical. Therefore, an inverse transform process is required to relate the transformed statistical evaluation back into standard concentration units. The inverse process is accomplished by taking the base 10 exponential of the background value (e.g., 10^x where x is the statistical background value).

The statistical background determination is summarized for each medium in Tables 3-8 through 3-11. The statistical background has been determined for all chemicals that had a positive hit for the specific medium. The statistical backgrounds were calculated based upon Equation 3-3, utilizing the tolerance values listed in Table 3-7.

The values in Tables 3-8 through 3-11 provided herein as background concentrations are calculated levels. While some of the figures were derived from available empirical data, others were developed using statistical analysis and assumptions with respect to analytic laboratory capabilities. There is no assertion that the values presented as background represent actual measurements of ambient concentrations.

3.4 Groundwater Sensitivity Analysis

Because the U.S. DOE groundwater data are unvalidated, a sensitivity analysis was performed on the calculated groundwater background levels. Using Equation 3-3, concentrations were calculated using the groundwater background data set with and without the U.S. DOE data. Then the percent difference in calculated values with

TABLE 3-8
BACKGROUND DETERMINATION IN SOILS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
Dissolved Metals						
Antimony (Dis.)	N/A	N/A	N/A			N/A
Arsenic (Dis.)	N/A	N/A	N/A			N/A
Beryllium (Dis.)	N/A	N/A	N/A			N/A
Cadmium (Dis.)	N/A	N/A	N/A			N/A
Chromium (Dis.)	N/A	N/A	N/A			N/A
Copper (Dis)	N/A	N/A	N/A			N/A
Lead (Dis.)	N/A	N/A	N/A			N/A
Mercury (Dis.)	N/A	N/A	N/A			N/A
Nickel (Dis.)	N/A	N/A	N/A			N/A
Selenium (Dis.)	N/A	N/A	N/A			N/A
Silver (Dis.)	N/A	N/A	N/A			N/A
Thallium (Dis.)	N/A	N/A	N/A			N/A
Zinc (Dis.)	N/A	N/A	N/A			N/A
Barium (Dis.)	N/A	N/A	N/A			N/A
Iron (Dis.)	N/A	N/A	N/A			N/A
Manganese (Dis.)	N/A	N/A	N/A			N/A
Vanadium (Dis.)	N/A	N/A	N/A			N/A
Aluminum (Dis.)	N/A	N/A	N/A			N/A
Cobalt (Dis.)	N/A	N/A	N/A			N/A
Magnesium (Dis.)	N/A	N/A	N/A			N/A
Calcium (Dis.)	N/A	N/A	N/A			N/A
Sodium (Dis.)	N/A	N/A	N/A			N/A
Potassium (Dis.)	N/A	N/A	N/A			N/A
Total Metals (mg/kg)						
Antimony (Tot.)	Normal	2.48	0.098	16	2.523	2.73
Arsenic (Tot.)	Normal	4.91	1.12	16	2.523	7.74
Beryllium (Tot.)	Normal	0.59	0.17	16	2.523	1.02
Cadmium (Tot.)	Normal	0.486	0.138	16	2.523	0.83
Chromium (Tot.)	Normal	14.68	3.48	16	2.523	23.46
Copper (Tot.)	Normal	16.89	4.55	16	2.523	28.37
Lead (Tot.)	Log Base 10	*1.32*	*0.29*	16	2.523	112.63
Mercury (Tot.)	Normal	0.079	0.047	16	2.523	0.20
Nickel (Tot.)	Normal	17.12	4.99	16	2.523	29.71
Selenium (Tot.)	Normal	0.524	0.74	16	2.523	2.39
Silver (Tot.)						ND
Thallium (Tot.)						ND
Zinc (Tot.)	Log Base 10	*1.84*	*0.21*	16	2.523	234.33
Barium (Tot.)	Normal	87.38	32.53	16	2.523	169.45
Iron (Tot.)	Normal	18354.38	4156.49	16	2.523	28841.20
Manganese (Tot.)	Normal	909.5	274.15	16	2.523	1601.18
Vanadium (Tot.)	Normal	22.36	4.82	16	2.523	34.52
Aluminum (Tot.)	Normal	11509.38	2871.42	16	2.523	18753.97
Cobalt (Tot.)	Normal	8.27	1.92	16	2.523	13.11
Magnesium (Tot.)	Log Base 10	*3.745*	*0.279*	16	2.523	28113.63
Calcium (Tot.)	Log Base 10	*4.046*	*0.407*	16	2.523	118266.30
Sodium (Tot.)	Normal	150.63	24.43	16	2.523	212.27
Potassium (Tot.)	Normal	1802.31	684.15	16	2.523	3528.42

TABLE 3-8 (Continued)
BACKGROUND DETERMINATION IN SOILS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
Volatile Organics (mg/kg)						
Acrolein						ND
Acrylonitrile						ND
Benzene	Normal	0.00297	0.00022	16	2.523	0.00353
Bromoform						ND
Carbon tetrachloride						ND
Chlorobenzene						ND
Dibromochloromethane						ND
Chloroethane						ND
Chloroform	Normal	0.00297	0.00022	16	2.523	0.00353
Bromodichloromethane						ND
1,1-Dichloroethane						ND
1,2-Dichloroethane						ND
1,1-Dichloroethene						ND
1,2-Dichloropropane						ND
Cis-1,3-Dichloropropene						ND
Ethylbenzene	Normal	0.00297	0.00022	16	2.523	0.00353
Bromomethane	Normal	0.00569	0.00036	16	2.523	0.00660
Chloromethane	Normal	0.00569	0.00036	16	2.523	0.00660
Methylene chloride	Log Base 10	*1.263*	*0.62*	16	2.523	0.672
1,1,2,2-Tetrachloroethane						ND
Tetrachloroethene	Normal	0.00297	0.00022	16	2.523	0.00353
Toluene	Normal	0.00297	0.00022	16	2.523	0.00353
1,1,1-Trichloroethane						ND
1,1,2-Trichloroethane						ND
Trichloroethene						ND
Vinyl chloride						ND
Trans-1,3-Dichloropropene	Normal	0.00297	0.00022	16	2.523	0.00353
Styrene	Normal	0.00297	0.00022	16	2.523	0.00353
Acetone	Log Base 10	*1.277*	*0.443*	16	2.523	0.248
2-Butanone	Normal	0.00569	0.00036	16	2.523	0.00660
Carbon disulfide						ND
2-Hexanone						ND
4-Methyl-2-pentanone						ND
Vinyl acetate						ND
Xylenes (Total)	Normal	0.00297	0.00022	16	2.523	0.00353
1,2-Dichloroethene(Total)	Normal	0.00297	0.00022	16	2.523	0.00353
Isopropylbenzene	Normal	0.00297	0.00022	16	2.523	0.00353

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TABLE 3-8 (Continued)
BACKGROUND DETERMINATION IN SOILS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
Semi-Volatile Organics (mg/kg)						
Acenaphthene	Log Base 10	*2.2702*	*0.0246*	16	2.523	0.215
Acenaphthylene	Log Base 10	*2.2702*	*0.0246*	16	2.523	0.215
Anthracene	Normal	0.1819	0.022	16	2.523	0.237
Benzo(a)anthracene	Log Base 10	*2.12*	*0.26*	16	2.523	0.597
Benzo(a)pyrene	Log Base 10	*2.13*	*0.32*	16	2.523	0.866
Benzo(b)fluoranthene	Log Base 10	*2.25*	*0.41*	16	2.523	1.925
Benzo(g,h,i)perylene	Log Base 10	*2.247*	*0.211*	16	2.523	0.602
Benzo(k)fluoranthene	Log Base 10	*2.21*	*0.44*	16	2.523	2.090
bis(2-Chloroethoxy)methane						ND
bis(2-Chloroethyl)ether						ND
bis(2-Chloroisopropyl)ether						ND
bis(2-Ethylhexyl)phthalate	Normal	0.333	0.108	16	2.523	0.605
4-Bromophenyl phenyl ether						ND
Butyl benzyl phthalate	Log Base 10	*2.2702*	*0.0246*	16	2.523	0.215
2-Chloronaphthalene						ND
4-Chlorophenyl phenyl ether						ND
Chrysene	Log Base 10	*2.14*	*0.31*	16	2.523	0.836
Dibenzo(a,h)anthracene	Normal	0.1925	0.0257	16	2.523	0.257
1,2-Dichlorobenzene						ND
1,3-Dichlorobenzene						ND
1,4-Dichlorobenzene						ND
3-3-Dichlorobenzidine						ND
Diethyl phthalate						ND
Dimethyl phthalate	Log Base 10	*2.2702*	*0.0246*	16	2.523	0.215
Di-n-butyl phthalate	Log Base 10	*2.2702*	*0.0246*	16	2.523	0.215
2,4-Dinitrotoluene	Log Base 10	*2.2702*	*0.0246*	16	2.523	0.215
2,6-Dinitrotoluene						ND
Di-n-octyl phthalate	Log Base 10	*2.2702*	*0.0246*	16	2.523	0.215
Fluoranthene	Normal	0.1928	0.124	16	2.523	0.506
Fluorene	Log Base 10	*2.2702*	*0.0246*	16	2.523	0.215
Hexachlorobenzene						ND
Hexachlorobutadiene						ND
Hexachlorocyclopentadiene						ND
Hexachloroethane						ND

TABLE 3-8 (Continued)
BACKGROUND DETERMINATION IN SOILS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
Semi-Volatile Organics (Continued)						
Indeno(1,2,3-cd)pyrene	Log Base 10	*2.19*	*0.25*	16	2.523	0.662
Isophorone						ND
Naphthalene	Log Base 10	*2.2702*	*0.0246*	16	2.523	0.215
Nitrobenzene						ND
N-Nitroso-di-n-propylamine						ND
N-Nitrosodiphenylamine(1)						ND
Phenanthrene	Normal	0.1263	0.0658	16	2.523	0.292
Pyrene	Normal	0.1871	0.1259	16	2.523	0.505
1,2,4-Trichlorobenzene						ND
Benzyl alcohol	Log Base 10	*2.2702*	*0.0246*	16	2.523	0.215
4-Chloroaniline						ND
Dibenzofuran	Log Base 10	*2.2702*	*0.0246*	16	2.523	0.215
2-Methylnaphthalene	Log Base 10	*2.2702*	*0.0246*	16	2.523	0.215
2-Nitroaniline						ND
3-Nitroaniline						ND
4-Nitroaniline						ND
2-Chlorophenol						ND
2,4-Dichlorophenol						ND
2,4-Dimethylphenol	Log Base 10	*2.2702*	*0.0246*	16	2.523	0.215
4,6-Dinitro-2-methylphenol	Normal	0.9031	0.0591	16	2.523	1.052
2,4-Dinitrophenol	Normal	0.9031	0.0591	16	2.523	1.052
2-Nitrophenol						ND
4-Nitrophenol	Normal	0.9031	0.0591	16	2.523	1.052
4-Chloro-3-methylphenol	Log Base 10	*2.2702*	*0.0246*	16	2.523	0.215
Pentachlorophenol	Normal	0.8468	0.2204	16	2.523	1.403
Phenol	Log Base 10	*2.2702*	*0.0246*	16	2.523	0.215
2,4,6-Trichlorophenol						ND
2-Methylphenol	Log Base 10	*2.2702*	*0.0246*	16	2.523	0.215
4-Methylphenol	Log Base 10	*2.2702*	*0.0246*	16	2.523	0.215
Benzoic acid	Normal	1.806	0.118	16	2.523	2.104
2,4,5-Trichlorophenol	Normal	0.9031	0.0591	16	2.523	1.052

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TABLE 3-8 (Continued)
BACKGROUND DETERMINATION IN SOILS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
Pesticides (mg/kg)						
Aldrin						ND
Alpha-BHC						ND
Beta-BHC	Normal	0.00899	0.00049	16	2.523	0.010
Gamma-BHC (Lindane)						ND
Delta-BHC						ND
4,4'-DDT	Normal	0.02734	0.04715	16	2.523	0.146
4,4'-DDE	Normal	0.06322	0.14374	16	2.523	0.426
4,4'-DDD	Normal	0.01794	0.001	16	2.523	0.020
Dieldrin	Normal	0.01794	0.001	16	2.523	0.020
Endosulfan I	Normal	0.00449	0.00025	16	2.523	0.005
Endosulfan II						ND
Endosulfan sulfate	Normal	0.01794	0.001	16	2.523	0.020
Endrin	Normal	0.00897	0.0005	16	2.523	0.010
Heptachlor						ND
Heptachlor epoxide	Normal	0.00449	0.00025	16	2.523	0.005
PCB-1242						ND
PCB-1254						ND
PCB-1221						ND
PCB-1232						ND
PCB-1248						ND
PCB-1260	Normal	0.1794	0.00998	16	2.523	0.205
PCB-1016	Normal	0.0899	0.00491	16	2.523	0.102
Toxaphene						ND
p,p'-Methoxychlor	Normal	0.04494	0.00246	16	2.523	0.051
Endrin ketone	Normal	0.01794	0.001	16	2.523	0.020
Alpha chlordane						ND
Gamma chlordane						ND

TABLE 3-8 (Continued)
BACKGROUND DETERMINATION IN SOILS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
General Parameters (mg/kg)						
Cyanide						N/A
Ammonia (N), Distillation	Log Base 10	*1.554*	*0.31*	16	2.523	216.835
BOD(O2) - 5 day						N/A
Carbon, Total Organic (C)						N/A
COD(O2)						N/A
Chloride (Cl)	Normal	5	0	16	2.523	5.000
Hardness, Total (as CaCO3)						N/A
Nitrate (as N)						N/A
Nitrogen, Kjeldahl (N)						N/A
pH	Normal	7.2	0.402	16	2.523	8.214
Phosphorus, Dissolved						N/A
Solids, Dissolved at 180C						N/A
Solids, Suspended at 103C						N/A
Oil and Grease						N/A
Petroleum Hydrocarbons						N/A
Sulfate, Turbid	Log Base 10	*2.314*	*0.54*	16	2.523	4747.008
Surfactants (MBAS)						N/A
Phosphorus, Total	Log Base 10	*2.336*	*0.449*	16	2.523	2943.249
Radiological Parameters (pCi/g)						
Gross Alpha	Normal	8.79	2.44	16	2.523	14.946
Gross Beta	Normal	18.94	4.51	16	2.523	30.319
Uranium, Total	Normal	0.63	0.21	16	2.523	1.160
Potassium-40	Normal	13.02	3.68	16	2.523	22.305
Miscellaneous						
Specific Conductivity						N/A
Oxygen, Dissolved						N/A
Temperature						N/A

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TABLE 3-9
BACKGROUND DETERMINATION IN GROUNDWATER - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
Dissolved Metals (mg/l)						
Antimony (Dis.)	Normal	0.0144	0.0038	35	2.166	0.0226
Arsenic (Dis.)	Normal	0.0017	0.00054	33	2.188	0.003
Beryllium (Dis.)	Normal	0.001	0.00104	35	2.166	0.003
Cadmium (Dis.)	Normal	0.0019	0.00077	36	2.158	0.004
Chromium (Dis.)	Normal	0.0026	0.00072	36	2.158	0.004
Copper (Dis)	Log Base 10	0.7	0.5	36	2.158	0.060
Lead (Dis.)	Log Base 10	0.5	0.61	62	2.005	0.053
Mercury (Dis.)	Normal	0.0001	0.00011	61	2.005	0.0003
Nickel (Dis.)	Normal	0.0107	0.00758	36	2.158	0.027
Selenium (Dis.)	Normal	0.0017	0.00084	29	2.234	0.004
Silver (Dis.)	Log Base 10	0.3	0.37	33	2.188	0.013
Thallium (Dis.)	Normal	0.0025	0.00262	35	2.166	0.008
Zinc (Dis.)	Log Base 10	1.1	0.61	37	2.15	0.258
Barium (Dis.)	Normal	0.0692	0.0261	62	2.005	0.122
Iron (Dis.)	Log Base 10	2.1	1.11	60	2.006	21.216
Manganese (Dis.)	Normal	0.186	0.1752	62	2.005	0.537
Vanadium (Dis.)	Normal	0.0068	0.0093	35	2.166	0.027
Aluminum (Dis.)	Log Base 10	1.8	0.36	40	2.125	0.367
Cobalt (Dis.)	Normal	0.003	0.0018	35	2.166	0.007
Magnesium (Dis.)	Normal	25.4516	4.0585	62	2.005	33.589
Calcium (Dis.)	Normal	100.0661	19.19334	62	2.005	138.549
Sodium (Dis.)	Log Base 10	4.2	0.29	62	2.005	60.457
Potassium (Dis.)	Log Base 10	3.4	0.15	62	2.005	5.021
Total Metals (mg/l)						
Antimony (Tot.)	Normal	0.0124	0.0013	21	2.371	0.015
Arsenic (Tot.)	Log Base 10	0.4	0.49	25	2.292	0.033
Beryllium (Tot.)	Normal	0.0023	0.002	22	2.35	0.007
Cadmium (Tot.)	Normal	0.0015	0.00073	23	2.329	0.003
Chromium (Tot.)	Log Base 10	0.9	0.6	25	2.292	0.188
Copper (Tot.)	Log Base 10	1.1	0.52	25	2.292	0.196
Lead (Tot.)	Log Base 10	0.6	0.53	24	2.309	0.067
Mercury (Tot.)	N/A					N/A
Nickel (Tot.)	Log Base 10	1	0.5	24	2.309	0.143
Selenium (Tot.)						ND
Silver (Tot.)						ND
Thallium (Tot.)						ND
Zinc (Tot.)	Log Base 10	1.5	0.49	25	2.292	0.420
Barium (Tot.)	Normal	0.0898	0.0412	25	2.292	0.184
Iron (Tot.)	Log Base 10	3.3	0.86	25	2.292	186.690
Manganese (Tot.)	Log Base 10	2.2	0.81	25	2.292	11.390
Vanadium (Tot.)	Normal	0.0133	0.0124	24	2.309	0.042
Aluminum (Tot.)	Log Base 10	2.5	0.76	24	2.309	17.982
Cobalt (Tot.)	Normal	0.007	0.0058	21	2.371	0.021
Magnesium (Tot.)	Normal	33.28	18.831	25	2.292	76.441
Calcium (Tot.)	Normal	112.334	54.9	25	2.292	238.165
Sodium (Tot.)	Log Base 10	4.2	0.47	25	2.292	189.339
Potassium (Tot.)	Normal	3.483	1.118	25	2.292	6.045

TABLE 3-9 (Continued)
BACKGROUND DETERMINATION IN GROUNDWATER - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
Volatile Organics (mg/l)						
Acrolein	N/A					N/A
Acrylonitrile	N/A					N/A
Benzene						ND
Bromoform	Normal	0.001	0.0002	27	2.263	0.00145
Carbon tetrachloride						ND
Chlorobenzene						ND
Dibromochloromethane						ND
Chloroethane						ND
Chloroform	Normal	0.001	0.0002	27	2.263	0.00145
Bromodichloromethane						ND
1,1-Dichloroethane	Normal	0.001	0.0002	27	2.263	0.00145
1,2-Dichloroethane	Normal	0.001	0.0002	27	2.263	0.00145
1,1-Dichloroethene						ND
1,2-Dichloropropane						ND
Cis-1,3-Dichloropropene						ND
Ethylbenzene						ND
Bromomethane	Normal	0.001	0.0002	27	2.263	0.00145
Chloromethane	Normal	0.001	0.0002	27	2.263	0.00145
Methylene chloride	Log Base 10	0.2111	0.4043	29	2.234	0.013
1,1,2,2-Tetrachloroethane						ND
Tetrachloroethene	Normal	0.001	0.0002	27	2.263	0.00145
Toluene						ND
1,1,1-Trichloroethane	Normal	0.001	0.0001	27	2.263	0.00123
1,1,2-Trichloroethane						ND
Trichloroethene	Normal	0.001	0.0002	27	2.263	0.00145
Vinyl chloride	Normal	0.001	0.0002	27	2.263	0.00145
Trans-1,3-Dichloropropene						ND
Styrene						ND
Acetone	Normal	0.0026	0.0003	27	2.263	0.00328
2-Butanone						
Carbon disulfide						ND
2-Hexanone	Normal	0.0026	0.0003	27	2.263	0.00328
4-Methyl-2-pentanone	N/A					N/A
Vinyl acetate						ND
Xylenes (Total)						ND
1,2-Dichloroethene(Total)	Normal	0.001	0.0002	27	2.263	0.00145
Isopropylbenzene						ND

000196

TABLE 3-9 (Continued)
BACKGROUND DETERMINATION IN GROUNDWATER - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
Semi-Volatile Organics (mg/l)						
Acenaphthene						
Acenaphthylene						
Anthracene						ND
Benzo(a)anthracene						
Benzo(a)pyrene						
Benzo(b)fluoranthene						
Benzo(g,h,i)perylene						
Benzo(k)fluoranthene						
bis(2-Chloroethoxy)methane						ND
bis(2-Chloroethyl)ether						ND
bis(2-Chloroisopropyl)ether						ND
bis(2-Ethylhexyl)phthalate	Log Base 10	0.06934	0.41229	29	2.234	0.010
4-Bromophenyl phenyl ether						ND
Butyl benzyl phthalate						ND
2-Chloronaphthalene						ND
4-Chlorophenyl phenyl ether						ND
Chrysene						ND
Dibenzo(a,h)anthracene						ND
1,2-Dichlorobenzene						ND
1,3-Dichlorobenzene						
1,4-Dichlorobenzene	Normal	0.00123	0.0012	26	2.278	0.0039
3-3-Dichlorobenzidine						ND
Diethyl phthalate						
Dimethyl phthalate						
Di-n-butyl phthalate						
2,4-Dinitrotoluene	Normal	0.0006	0.0007	28	2.249	0.002
2,6-Dinitrotoluene						ND
Di-n-octyl phthalate	Normal	0.001	0.0002	28	2.249	0.001
Fluoranthene						
Fluorene						
Hexachlorobenzene	Normal	0.0012	0.0011	28	2.249	0.004
Hexachlorobutadiene						ND
Hexachlorocyclopentadiene						ND
Hexachloroethane						ND

TABLE 3-9 (Continued)
BACKGROUND DETERMINATION IN GROUNDWATER - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
Semi-Volatile Organics (Continued)						
Indeno(1,2,3-cd)pyrene						ND
Isophorone						
Naphthalene						
Nitrobenzene						ND
N-Nitroso-di-n-propylamine						ND
N-Nitrosodiphenylamine(1)						ND
Phenanthrene						
Pyrene						
1,2,4-Trichlorobenzene						ND
Benzyl alcohol						
4-Chloroaniline						ND
Dibenzofuran						
2-Methylnaphthalene						
2-Nitroaniline						ND
3-Nitroaniline	Normal	0.0001	0.0002	28	2.249	0.001
4-Nitroaniline						
2-Chlorophenol						ND
2,4-Dichlorophenol						ND
2,4-Dimethylphenol						
4,6-Dinitro-2-methylphenol						ND
2,4-Dinitrophenol						ND
2-Nitrophenol						ND
4-Nitrophenol						
4-Chloro-3-methylphenol						
Pentachlorophenol						
Phenol						
2,4,6-Trichlorophenol						ND
2-Methylphenol						
4-Methylphenol						
Benzoic acid						
2,4,5-Trichlorophenol						ND

000198

TABLE 3-9 (Continued)
BACKGROUND DETERMINATION IN GROUNDWATER - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
Pesticides (mg/l)						
Aldrin						
Alpha-BHC						
Beta-BHC						ND
Gamma-BHC (Lindane)						ND
Delta-BHC						
4,4'-DDT						
4,4'-DDE						
4,4'-DDD						
Dieldrin						
Endosulfan I						ND
Endosulfan II						
Endosulfan sulfate						
Endrin						
Heptachlor						
Heptachlor epoxide						
PCB-1242						ND
PCB-1254						ND
PCB-1221						ND
PCB-1232						
PCB-1248						ND
PCB-1260						ND
PCB-1016						ND
Toxaphene						ND
p,p'-Methoxychlor						
Endrin ketone						
Alpha chlordane						ND
Gamma chlordane						ND

TABLE 3-9 (Continued)
BACKGROUND DETERMINATION IN GROUNDWATER - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
General Parameters (mg/l)						
Cyanide						N/A
Ammonia (N), Distillation	Log Base 10	1.8	0.4	70	2	0.398
BOD(O2) - 5 day						N/A
Carbon, Total Organic (C)	Log Base 10	3.5	0.48	40	2.125	33.113
COD(O2)						N/A
Chloride (Cl)	Log Base 10	4.5	0.25	92	2	100.000
Hardness, Total (as CaCO3)						N/A
Nitrate (as N)	Log Base 10	-0.6	1.05	61	2.005	0.032
Nitrogen, Kjeldahl (N)	Normal	30.2	94.8	10	2.911	306.163
pH	Normal	7.2	0.27	38	2.141	7.778
Phosphorus, Dissolved	Log Base 10	1.6	0.52	68	2	0.437
Solids, Dissolved at 180C	Normal	435.327	97.822	55	2.035	634.395
Solids, Suspended at 103C						N/A
Oil and Grease						N/A
Petroleum Hydrocarbons						N/A
Sulfate, Turbid	Normal	71.842	25.608	91	2	123.058
Surfactants (MBAS)	Normal	0.1793	0.1373	29	2.234	0.486
Phosphorus, Total	Log Base 10	2.2	0.75	19	2.523	12.367
Radiological Parameters (pCi/l)						
Gross Alpha	Log Base 10	1.233	0.732	46	2.09	579.269
Gross Beta	Log Base 10	1.384	0.564	46	2.09	365.393
Uranium, Total	Log Base 10	0.701	1.0369	55	2.035	647.279
Potassium-40	Log Base 10	1.752	0.2439	36	2.158	189.817
Miscellaneous						
Specific Conductivity	Normal	651.3	136.55	27	2.263	960.313
Oxygen, Dissolved						N/A
Temperature						N/A

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000200

TABLE 3-10
BACKGROUND DETERMINATION IN SURFACE WATERS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerances Factor	
Dissolved Metals (mg/l)						
Antimony (Dis.)	Normal	0.00555	0.00478	5	4.202	0.0256
Arsenic (Dis.)						ND
Beryllium (Dis.)	Normal	0.00166	0.0019	5	4.202	0.0096
Cadmium (Dis.)						ND
Chromium (Dis.)	Normal	0.0097	0.007	9	3.031	0.0309
Copper (Dis)	Normal	0.0063	0.00376	9	3.031	0.0177
Lead (Dis.)	Normal	0.00341	0.00361	9	3.031	0.0144
Mercury (Dis.)						ND
Nickel (Dis.)						ND
Selenium (Dis.)						ND
Silver (Dis.)						ND
Thallium (Dis.)						ND
Zinc (Dis.)	N/A					N/A
Barium (Dis.)	Normal	0.04266	0.01213	9	3.031	0.0794
Iron (Dis.)	Log Base 10	-0.7795	0.6568	9	3.031	16.270
Manganese (Dis.)	Normal	0.0255	0.01257	9	3.031	0.0636
Vanadium (Dis.)	Normal	0.008513	0.005467	8	3.188	0.0259
Aluminum (Dis.)	Log Base 10	-0.8151	0.61496	8	3.188	13.980
Cobalt (Dis.)	Normal	0.0038	0.00168	5	4.202	0.0109
Magnesium (Dis.)	Normal	18.096	5.176	8	3.188	34.597
Calcium (Dis.)	Normal	71.288	18.815	8	3.188	131.270
Sodium (Dis.)	Normal	10.468	2.925	8	3.188	19.793
Potassium (Dis.)	Normal	2.42	1.0637	9	3.031	5.644
Total Metals (mg/l)						
Antimony (Tot.)	N/A					N/A
Arsenic (Tot.)						ND
Beryllium (Tot.)						ND
Cadmium (Tot.)						ND
Chromium (Tot.)						ND
Copper (Tot.)						ND
Lead (Tot.)	N/A					N/A
Mercury (Tot.)						ND
Nickel (Tot.)						ND
Selenium (Tot.)						ND
Silver (Tot.)						ND
Thallium (Tot.)						ND
Zinc (Tot.)	N/A					N/A
Barium (Tot.)	N/A					N/A
Iron (Tot.)	N/A					N/A
Manganese (Tot.)	N/A					N/A
Vanadium (Tot.)						ND
Aluminum (Tot.)	N/A					N/A
Cobalt (Tot.)						ND
Magnesium (Tot.)	N/A					N/A
Calcium (Tot.)	N/A					N/A
Sodium (Tot.)	N/A					N/A
Potassium (Tot.)	N/A					N/A

TABLE 3-10 (Continued)
BACKGROUND DETERMINATION IN SURFACE WATERS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerances Factor	
Volatile Organics (mg/l)						
Acrolein						ND
Acrylonitrile	N/A					N/A
Benzene						ND
Bromoform						ND
Carbon tetrachloride						ND
Chlorobenzene						ND
Dibromochloromethane						ND
Chloroethane						ND
Chloroform						ND
Bromodichloromethane						ND
1,1-Dichloroethane						ND
1,2-Dichloroethane	Normal	0.0022	0.00067	5	4.202	0.0050
1,1-Dichloroethene						ND
1,2-Dichloropropane						ND
Cis-1,3-Dichloropropene						ND
Ethylbenzene						ND
Bromomethane						ND
Chloromethane	Normal	0.0042	0.0018	5	4.202	0.0118
Methylene chloride	Normal	0.00234	0.0017	5	4.202	0.0095
1,1,2,2-Tetrachloroethane						ND
Tetrachloroethene						ND
Toluene						ND
1,1,1-Trichloroethane						ND
1,1,2-Trichloroethane						ND
Trichloroethene						ND
Vinyl chloride						ND
Trans-1,3-Dichloropropene						ND
Styrene						ND
Acetone	Normal	0.00458	0.00102	6	3.707	0.0084
2-Butanone						ND
Carbon disulfide						ND
2-Hexanone						ND
4-Methyl-2-pentanone						ND
Vinyl acetate						ND
Xylenes (Total)						ND
1,2-Dichloroethene(Total)						ND
Isopropylbenzene						ND

000202

TABLE 3-10 (Continued)
BACKGROUND DETERMINATION IN SURFACE WATERS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerances Factor	
Semi-Volatile Organics (mg/l)						
Acenaphthene						ND
Acenaphthylene						ND
Anthracene						ND
Benzo(a)anthracene						ND
Benzo(a)pyrene						ND
Benzo(b)fluoranthene						ND
Benzo(g,h,i)perylene						ND
Benzo(k)fluoranthene						ND
bis(2-Chloroethoxy)methane						ND
bis(2-Chloroethyl)ether						ND
bis(2-Chloroisopropyl)ether						ND
bis(2-Ethylhexyl)phthalate	Normal	0.0035	0.00212	5	4.202	0.0124
4-Bromophenyl phenyl ether						ND
Butyl benzyl phthalate						ND
2-Chloronaphthalene						ND
4-Chlorophenyl phenyl ether						ND
Chrysene						ND
Dibenzo(a,h)anthracene						ND
1,2-Dichlorobenzene						ND
1,3-Dichlorobenzene						ND
1,4-Dichlorobenzene						ND
3-3-Dichlorobenzidine						ND
Diethyl phthalate						ND
Dimethyl phthalate						ND
Di-n-butyl phthalate						ND
2,4-Dinitrotoluene						ND
2,6-Dinitrotoluene						ND
Di-n-octyl phthalate						ND
Flouranthene						ND
Fluorene						ND
Hexachlorobenzene						ND
Hexachlorobutadiene						ND
Hexachlorocyclopentadiene						ND
Hexachloroethane						ND

TABLE 3-10 (Continued)
BACKGROUND DETERMINATION IN SURFACE WATERS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerances Factor	
Semi-Volatile Organics (Continued)						
Indeno(1,2,3-cd)pyrene						ND
Isophorone						ND
Naphthalene						ND
Nitrobenzene						ND
N-Nitroso-di-n-propylamine						ND
N-Nitrosodiphenylamine(1)						ND
Phenanthrene						ND
Pyrene						ND
1,2,4-Trichlorobenzene						ND
Benzyl alcohol						ND
4-Chloroaniline						ND
Dibenzofuran						ND
2-Methylnaphthalene						ND
2-Nitroaniline						ND
3-Nitroaniline						ND
4-Nitroaniline						ND
2-Chlorophenol						ND
2,4-Dichlorophenol						ND
2,4-Dimethylphenol						ND
4,6-Dinitro-2-methylphenol						ND
2,4-Dinitrophenol						ND
2-Nitrophenol						ND
4-Nitrophenol						ND
4-Chloro-3-methylphenol						ND
Pentachlorophenol						ND
Phenol						ND
2,4,6-Trichlorophenol						ND
2-Methylphenol						ND
4-Methylphenol						ND
Benzoic acid						ND
2,4,5-Trichlorophenol						ND

000204

TABLE 3-10 (Continued)
BACKGROUND DETERMINATION IN SURFACE WATERS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerances Factor	
Pesticides (mg/l)						
Aldrin						ND
Alpha-BHC						ND
Beta-BHC						ND
Gamma-BHC (Lindane)						ND
Delta-BHC						ND
4,4'-DDT						ND
4,4'-DDE						ND
4,4'-DDD						ND
Dieldrin						ND
Endosulfan I						ND
Endosulfan II						ND
Endosulfan sulfate						ND
Endrin						ND
Heptachlor						ND
Heptachlor epoxide						ND
PCB-1242						ND
PCB-1254						ND
PCB-1221						ND
PCB-1232						ND
PCB-1248						ND
PCB-1260						ND
PCB-1016						ND
Toxaphene	Normal	0.00032	0.000246	5	4.202	0.0014
p,p'-Methoxychlor						ND
Endrin ketone						ND
Alpha chlordane						ND
Gamma chlordane						ND

TABLE 3-10 (Continued)
BACKGROUND DETERMINATION IN SURFACE WATERS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerances Factor	
General Parameters (mg/l)						
Cyanide						N/A
Ammonia (N), Distillation	Log Base 10	-0.7768	0.5567	9	3.031	8.139
BOD(O2) - 5 day						N/A
Carbon, Total Organic (C)						N/A
COD(O2)						N/A
Chloride (Cl)	Normal	20.353	7.165	9	3.031	42.070
Hardness, Total (as CaCO3)	N/A					N/A
Nitrate (as N)						N/A
Nitrogen, Kjeldahl (N)						N/A
pH	N/A					N/A
Phosphorus, Dissolved	N/A					N/A
Solids, Dissolved at 180C	N/A					N/A
Solids, Suspended at 103C						N/A
Oil and Grease						N/A
Petroleum Hydrocarbons						N/A
Sulfate, Turbid	Normal	50.213	10.956	9	3.031	83.421
Surfactants (MBAS)						N/A
Phosphorus, Total	Normal	0.2344	0.1985	9	3.031	0.836
Radiological Parameters (pCi/l)						
Gross Alpha	N/A					N/A
Gross Beta	N/A					N/A
Uranium, Total	Normal	8.257	5.434	7	3.399	26.727
Potassium-40	N/A					N/A
Miscellaneous						
Specific Conductivity						N/A
Oxygen, Dissolved						N/A
Temperature						N/A

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000206

TABLE 3-11
BACKGROUND DETERMINATION IN SEDIMENTS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
Dissolved Metals						
Antimony (Dis.)	N/A	N/A	N/A			N/A
Arsenic (Dis.)	N/A	N/A	N/A			N/A
Beryllium (Dis.)	N/A	N/A	N/A			N/A
Cadmium (Dis.)	N/A	N/A	N/A			N/A
Chromium (Dis.)	N/A	N/A	N/A			N/A
Copper (Dis)	N/A	N/A	N/A			N/A
Lead (Dis.)	N/A	N/A	N/A			N/A
Mercury (Dis.)	N/A	N/A	N/A			N/A
Nickel (Dis.)	N/A	N/A	N/A			N/A
Selenium (Dis.)	N/A	N/A	N/A			N/A
Silver (Dis.)	N/A	N/A	N/A			N/A
Thallium (Dis.)	N/A	N/A	N/A			N/A
Zinc (Dis.)	N/A	N/A	N/A			N/A
Barium (Dis.)	N/A	N/A	N/A			N/A
Iron (Dis.)	N/A	N/A	N/A			N/A
Manganese (Dis.)	N/A	N/A	N/A			N/A
Vanadium (Dis.)	N/A	N/A	N/A			N/A
Aluminum (Dis.)	N/A	N/A	N/A			N/A
Cobalt (Dis.)	N/A	N/A	N/A			N/A
Magnesium (Dis.)	N/A	N/A	N/A			N/A
Calcium (Dis.)	N/A	N/A	N/A			N/A
Sodium (Dis.)	N/A	N/A	N/A			N/A
Potassium (Dis.)	N/A	N/A	N/A			N/A
Total Metals (mg/kg)						
Antimony (Tot.)	Normal	3.175	4.867	4	5.145	28.22
Arsenic (Tot.)	Normal	4.62	2.58	6	3.707	14.18
Beryllium (Tot.)	Normal	0.37	0.2	6	3.707	1.11
Cadmium (Tot.)	Normal	2.353	2.258	8	3.188	9.55
Chromium (Tot.)	Normal	13.4	6.75	6	3.707	38.42
Copper (Tot.)	Normal	10.6	2.72	6	3.707	20.68
Lead (Tot.)	Normal	*13.1*	*6.88*	4	5.145	48.50
Mercury (Tot.)	N/A					N/A
Nickel (Tot.)	Normal	14.35	4.53	6	3.707	31.14
Selenium (Tot.)	Log Base 10	-0.54	0.29	7	3.399	2.79
Silver (Tot.)						ND
Thallium (Tot.)						ND
Zinc (Tot.)	Normal	*20.23*	*7.98*	*6*	*3.707*	49.81
Barium (Tot.)	Normal	23.03	5.66	6	3.707	44.01
Iron (Tot.)	Log Base 10	3.84	0.08	6	3.707	13694.94
Manganese (Tot.)	Normal	352.17	55.55	6	3.707	558.09
Vanadium (Tot.)	Normal	*11.48*	*4.81*	6	3.707	29.31
Aluminum (Tot.)	Normal	2853.33	1174.8	6	3.707	7208.31
Cobalt (Tot.)	Normal	4.4	1.75	6	3.707	10.89
Magnesium (Tot.)	Normal	*23200*	*7152.6*	6	3.707	49714.69
Calcium (Tot.)	Normal	*82683.3*	*29982.2*	6	3.707	193827.31
Sodium (Tot.)	Log Base 10	2.37	0.21	6	3.707	1407.57
Potassium (Tot.)	Normal	648.5	285.25	8	3.188	1557.88

TABLE 3-11 (Continued)
BACKGROUND DETERMINATION IN SEDIMENTS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
Volatile Organics (mg/kg)						
Acrolein						ND
Acrylonitrile						ND
Benzene						ND
Bromoform						ND
Carbon tetrachloride						ND
Chlorobenzene						ND
Dibromochloromethane						ND
Chloroethane						ND
Chloroform						ND
Bromodichloromethane						ND
1,1-Dichloroethane						ND
1,2-Dichloroethane						ND
1,1-Dichloroethene						ND
1,2-Dichloropropane						ND
Cis-1,3-Dichloropropene						ND
Ethylbenzene						ND
Bromomethane						ND
Chloromethane						ND
Methylene chloride	Normal	0.014	0.0095	8	3.188	0.0443
1,1,2,2-Tetrachloroethane						ND
Tetrachloroethene						ND
Toluene						ND
1,1,1-Trichloroethane						ND
1,1,2-Trichloroethane						ND
Trichloroethene						ND
Vinyl chloride						ND
Trans-1,3-Dichloropropene						ND
Styrene						ND
Acetone	Log Base 10	-1.739	0.3999	8	3.188	0.3435
2-Butanone						ND
Carbon disulfide						ND
2-Hexanone						ND
4-Methyl-2-pentanone						ND
Vinyl acetate						ND
Xylenes (Total)						ND
1,2-Dichloroethene(Total)						ND
Isopropylbenzene						ND

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TABLE 3-11 (Continued)
BACKGROUND DETERMINATION IN SEDIMENTS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
Semi-Volatile Organics (mg/kg)						
Acenaphthene	Normal	*0.2113*	*0.02*	8	3.188	0.275
Acenaphthylene	Normal	*0.2113*	*0.02*	8	3.188	0.275
Anthracene	Normal	0.192	0.0603	8	3.188	0.384
Benzo(a)anthracene	Normal	*0.1943*	*0.0582*	8	3.188	0.380
Benzo(a)pyrene	Normal	*0.197*	*0.0636*	8	3.188	0.400
Benzo(b)fluoranthene	Normal	*0.1934*	*0.0469*	8	3.188	0.343
Benzo(g,h,i)perylene	Normal	*0.2031*	*0.0323*	8	3.188	0.306
Benzo(k)fluoranthene	Normal	*0.2209*	*0.0861*	8	3.188	0.495
bis(2-Chloroethoxy)methane						ND
bis(2-Chloroethyl)ether						ND
bis(2-Chloroisopropyl)ether						ND
bis(2-Ethylhexyl)phthalate	Normal	0.3319	0.1827	8	3.188	0.914
4-Bromophenyl phenyl ether						ND
Butyl benzyl phthalate						ND
2-Chloronaphthalene						ND
4-Chlorophenyl phenyl ether						ND
Chrysene	Normal	*0.1953*	*0.0638*	8	3.188	0.399
Dibenzo(a,h)anthracene	Normal	*0.2113*	*0.02*	8	3.188	0.275
1,2-Dichlorobenzene						ND
1,3-Dichlorobenzene						ND
1,4-Dichlorobenzene						ND
3-3-Dichlorobenzidine						ND
Diethyl phthalate						ND
Dimethyl phthalate						ND
Di-n-butyl phthalate	Normal	0.1114	0.0897	8	3.188	0.397
2,4-Dinitrotoluene						ND
2,6-Dinitrotoluene						ND
Di-n-octyl phthalate						ND
Flouranthene	Normal	0.2381	0.121	8	3.188	0.624
Fluorene	Normal	*0.2113*	*0.02*	8	3.188	0.275
Hexachlorobenzene						ND
Hexachlorobutadiene						ND
Hexachlorocyclopentadiene						ND
Hexachloroethane						ND

TABLE 3-11 (Continued)
BACKGROUND DETERMINATION IN SEDIMENTS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
Semi-Volatile Organics (Continued)						
Indeno(1,2,3-cd)pyrene	Normal	*0.2006*	*0.03812*	8	3.188	0.322
Isophorone						ND
Naphthalene	Normal	*0.2113*	*0.02*	8	3.188	0.275
Nitrobenzene						ND
N-Nitroso-di-n-propylamine						ND
N-Nitrosodiphenylamine(1)						ND
Phenanthrene	Normal	0.2026	0.0681	8	3.188	0.420
Pyrene	Normal	0.2369	0.1275	8	3.188	0.643
1,2,4-Trichlorobenzene						ND
Benzyl alcohol						ND
4-Chloroaniline						ND
Dibenzofuran	Normal	*0.2113*	*0.02*	8	3.188	0.275
2-Methylnaphthalene	Normal	*0.2113*	*0.02*	8	3.188	0.275
2-Nitroaniline						ND
3-Nitroaniline						ND
4-Nitroaniline						ND
2-Chlorophenol						ND
2,4-Dichlorophenol						ND
2,4-Dimethylphenol						ND
4,6-Dinitro-2-methylphenol						ND
2,4-Dinitrophenol						ND
2-Nitrophenol						ND
4-Nitrophenol						ND
4-Chloro-3-methylphenol						ND
Pentachlorophenol						ND
Phenol						ND
2,4,6-Trichlorophenol						ND
2-Methylphenol						ND
4-Methylphenol	N/A					N/A
Benzoic acid	Normal	1.0438	0.105	8	3.188	1.379
2,4,5-Trichlorophenol						ND

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TABLE 3-11 (Continued)
BACKGROUND DETERMINATION IN SEDIMENTS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
Pesticides (mg/kg)						
Aldrin						ND
Alpha-BHC						ND
Beta-BHC						ND
Gamma-BHC (Lindane)						ND
Delta-BHC						ND
4,4'-DDT						ND
4,4'-DDE						ND
4,4'-DDD						ND
Dieldrin						ND
Endosulfan I						ND
Endosulfan II						ND
Endosulfan sulfate						ND
Endrin						ND
Heptachlor						ND
Heptachlor epoxide						ND
PCB-1242						ND
PCB-1254						ND
PCB-1221						ND
PCB-1232						ND
PCB-1248						ND
PCB-1260						ND
PCB-1016						ND
Toxaphene						ND
p,p'-Methoxychlor						ND
Endrin ketone						ND
Alpha chlordane						ND
Gamma chlordane						ND

TABLE 3-11 (Continued)
BACKGROUND DETERMINATION IN SEDIMENTS - STATISTICAL SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BACKGROUND
	Distribution	Mean	Standard Deviation	No. Samples	Tolerance Factor	
General Parameters (mg/kg)						
Cyanide	Normal	0.859	0.435	7	3.399	2.338
Ammonia (N), Distillation	Normal	49.168	35.645	4	5.145	232.561
BOD(O2) - 5 day						N/A
Carbon, Total Organic (C)						N/A
COD(O2)						N/A
Chloride (Cl)	Normal	102.275	97.439	4	5.145	603.599
Hardness, Total (as CaCO3)						N/A
Nitrate (as N)						N/A
Nitrogen, Kjeldahl (N)						N/A
pH						N/A
Phosphorus, Dissolved						N/A
Solids, Dissolved at 180C						N/A
Solids, Suspended at 103C						N/A
Oil and Grease						N/A
Petroleum Hydrocarbons						N/A
Sulfate, Turbid	Normal	410.56	213.6	4	5.415	1567.204
Surfactants (MBAS)						N/A
Phosphorus, Total	Normal	248.28	354.53	4	5.145	2072.340
Radiological Parameters (pCi/g)						
Gross Alpha	N/A					N/A
Gross Beta	N/A					N/A
Uranium, Total	Log Base 10	0.1445	0.6372	8	3.188	149.932
Potassium-40	N/A					N/A
Miscellaneous						
Specific Conductivity						N/A
Oxygen, Dissolved						N/A
Temperature						N/A

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and without U.S. DOE data were calculated. The sensitivity analysis results are tabulated in Appendix J.

As shown in the tables in Appendix J, a majority of the percent differences are below 50%. In addition, the majority of background values increased when they were calculated without the U.S. DOE data. Hence, the sensitivity analysis indicates that the existing groundwater background concentrations are relatively insensitive to changes in the U.S. DOE data.

4.0 SUMMARY

The previous sections of this report have:

- Identified, for comparison purposes, concentration ranges typically found in the PRRS region based upon a review of available literature,
- Presented the methodology and analyses conducted for background samples,
- Confirmed that an adequate number of samples was collected, and
- Determined statistical background concentrations for Study Area comparison purposes, following Ohio EPA guidance.

This section summarizes and presents the medium-specific chemical background comparison values for the PRRS. The comparison values are developed by one of the following methods:

A. Statistical background calculated in accordance with the Ohio EPA "How Clean is Clean" policy (1991). These numbers are based upon the procedures presented in Section 3.

B. Background is the detection limit (DL), which is the highest reported CRQL (listed in parenthesis). The chemicals were not identified for that medium in either background or Study Area samples.

C. Background is listed as the DL, which is the CRQL. The chemical did not exhibit a positive hit in the background samples and the statistical evaluation (using a value of one-half the DL) resulted in a value less than the DL (which is the CRQL).

D. Not Applicable (N/A) as the chemical was not analyzed in the specific medium.

E. Background determined based upon the background analysis for the dissolved metals analysis. Note that the total concentration of a chemical incorporates both the dissolved and non-dissolved species and thus should be greater than the dissolved alone.

F. The background is listed as the DL, which is the CRQL. No variability was present in the background results to determine statistical background.

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G. The background is identified as the highest (maximum) reported value. An insufficient number of samples (<3) was available for statistical evaluation of background.

The following tables have been developed to summarize the background comparison values:

Table	Title
4-1	Total CLP Metals Background Concentration Summary
4-2	Dissolved CLP Metals Background Concentration Summary
4-3	CLP Volatile Background Concentration Summary
4-4	CLP Semivolatile Background Concentration Summary
4-5	CLP Pesticides/PCB Background Concentration Summary
4-6	General and Radiological Parameter Background Concentration Summary

Comparison of the magnitudes of the statistical background values for the PRRS to available outside references indicates that a large majority of the PRRS background values are similar to typical regional levels tabulated in Section 1.0 and in U.S. DOE's recent background documents (U.S. DOE, March 1993, May 1993).

TABLE 4-1
TOTAL CLP METALS BACKGROUND CONCENTRATION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Soils (mg/kg)		Groundwater (ug/l)		Sediments (mg/kg)		Surface Water (ug/l)	
	Concentration	Basis	Concentration	Basis	Concentration	Basis	Concentration	Basis
Aluminum	18753.97	A	17982.0	A	7208.31	A	13980.0	E
Antimony	4.96	C	15.0	A	28.22	A	22.0	E
Arsenic	7.74	A	33.0	A	14.18	A	DL (3.0)	E
Barium	169.45	A	184.0	A	44.01	A	79.4	E
Beryllium	1.02	A	7.0	A	1.11	A	DL (1.0)	B
Cadmium	0.83	A	3.0	A	9.55	A	DL (4.0)	B
Calcium	118266.30	A	238165.0	A	193827.31	A	131270.0	E
Chromium	23.46	A	188.0	A	38.42	A	DL (5.0)	B
Cobalt	13.11	A	21.0	A	10.89	A	DL (5.0)	B
Copper	28.37	A	196.0	A	20.68	A	DL (4.0)	B
Iron	28841.20	A	186690.0	A	13694.94	A	16270.0	E
Lead	112.63	A	67.0	A	48.50	A	14.4	E
Magnesium	28113.63	A	76441.0	A	49714.69	A	34597.0	E
Manganese	1601.18	A	11390.0	A	558.09	A	63.6	E
Mercury	0.20	A	0.2	F	DL (0 .1)	B	DL (0.2)	B
Nickel	29.71	A	143.0	A	31.14	A	DL(7.0)	B
Potassium	3528.42	A	6045.0	A	1557.88	A	5644.0	E
Selenium	2.39	A	DL (3.0)	B	2.79	A	DL (3.0)	B
Silver	DL (1.2)	B	DL (5.0)	B	DL (1.1)	B	DL (5.0)	B
Sodium	212.27	A	189339.0	A	1407.57	A	19793.0	E
Thallium	DL (0.73)	B	DL (3.0)	B	DL (0.63)	B	DL (3.0)	B
Vanadium	34.52	A	42.0	A	29.31	A	DL (4.0)	B
Zinc	234.33	A	420.0	A	49.81	A	3.7	G

539-15\BG\TAB-4-1.WQ!

Basis Notes:

A - Background determined statistically in accordance with Ohio EPA "How Clean is Clean" policy (July 1991).

B - Background identified as the detection limit (DL), which is the highest reported Contract Required Quantification Limit (CRQL) (listed in parenthesis). The constituent was not found in Site or background samples in the medium.

C - Background identified as the DL, which is the CRQL. The constituent did not exhibit a positive hit above the DL in the background samples. AND the statistical evaluation (using a value of one-half the DL) resulted in a value less than the DL (which is the CRQL).

D - Not Applicable (N/A) as the constituent was not analyzed in Site medium.

E - Background determined based upon results of the dissolved metals analysis.

F - Background listed as the DL, which is the CRQL. No variability was present in the background. results to determine statistical background.

G - Background identified as the highest (maximum) reported value. An insufficient number of samples (<3) was available for statistical evaluation of background.

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TABLE 4-2
DISSOLVED CLP METALS BACKGROUND CONCENTRATION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Soils (mg/kg)		Groundwater (ug/l)		Sediments (mg/kg)		Surface Water (ug/l)	
	Concentration	Basis	Concentration	Basis	Concentration	Basis	Concentration	Basis
Aluminum	N/A	D	367.0	A	N/A	D	13980.0	A
Antimony	N/A	D	39.0	C	N/A	D	22.0	C
Arsenic	N/A	D	3.0	A	N/A	D	DL (3.0)	B
Barium	N/A	D	122.0	A	N/A	D	79.4	A
Beryllium	N/A	D	5.0	C	N/A	D	9.64	A
Cadmium	N/A	D	5.0	C	N/A	D	DL (5.0)	B
Calcium	N/A	D	138549.0	A	N/A	D	131270.0	A
Chromium	N/A	D	4.0	A	N/A	D	30.9	A
Cobalt	N/A	D	7.0	A	N/A	D	10.9	A
Copper	N/A	D	60.0	A	N/A	D	17.7	A
Iron	N/A	D	21216.0	A	N/A	D	16270.0	A
Lead	N/A	D	53.0	A	N/A	D	14.4	A
Magnesium	N/A	D	33589.0	A	N/A	D	34597.0	A
Manganese	N/A	D	537.0	A	N/A	D	63.6	A
Mercury	N/A	D	0.3	A	N/A	D	DL (0.2)	B
Nickel	N/A	D	27.0	A	N/A	D	DL (29.0)	B
Potassium	N/A	D	5021.0	A	N/A	D	5644.0	A
Selenium	N/A	D	4.0	A	N/A	D	DL (3.0)	B
Silver	N/A	D	13.0	A	N/A	D	DL (5.0)	B
Sodium	N/A	D	60457.0	A	N/A	D	19793.0	A
Thallium	N/A	D	8.0	A	N/A	D	DL (3.0)	B
Vanadium	N/A	D	27.0	A	N/A	D	25.9	A
Zinc	N/A	D	258.0	A	N/A	D	14.8	G

539-15\BG\TAB-4-2-.WQ!

Basis Notes:

A - Background determined statistically in accordance with Ohio EPA "How Clean is Clean" policy (July 1991).

B - Background identified as the detection limit (DL), which is the highest reported Contract Required Quantification Limit (CRQL) (listed in parenthesis). The constituent was not found in Site or background samples in the medium.

C - Background identified as the DL, which is the CRQL. The constituent did not exhibit a positive hit above the DL in the background samples. AND the statistical evaluation (using a value of one-half the DL) resulted in a value less than the DL (which is the CRQL).

D - Not Applicable (N/A) as the constituent was not analyzed in Site medium.

E - Background determined based upon results of the dissolved metals analysis.

F - Background listed as the DL, which is the CRQL. No variability was present in the background. results to determine statistical background.

G - Background identified as the highest (maximum) reported value. An insufficient number of samples (<3) was available for statistical evaluation of background.

TABLE 4-3
CLP VOLATILE ORGANIC BACKGROUND CONCENTRATION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Soils (ug/kg)		Groundwater (ug/l)		Sediments (ug/kg)		Surface Water (ug/l)	
	Concentration	Basis	Concentration	Basis	Concentration	Basis	Concentration	Basis
Acrolein	N/A	D	25.0	C	N/A	D	DL(25.0)	B
Acrylonitrile	N/A	D	25.0	C	N/A	D	25.0	G
Benzene	5.9	C	5.0	C	DL(6.0)	B	DL(5.0)	B
Bromoform	DL(7.0)	B	5.0	C	DL(6.0)	B	DL(5.0)	B
Carbon tetrachloride	DL(7.0)	B	DL(5.0)	B	DL(6.0)	B	DL(5.0)	B
Chlorobenzene	DL(7.0)	B	DL(5.0)	B	DL(6.0)	B	DL(5.0)	B
Dibromochloromethane	DL(7.0)	B	DL(5.0)	B	DL(6.0)	B	DL(5.0)	B
Chloroethane	DL(13.0)	B	DL(10.0)	B	DL(13.0)	B	DL(10.0)	B
Chloroform	5.9	C	5.0	C	DL(6.0)	B	DL(5.0)	B
Bromodichloromethane	DL(7.0)	B	DL(50.0)	B	DL(6.0)	B	DL(5.0)	B
1,1-Dichloroethane	DL(7.0)	B	5.0	C	DL(6.0)	B	DL(5.0)	B
1,2-Dichloroethane	DL(7.0)	B	5.0	C	DL(6.0)	B	5.0	A
1,1-Dichloroethene	DL(7.0)	B	DL(5.0)	B	DL(6.0)	B	DL(5.0)	B
1,2-Dichloropropane	DL(7.0)	B	DL(5.0)	B	DL(6.0)	B	DL(5.0)	B
Cis-1,3-Dichloropropene	DL(7.0)	B	DL(5.0)	B	DL(6.0)	B	DL(5.0)	B
Ethylbenzene	5.9	C	5.0	C	6.0	C	DL(5.0)	B
Bromomethane	11.4	C	5.0	C	DL(13.0)	B	DL(10.0)	B
Chloromethane	11.4	C	5.0	C	DL(13.0)	B	11.8	A
Methylene chloride	672.0	A	13.0	A	44.3	A	9.5	A
1,1,2,2-Tetrachloroethane	DL(7.0)	B	DL(5.0)	B	DL(6.0)	B	DL(5.0)	B
Tetrachloroethene	5.9	C	5.0	C	DL(6.0)	B	DL(5.0)	B
Toluene	5.9	C	5.0	C	6.0	C	DL(5.0)	B
1,1,1-Trichloroethane	DL(7.0)	B	5.0	C	DL(6.0)	B	DL(5.0)	B
1,1,2-Trichloroethane	DL(7.0)	B	DL(5.0)	B	DL(6.0)	B	DL(5.0)	B
Trichloroethene	DL(7.0)	B	5.0	C	DL(6.0)	B	DL(5.0)	B
Vinyl chloride	DL(13.0)	B	5.0	C	DL(13.0)	B	DL(10.0)	B
Trans-1,3-dichloropropene	5.9	C	DL(5.0)	B	DL(6.0)	B	DL(5.0)	B
Styrene	5.9	C	DL(5.0)	B	DL(6.0)	B	DL(5.0)	B
Acetone	248.0	A	3.3	A	343.5	A	8.36	A
2-Butanone	11.4	C	DL(10.0)	B	DL(13.0)	B	DL(10.0)	B
Carbon disulfide	DL(7.0)	B	DL(5.0)	B	DL(6.0)	B	DL(5.0)	B
2-Hexanone	DL(13.0)	B	3.3	A	DL(13.0)	B	DL(10.0)	B
4-Methyl-2-pentanone	DL(13.0)	B	10.0	C	DL(13.0)	B	DL(10.0)	B
Vinyl acetate	DL(13.0)	B	DL(10.0)	B	DL(13.0)	B	DL(10.0)	B
Xylenes (total)	5.9	C	5.0	C	6.0	C	DL(5.0)	B
1,2-Dichloroethene (total)	5.9	C	5.0	C	DL(6.0)	B	DL(5.0)	B
Isopropylbenzene	5.9	C	5.0	C	6.0	C	DL(5.0)	B

539-15\BG\TAB-4-3.WQ!

Basis Notes:

A - Background determined statistically in accordance with Ohio EPA "How Clean is Clean" policy (July 1991).

B - Background identified as the detection limit (DL), which is the highest reported Contract Required Quantification Limit (CRQL) (listed in parenthesis). The constituent was not found in Site or background samples in the medium.

C - Background identified as the DL, which is the CRQL. The constituent did not exhibit a positive hit above the DL in the background samples. AND the statistical evaluation (using a value of one-half the DL) resulted in a value less than the DL (which is the CRQL).

D - Not Applicable (N/A) as the constituent was not analyzed in Site medium.

E - Background determined based upon results of the dissolved metals analysis.

F - Background listed as the DL, which is the CRQL. No variability was present in the background. results to determine statistical background.

G - Background identified as the highest (maximum) reported value. An insufficient number of samples (<3) was available for statistical evaluation of background.

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TABLE 4-4
CLP SEMI-VOLATILE ORGANIC BACKGROUND CONCENTRATION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Soils (ug/kg)		Groundwater (ug/l)		Sediments (ug/kg)		Surface Water (ug/l)	
	Concentration	Basis	Concentration	Basis	Concentration	Basis	Concentration	Basis
Acenaphthene	372.6	C	DL (10.0)	F	425.0	C	DL (10.0)	B
Acenaphthylene	372.6	C	DL (10.0)	F	425.0	C	DL (10.0)	B
Anthracene	237.0	A	DL (10.0)	B	384.0	A	DL (10.0)	B
Benzo(a)anthracene	597.0	A	DL (10.0)	B	380.0	A	DL (10.0)	B
Benzo(a)pyrene	866.0	A	DL (10.0)	F	400.0	A	DL (10.0)	B
Benzo(b)fluoranthene	1925.0	A	DL (10.0)	F	343.0	A	DL (10.0)	B
Benzo(g,h,i)perylene	602.0	A	DL (10.0)	B	306.0	A	DL (10.0)	B
Benzo(k)fluoranthene	2090.0	A	DL (10.0)	F	495.0	A	DL (10.0)	B
bis(2-Chloroethoxy)methane	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
bis(2-Chloroethyl)ether	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
bis(2-Chloroisopropyl)ether	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
bis(2-Ethylhexyl)phthalate	605.0	A	10.0	A	914.0	A	12.4	A
4-Bromophenyl phenyl ether	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
Butyl benzyl phthalate	372.6	C	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
2-Chloronaphthalene	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
4-Chlorophenyl phenyl ether	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
Chrysene	836.0	A	DL (10.0)	B	399.0	A	DL (10.0)	B
Dibenzo(a,h)anthracene	257.0	A	DL (10.0)	B	425.0	C	DL (10.0)	B
1,2-Dichlorobenzene	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
1,3-Dichlorobenzene	DL (430.0)	B	DL (10.0)	F	DL (420.0)	B	DL (10.0)	B
1,4-Dichlorobenzene	DL (430.0)	B	3.9	A	DL (420.0)	B	DL (10.0)	B
3-3-Dichlorobenzidine	DL (860.0)	B	DL (10.0)	B	DL (850.0)	B	DL (10.0)	B
Diethyl phthalate	DL (430.0)	B	DL (10.0)	F	DL (420.0)	B	DL (10.0)	B
Dimethyl phthalate	372.6	C	DL (10.0)	F	DL (420.0)	B	DL (10.0)	B
Di-n-butyl phthalate	372.6	C	DL (10.0)	F	397.0	A	DL (10.0)	B
2-4-Dinitrotoluene	372.6	C	2.1	A	DL (420.0)	B	DL (10.0)	B
2,6-Dinitrotoluene	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
Di-n-octyl phthalate	372.6	C	1.5	A	DL (420.0)	B	DL (10.0)	B
Fluoranthene	506.0	A	DL (10.0)	F	624.0	A	DL (10.0)	B
Fluorene	372.6	C	DL (10.0)	F	425.0	C	DL (10.0)	B
Hexachlorobenzene	DL (430.0)	B	3.8	A	DL (420.0)	B	DL (10.0)	B
Hexachlorobutadiene	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
Hexachlorocyclopentadiene	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
Hexachloroethane	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B

Basis Notes:

A - Background determined statistically in accordance with Ohio EPA "How Clean is Clean" policy (July 1991).

B - Background identified as the detection limit (DL), which is the highest reported Contract Required Quantification Limit (CRQL) (listed in parenthesis). The constituent was not found in Site or background samples in the medium.

C - Background identified as the DL, which is the CRQL. The constituent did not exhibit a positive hit above the DL in the background samples. AND the statistical evaluation (using a value of one-half the DL) resulted in a value less than the DL (which is the CRQL).

D - Not Applicable (N/A) as the constituent was not analyzed in Site medium.

E - Background determined based upon results of the dissolved metals analysis.

F - Background listed as the DL, which is the CRQL. No variability was present in the background. results to determine statistical background.

G - Background identified as the highest (maximum) reported value. An insufficient number of samples (<3) was available for statistical evaluation of background.

TABLE 4-4 (Continued)
CLP SEMI-VOLATILE ORGANIC BACKGROUND CONCENTRATION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Soils (ug/kg)		Groundwater (ug/l)		Sediments (ug/kg)		Surface Water (ug/l)	
	Concentration	Basis	Concentration	Basis	Concentration	Basis	Concentration	Basis
Indeno (1,2,3-cd)pyrene	662.0	A	DL (10.0)	B	425.0	C	DL (10.0)	B
Isophorone	DL (430.0)	B	DL (10.0)	C	DL (420.0)	B	DL (10.0)	B
Naphthalene	372.6	C	DL (10.0)	F	425.0	C	DL (10.0)	B
Nitrobenzene	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
Nitroso-di-n-propylamine	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
N-Nitrosodiphenylamine(1)	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
Phenanthrene	292.0	A	DL (10.0)	F	420.0	A	DL (10.0)	B
Pyrene	505.0	A	DL (10.0)	F	643.0	A	DL(10.0)	B
1,2,4-Trichlorobenzene	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
Benzyl alcohol	372.6	C	DL (10.0)	F	DL (420.0)	B	DL (10.0)	B
4-Chloroaniline	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
Dibenzofuran	372.6	C	DL (10.0)	F	425.0	C	DL (10.0)	B
2-Methylnaphthalene	372.6	C	DL (10.0)	F	425.0	C	DL (10.0)	B
2-Nitroaniline	DL (2100.0	B	DL (50.0)	B	DL (2100.0)	B	DL (50.0)	B
3-Nitroaniline	DL (2100.0)	B	DL (50.0)	C	DL (2100.0)	B	DL (50.0)	B
4-Nitroaniline	DL (2100.0)	B	DL (50.0)	F	DL (2100.0)	B	DL (50.0)	B
2-Chlorophenol	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
2,4-Dichlorophenol	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
2,4-Dimethylphenol	372.6	C	DL (10.0)	F	425.0	C	DL (10.0)	B
4,6-Dinitro-2-Methylphenol	1806.2	C	DL (50.0)	B	DL (2100.0)	B	DL (50.0)	B
2,4-Dinitrophenol	1806.2	C	DL (50.0)	B	DL (2100.0)	B	DL (50.0)	B
2-Nitrophenol	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
4-Nitrophenol	1806.2	C	DL (50.0)	F	DL (2100.0)	B	DL (50.0)	B
4-Chloro-3-methylphenol	1372.6	C	DL (10.0)	F	DL (420.0)	B	DL (10.0)	B
Pentachlorophenol	1403.0	A	DL (50.0)	F	DL (2100.0)	B	DL (50.0)	B
Phenol	372.6	C	DL (10.0)	F	425.0	C	DL (10.0)	B
2,4,6-Trichlorophenol	DL (430.0)	B	DL (10.0)	B	DL (420.0)	B	DL (10.0)	B
2-Methylphenol	372.6	C	DL (10.0)	F	DL (420.0)	B	DL (10.0)	B
4-Methylphenol	372.6	C	DL (10.0)	F	425.0	C	DL (10.0)	B
Benzoic acid	3612.4	C	DL (50.0)	F	1379.0	A	DL (50.0)	B
2,4,5-Trichlorophenol	1806.2	C	DL (50.0)	B	DL (2100.0)	B	DL (50.0)	B

539-15\BG\TAB-4-4.WQ!

Basis Notes:

A - Background determined statistically in accordance with Ohio EPA "How Clean is Clean" policy (July 1991).

B - Background identified as the detection limit (DL), which is the highest reported Contract Required Quantification Limit (CRQL) (listed in parenthesis). The constituent was not found in Site or background samples in the medium.

C - Background identified as the DL, which is the CRQL. The constituent did not exhibit a positive hit above the DL in the background samples. AND the statistical evaluation (using a value of one-half the DL) resulted in a value less than the DL (which is the CRQL).

D - Not Applicable (N/A) as the constituent was not analyzed in Site medium.

E - Background determined based upon results of the dissolved metals analysis.

F - Background listed as the DL, which is the CRQL. No variability was present in the background. results to determine statistical background.

G - Background identified as the highest (maximum) reported value. An insufficient number of samples (<3) was available for statistical evaluation of background.

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TABLE 4-5
CLP PESTICIDES/PCB BACKGROUND CONCENTRATION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Soils (ug/kg)		Groundwater (ng/l)		Sediments (ug/kg)		Surface Water (ng/l)	
	Concentration	Basis	Concentration	Basis	Concentration	Basis	Concentration	Basis
Pesticides								
Aldrin	DL (10.0)	B	DL (5.0)	F	DL (10.0)	B	DL (5.0)	B
Alpha-BHC	DL (10.0)	B	DL (5.0)	F	DL (10.0)	B	DL (5.0)	B
Beta-BHC	18.0	C	DL (5.0)	B	DL (10.0)	B	DL (5.0)	B
Gamma-BHC	DL (10.0)	B	DL (5.0)	B	DL (10.0)	B	DL (5.0)	B
Delta-BHC	DL (10.0)	B	DL (5.0)	F	DL (10.0)	B	DL (5.0)	B
4,4'-DDT	146.0	A	DL (10.0)	F	DL (20.0)	B	DL (10.0)	B
4,4'-DDE	426.0	A	DL (10.0)	F	DL (20.0)	B	DL (10.0)	B
4,4-DDD	35.9	C	DL (10.0)	F	DL (20.0)	B	DL (10.0)	B
Dieldrin	35.9	C	DL (10.0)	F	DL (20.0)	B	DL (10.0)	B
Endosulfan I	9.0	C	DL (5.0)	B	DL (10.0)	B	DL (5.0)	B
Endosulfan II	DL (20.0)	B	DL (10.0)	F	DL (20.0)	B	DL (10.0)	B
Endosulfan Sulfate	35.9	C	DL (10.0)	F	DL (20.0)	B	DL (10.0)	B
Endrin	17.9	C	DL (10.0)	F	DL (20.0)	B	DL (10.0)	B
Heptachlor	DL (10.0)	B	DL (5.0)	F	DL (10.0)	B	DL (5.0)	B
Heptachlor epoxide	9.0	C	DL (10.0)	F	DL (10.0)	B	DL (10.0)	B
Toxaphene	DL (200.0)	B	DL (100.0)	B	DL (200.0)	B	1350.0	A
p,p'-Methoxychlor	89.8	C	DL (50.0)	F	DL (100.0)	B	DL (50.0)	B
Endrin Ketone	35.9	C	DL (10.0)	F	DL (20.0)	B	DL (10.0)	B
Alpha Chlordane	DL (100.0)	B	DL (50.0)	B	DL (100.0)	B	DL (50.0)	B
Gamma Chlordane	DL (100.0)	B	DL (50.0)	B	DL (100.0)	B	DL (50.0)	B
Polychlorinated Biphenyls								
PCB-1242	DL (100.0)	B	DL (50.0)	B	DL (100.0)	B	DL (50.0)	B
PCB-1254	DL (200.0)	B	DL (100.0)	B	DL (200.0)	B	DL (100.0)	B
PCB-1221	DL (100.0)	B	DL (50.0)	B	DL (100.0)	B	DL (50.0)	B
PCB-1232	DL (100.0)	B	DL (50.0)	F	DL (100.0)	B	DL (50.0)	B
PCB-1248	DL (100.0)	B	DL (50.0)	B	DL (100.0)	B	DL (50.0)	B
PCB-1260	358.8	C	DL (100.0)	B	DL (200.0)	B	DL (100.0)	B
PCB-1016	179.8	C	DL (50.0)	B	DL (100.0)	B	DL (50.0)	B

539-15\BG\TAB-4-5.WQ!

Basis Notes:

A - Background determined statistically in accordance with Ohio EPA "How Clean is Clean" policy (July 1991).

B - Background identified as the detection limit (DL), which is the highest reported Contract Required Quantification Limit (CRQL) (listed in parenthesis). The constituent was not found in Site or background samples in the medium.

C - Background identified as the DL, which is the CRQL. The constituent did not exhibit a positive hit above the DL in the background samples. AND the statistical evaluation (using a value of one-half the DL) resulted in a value less than the DL (which is the CRQL).

D - Not Applicable (N/A) as the constituent was not analyzed in Site medium.

E - Background determined based upon results of the dissolved metals analysis.

F - Background listed as the DL, which is the CRQL. No variability was present in the background. results to determine statistical background.

G - Background identified as the highest (maximum) reported value. An insufficient number of samples (<3) was available for statistical evaluation of background.

TABLE 4-6
GENERAL AND RADIOLOGICAL BACKGROUND CONCENTRATION SUMMARY
PADDYS RUN ROAD SITE

CHEMICAL	Soils (mg/kg)		Groundwater (mg/l)		Sediments (mg/kg)		Surface Water (mg/l)	
	Concentration	Basis	Concentration	Basis	Concentration	Basis	Concentration	Basis
General Parameter								
Cyanide	DL(0.52)	D	DL (0.01)	D	2.338	A	DL (0.01)	D
Ammonia	216.835	A	0.398	A	232.561	A	8.139	A
Chloride	10	C	100	A	603.6	A	42.07	A
Total Organic Carbon	N/A	D	33.113	A	N/A	D	N/A	D
Nitrate	N/A	D	0.032	A	N/A	D	N/A	D
pH (S.U.*)	6.798-8.214	A	6.62-7.78	A	7.2 - 7.5	G	7.2 - 7.5	G
Total Phosphorus	2943.249	A	12.367	A	2072.34	A	0.836	A
Diss. Phosphorus	N/A	D	0.437	A	N/A	D	0.1	G
Diss. Solids	N/A	D	634.395	A	N/A	D	N/A	D
Sulfate	4747.008	A	123.068	A	1567.204	A	83.421	A
Radiological (pCi/l and pCi/g)								
Gross Alpha	14.946	A	579.27	A	7.4	G	17	G
Gross Beta	30.319	A	365.393	A	16	G	18	G
Total Uranium	1.16	A	647.279	A	149.932	A	26.727	A
Potassium-40	22.305	A	189.817	A	5.7	G	DL (80)	G

539-15\BG\TAB-4-6.WQ!

Basis Notes:

A - Background determined statistically in accordance with Ohio EPA "How Clean is Clean" policy (July 1991).

B - Background identified as the detection limit (DL), which is the highest reported Contract Required Quantification Limit (CRQL) (listed in parenthesis). The constituent was not found in Site or background samples in the medium.

C - Background identified as the DL, which is the CRQL. The constituent did not exhibit a positive hit above the DL in the background samples. AND the statistical evaluation (using a value of one-half the DL) resulted in a value less than the DL (which is the CRQL).

D - Not Applicable (N/A) as the constituent was not analyzed in Site medium.

E - Background determined based upon results of the dissolved metals analysis.

F - Background listed as the DL, which is the CRQL. No variability was present in the background. results to determine statistical background.

G - Background identified as the highest (maximum) reported value. An insufficient number of samples (<3) was available for statistical evaluation of background.

* Standard Units

000232

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REV. 1: MAY 1994

APPENDIX A

SURFACE SOIL RESULTS SUMMARY

data file: g:/project/539-02/bg/soil/SSBGREV.CSS
[55 cases with 42 variables]

0 CASE NAME	1 ARSENIC	2 BERYLLIU	3 CHROMIUM	4 COPPER
BG-01-01	4.60000	.52000	14.70000	18.40000
BG-02-01	5.10000	.62000	16.90000	22.60000
BG-03-01	4.80000	.56000	13.80000	19.50000
BG-04-01	5.10000	.50000	16.60000	18.70000
BG-05-01	5.10000	.54000	15.40000	13.70000
BG-06-01	5.50000	.58000	13.40000	12.70000
BG-07-01	5.50000	.62000	14.40000	15.00000
BG-08-01	3.40000	.49000	14.00000	12.40000
BG-09-01	3.50000	.51000	12.40000	13.00000
BG-10-01	4.50000	.68000	14.60000	16.70000
BG-11-01	4.00000	.61000	13.40000	17.80000
BG-12-01	8.00000	.60000	14.00000	18.30000
BG-13-01	4.00000	.11000	4.40000	6.10000
BG-14-01	4.30000	.90000	19.80000	23.60000
BG-15-01	4.90000	.83000	19.30000	22.10000
BG-16-01	6.30000	.73000	17.70000	19.60000

data file: g:/project/539-02/bg/soil/SSBGREV.CSS
[55 cases with 42 variables]

0 CASE NAME	5 LEAD	6 NICKEL	7 ZINC	8 BARIUM
BG-01-01	40.30000	15.30000	89.20000	115.00000
BG-02-01	78.50000	17.40000	173.00000	160.00000
BG-03-01	69.80000	16.10000	179.00000	112.00000
BG-04-01	51.50000	15.70000	94.60000	111.00000
BG-05-01	20.60000	15.20000	65.50000	107.00000
BG-06-01	18.90000	14.70000	56.60000	85.60000
BG-07-01	11.70000	16.20000	51.40000	47.60000
BG-08-01	13.50000	15.10000	50.00000	74.40000
BG-09-01	17.10000	13.90000	51.60000	71.80000
BG-10-01	17.30000	18.60000	60.80000	94.10000
BG-11-01	18.30000	15.00000	69.80000	72.00000
BG-12-01	18.00000	16.80000	69.60000	67.40000
BG-13-01	6.50000	6.90000	23.70000	14.20000
BG-14-01	13.80000	28.40000	75.40000	99.90000
BG-15-01	13.70000	24.80000	70.40000	88.50000
BG-16-01	16.10000	23.80000	62.60000	77.60000

000227

data file: g:/project/539-02/bg/soil/SSBGREV.CSS
[55 cases with 42 variables]

0 CASE NAME	9 IRON	10 MANGANES	11 VANADIUM	12 ALUMINUM
BG-01-01	17000.00000	1050.00000	24.00000	12400.00000
BG-02-01	19600.00000	1270.00000	26.80000	14700.00000
BG-03-01	16800.00000	1120.00000	18.40000	10400.00000
BG-04-01	18000.00000	1040.00000	25.60000	13200.00000
BG-05-01	17900.00000	1160.00000	26.60000	12800.00000
BG-06-01	17200.00000	999.00000	20.10000	9500.00000
BG-07-01	19600.00000	464.00000	23.60000	12000.00000
BG-08-01	15400.00000	773.00000	21.80000	11200.00000
BG-09-01	15800.00000	846.00000	16.30000	8920.00000
BG-10-01	18800.00000	950.00000	20.50000	11300.00000
BG-11-01	17200.00000	733.00000	18.40000	9220.00000
BG-12-01	19600.00000	666.00000	25.70000	11600.00000
BG-13-01	7570.00000	280.00000	10.10000	3610.00000
BG-14-01	26200.00000	1230.00000	27.60000	15400.00000
BG-15-01	24200.00000	1090.00000	27.20000	14700.00000
BG-16-01	22800.00000	881.00000	25.00000	13200.00000

data file: g:/project/539-02/bg/soil/SSBGREV.CSS
[55 cases with 42 variables]

0 CASE NAME	13 COBALT	14 MAGNESIU	15 CALCIUM	16 SODIUM
BG-01-01	6.90000	7950.00000	15700.00000	145.00000
BG-02-01	8.20000	5270.00000	11800.00000	170.00000
BG-03-01	7.00000	12400.00000	29500.00000	167.00000
BG-04-01	8.20000	5920.00000	16600.00000	164.00000
BG-05-01	8.00000	6290.00000	13000.00000	143.00000
BG-06-01	7.50000	6560.00000	10600.00000	141.00000
BG-07-01	7.00000	5550.00000	14300.00000	146.00000
BG-08-01	8.10000	2300.00000	3220.00000	151.00000
BG-09-01	9.00000	2150.00000	2150.00000	135.00000
BG-10-01	8.80000	3820.00000	6130.00000	140.00000
BG-11-01	8.40000	2630.00000	5580.00000	108.00000
BG-12-01	8.10000	9510.00000	26100.00000	157.00000
BG-13-01	3.60000	27100.00000	116000.00000	217.00000
BG-14-01	12.20000	5260.00000	9880.00000	167.00000
BG-15-01	10.90000	4250.00000	6440.00000	138.00000
BG-16-01	10.40000	4090.00000	6720.00000	121.00000

data file: g:/project/539-02/bg/soil/SSBGREV.CSS
[55 cases with 42 variables]

0 CASE NAME	17 POTASSIU	18 BENZO_A	19 BEN_A_PY	20 BEN_B_FL
BG-01-01	2350.00000	190.00000	190.00000	190.00000
BG-02-01	2410.00000	58.00000	91.00000	200.00000
BG-03-01	1790.00000	120.00000	160.00000	360.00000
BG-04-01	2260.00000	70.00000	83.00000	200.00000
BG-05-01	1630.00000	41.00000	49.00000	62.00000
BG-06-01	1070.00000	54.00000	55.00000	120.00000
BG-07-01	1440.00000	150.00000	150.00000	290.00000
BG-08-01	1580.00000	180.00000	180.00000	65.00000
BG-09-01	1290.00000	190.00000	190.00000	50.00000
BG-10-01	1520.00000	95.00000	92.00000	200.00000
BG-11-01	1120.00000	190.00000	38.00000	70.00000
BG-12-01	1160.00000	370.00000	900.00000	2900.00000
BG-13-01	837.00000	170.00000	170.00000	170.00000
BG-14-01	3210.00000	195.00000	195.00000	195.00000
BG-15-01	2720.00000	185.00000	185.00000	185.00000
BG-16-01	2450.00000	190.00000	190.00000	190.00000

data file: g:/project/539-02/bg/soil/SSBGREV.CSS
[55 cases with 42 variables]

0 CASE NAME	21 BEN_K_FL	22 CHRYSENE	23 FLUORANT	24 INDENO
BG-01-01	45.00000	190.00000	67.00000	190.00000
BG-02-01	200.00000	75.00000	89.00000	65.00000
BG-03-01	360.00000	140.00000	190.00000	96.00000
BG-04-01	200.00000	110.00000	190.00000	54.00000
BG-05-01	61.00000	55.00000	99.00000	195.00000
BG-06-01	120.00000	62.00000	140.00000	175.00000
BG-07-01	290.00000	140.00000	210.00000	60.00000
BG-08-01	65.00000	180.00000	59.00000	180.00000
BG-09-01	50.00000	190.00000	57.00000	190.00000
BG-10-01	200.00000	120.00000	300.00000	215.00000
BG-11-01	70.00000	42.00000	84.00000	190.00000
BG-12-01	2900.00000	940.00000	120.00000	530.00000
BG-13-01	170.00000	170.00000	340.00000	170.00000
BG-14-01	195.00000	195.00000	390.00000	195.00000
BG-15-01	185.00000	185.00000	370.00000	185.00000
BG-16-01	190.00000	190.00000	380.00000	190.00000

000231

data file: g:/project/539-02/bg/soil/SSBGREV.CSS
[55 cases with 42 variables]

0	25	26	27	28
CASE NAME	PHENANTH	PYRENE	ALPHA	BETA
BG-01-01	190.00000	49.00000	3.80000	11.00000
BG-02-01	175.00000	81.00000	8.50000	15.00000
BG-03-01	64.00000	200.00000	13.00000	17.00000
BG-04-01	78.00000	150.00000	6.70000	16.00000
BG-05-01	42.00000	88.00000	9.90000	16.00000
BG-06-01	49.00000	100.00000	9.30000	17.00000
BG-07-01	55.00000	210.00000	12.00000	19.00000
BG-08-01	180.00000	50.00000	8.50000	20.00000
BG-09-01	190.00000	60.00000	7.70000	22.00000
BG-10-01	160.00000	190.00000	7.40000	27.00000
BG-11-01	50.00000	75.00000	9.60000	18.00000
BG-12-01	48.00000	260.00000	11.00000	18.00000
BG-13-01	170.00000	340.00000	5.30000	14.00000
BG-14-01	195.00000	390.00000	10.00000	27.00000
BG-15-01	185.00000	370.00000	11.00000	22.00000
BG-16-01	190.00000	380.00000	7.00000	24.00000

data file: g:/project/539-02/bg/soil/SSBGREV.CSS
[55 cases with 42 variables]

0 CASE NAME	29 URANIUM	30 POTASSIU	31 LG10BNZK	32 LG10CHRY
BG-01-01	.60000	9.50000	1.65321	2.27875
BG-02-01	.50000	11.00000	2.30103	1.87506
BG-03-01	.50000	11.00000	2.55630	2.14613
BG-04-01	.20000	11.00000	2.30103	2.04139
BG-05-01	.60000	7.50000	1.78533	1.74036
BG-06-01	.60000	9.70000	2.07918	1.79239
BG-07-01	.60000	9.70000	2.46240	2.14613
BG-08-01	.90000	16.00000	1.81291	2.25527
BG-09-01	1.00000	17.00000	1.69897	2.27875
BG-10-01	.90000	18.00000	2.30103	2.07918
BG-11-01	.90000	14.00000	1.84510	1.62325
-12-01	.50000	13.00000	3.46240	2.97313
-13-01	.60000	8.90000	2.23045	2.23045
-14-01	.50000	18.00000	2.29003	2.29003
-15-01	.40000	18.00000	2.26717	2.26717
-16-01	.70000	16.00000	2.27875	2.27875

000233

data file: g:/project/539-02/bg/soil/SSBGREV.CSS
[55 cases with 42 variables]

0 CASE NAME	33 LG10INDE	34 LOG10PB	35 LOG10ZN	36 LOG10MN
BG-01-01	2.27875	1.60531	1.95036	3.02119
BG-02-01	1.81291	1.89487	2.23805	3.10380
BG-03-01	1.98227	1.84386	2.25285	3.04922
BG-04-01	1.73239	1.71181	1.97589	3.01703
BG-05-01	2.29003	1.31387	1.81624	3.06446
BG-06-01	2.24304	1.27646	1.75282	2.99957
BG-07-01	1.77815	1.06819	1.71096	2.66652
BG-08-01	2.25527	1.13033	1.69897	2.88818
BG-09-01	2.27875	1.23300	1.71265	2.92737
BG-10-01	2.33244	1.23805	1.78390	2.97772
BG-11-01	2.27875	1.26245	1.84386	2.86510
BG-12-01	2.72428	1.25527	1.84261	2.82347
BG-13-01	2.23045	.81291	1.37475	2.44716
BG-14-01	2.29003	1.13988	1.87737	3.08991
BG-15-01	2.26717	1.13672	1.84757	3.03743
BG-16-01	2.27875	1.20683	1.79657	2.94498

data file: g:/project/539-02/bg/soil/SSBGREV.CSS
[55 cases with 42 variables]

0	37	38	39	40
CASE NAME	LG10BNZB	LG10BENZ	LG10BENA	LOG10FLT
BG-01-01	2.27875	2.27875	2.27875	1.82607
BG-02-01	2.30103	1.76343	1.95904	1.94939
BG-03-01	2.55630	2.07918	2.20412	2.27875
BG-04-01	2.30103	1.84510	1.91908	2.27875
BG-05-01	1.79239	1.61278	1.69020	1.99564
BG-06-01	2.07918	1.73239	1.74036	2.14613
BG-07-01	2.46240	2.17609	2.17609	2.32222
BG-08-01	1.81291	2.25527	2.25527	1.77085
BG-09-01	1.69897	2.27875	2.27875	1.75587
BG-10-01	2.30103	1.97772	1.96379	2.47712
BG-11-01	1.84510	2.27875	1.57978	1.92428
BG-12-01	3.46240	2.56820	2.95424	2.07918
BG-13-01	2.23045	2.23045	2.23045	2.53148
BG-14-01	2.29003	2.29003	2.29003	2.59106
BG-15-01	2.26717	2.26717	2.26717	2.56820
BG-16-01	2.27875	2.27875	2.27875	2.57978

data file: g:/project/539-02/bg/soil/SSBGREV.CSS
[55 cases with 42 variables]

0	41	42
CASE NAME	LOG10PYR	L10MGNES
BG-01-01	1.69020	3.9003671
BG-02-01	1.90849	3.7218106
BG-03-01	2.30103	4.0934217
BG-04-01	2.17609	3.7723217
BG-05-01	1.94448	3.7986506
BG-06-01	2.00000	3.8169038
BG-07-01	2.32222	3.7442930
BG-08-01	1.69897	3.3617278
BG-09-01	1.77815	3.3324385
BG-10-01	2.27875	3.5820634
BG-11-01	1.87506	3.4199557
BG-12-01	2.41497	3.9781805
BG-13-01	2.53148	4.4329693
BG-14-01	2.59106	3.7209857
BG-15-01	2.56820	3.6283889
BG-16-01	2.57978	3.6117233

css/3: basic stats

Descriptive Statistics
N. of Cases = 16 [from 55]
(MD pairwise deleted)

	N	Min	Max	Mean	St. Err.	St. Dev.
ARSENIC	16	3.400	8.0	4.91	.280	1.12
BERYLLIU	16	.110	.9	.59	.043	.17
CHROMIUM	16	4.400	19.8	14.68	.870	3.48
COPPER	16	6.100	23.6	16.89	1.137	4.55
LEAD	16	6.500	78.5	26.60	5.409	21.63
NICKEL	16	6.900	28.4	17.12	1.247	4.99
ZINC	16	23.700	179.0	77.70	10.431	41.72
BARIUM	16	14.200	160.0	87.38	8.132	32.53
IRON	16	7570.000	26200.0	18354.38	1039.121	4156.49
MANGANES	16	280.000	1270.0	909.50	68.538	274.15
VANADIUM	16	10.100	27.6	22.36	1.205	4.82
ALUMINUM	16	3610.000	15400.0	11509.38	717.854	2871.42
COBALT	16	3.600	12.2	8.27	.480	1.92
MAGNESIU	16	2150.000	27100.0	6940.63	1501.604	6006.42
CALCIUM	16	2150.000	116000.0	18357.50	6779.437	27117.75
SODIUM	16	108.000	217.0	150.63	6.107	24.43
POTASSIU	16	837.000	3210.0	1802.31	171.037	684.15
BENZO_A	16	41.000	370.0	153.00	20.320	81.28
BEN_A_PY	16	38.000	900.0	182.38	49.928	199.71
BEN_B_FL	16	50.000	2900.0	340.44	171.908	687.63
BEN_K_FL	16	45.000	2900.0	331.31	172.680	690.72
CHRYSENE	16	42.000	940.0	186.50	51.997	207.99
FLUORANT	16	57.000	390.0	192.81	30.989	123.95
INDENO	16	54.000	530.0	180.00	27.025	108.10
PHENANTH	16	42.000	195.0	126.31	16.453	65.81
PYRENE	16	49.000	390.0	187.06	31.481	125.92
ALPHA	16	3.800	13.0	8.79	.610	2.44
BETA	16	11.000	27.0	18.94	1.127	4.51
URANIUM	16	.200	1.0	.63	.053	.21
POTASSIU	16	7.500	18.0	13.02	.920	3.68
LG10BNZK	16	1.653	3.5	2.21	.109	.44
LG10CHRY	16	1.623	3.0	2.14	.078	.31
LG10INDE	16	1.732	2.7	2.19	.062	.25
LOG10PB	16	.813	1.9	1.32	.074	.29
LOG10ZN	16	1.375	2.3	1.84	.052	.21
LOG10MN	16	2.447	3.1	2.93	.043	.17
LG10BNZB	16	1.699	3.5	2.25	.102	.41
LG10BENZ	16	1.613	2.6	2.12	.065	.26
LG10BENA	16	1.580	3.0	2.13	.081	.32
LOG10FLT	16	1.756	2.6	2.19	.075	.30

000237

css/3: basic stats	Descriptive Statistics N. of Cases = 16 [from 55] (MD pairwise deleted)					
	N	Min	Max	Mean	St. Err.	St. Dev.
LOG10PYR	16	1.690	2.6	2.17	.081	.33
L10MGNES	16	3.332	4.4	3.74	.070	.28

css/3: basic stats	Descriptive Statistics N. of Cases = 16 [from 55] (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
ARSENIC	5.51	4.31
BERYLLIU	.68	.50
CHROMIUM	16.54	12.81
COPPER	19.32	14.45
LEAD	38.19	15.01
NICKEL	19.79	14.45
ZINC	100.05	55.35
BARIUM	104.81	69.95
IRON	20581.30	16127.45
MANGANES	1056.38	762.62
VANADIUM	24.94	19.77
ALUMINUM	13047.80	9970.95
COBALT	9.30	7.24
MAGNESIU	10158.69	3722.56
CALCIUM	32886.41	3828.59
SODIUM	163.71	137.54
POTASSIU	2168.86	1435.77
BENZO_A	196.55	109.45
BEN_A_PY	289.38	75.37
BEN_B_FL	708.85	-27.98
BEN_K_FL	701.38	-38.76
CHRYSENE	297.93	75.07
FLUORANT	259.22	126.40
INDENO	237.92	122.08
PHENANTH	161.57	91.05
PYRENE	254.53	119.60
ALPHA	10.10	7.49
BETA	21.35	16.52
URANIUM	.74	.51
POTASSIU	14.99	11.05
LG10BNZK	2.44	1.97
LG10CHRY	2.31	1.98
LG10INDE	2.32	2.06
LOG10PB	1.48	1.16
LOG10ZN	1.95	1.73
LOG10MN	3.02	2.84
LG10BNZB	2.47	2.03
LG10BENZ	2.26	1.98
LG10BENA	2.30	1.96
LOG10FLT	2.35	2.03

000239

data file: g:/project/539-02/bg/soil/ADDBGSS2.CSS
[16 cases with 31 variables]

0	1	2	3	4	5	6	7	8
C	SAMPLE	CADMIUM	MERCURY	METH_CHL	ACETONE	ANTHRACE	BENZO_GH	BIS_2_ET
1	101.000	.430	.140	3.000	6.000	190.000	190.000	190.000
2	102.000	.445	.220	96.000	130.000	175.000	74.000	175.000
3	103.000	1.000	.110	21.500	17.500	190.000	190.000	190.000
4	104.000	.445	.120	3.000	5.500	175.000	57.000	175.000
5	105.000	.445	.055	3.000	6.000	195.000	195.000	195.000
6	106.000	.455	.055	24.500	16.500	175.000	175.000	175.000
7	107.000	.460	.060	120.000	19.500	185.000	185.000	185.000
8	108.000	.445	.055	3.000	41.000	180.000	180.000	180.000
9	109.000	.480	.060	32.000	24.000	190.000	190.000	190.000
1	110.000	.450	.055	190.000	180.000	215.000	215.000	215.000
1	111.000	.460	.055	36.000	17.000	190.000	190.000	190.000
1	112.000	.430	.055	30.500	13.500	110.000	580.000	58.000
1	113.000	.435	.055	2.500	5.000	170.000	170.000	170.000
1	114.000	.480	.060	20.000	20.500	195.000	195.000	67.000
1	115.000	.460	.055	32.000	18.500	185.000	185.000	185.000
1	116.000	.450	.055	31.000	24.000	190.000	190.000	190.000

data file: g:/project/539-02/bg/soil/ADDBGSS2.CSS
[16 cases with 31 variables]

	9	10	11	12	13	14	15	16
C	DIBENZO	PCP	DDT	DDE	SELENIUM	SILVER	THALLIUM	ANTIMONY
1	190.000	900.000	170.000	400.000	.325	.550	.325	2.350
2	175.000	850.000	9.000	9.000	.335	.550	.335	2.450
3	190.000	950.000	9.000	9.000	.325	.550	.325	2.400
4	175.000	850.000	8.000	8.000	3.300	.550	.330	2.450
5	195.000	950.000	9.500	9.500	.335	.550	.335	2.450
6	175.000	850.000	120.000	460.000	.340	.550	.340	2.500
7	185.000	900.000	31.000	35.000	.350	.600	.350	2.550
8	180.000	850.000	9.000	9.000	.335	.550	.335	2.450
9	190.000	49.000	9.000	9.000	.360	.600	.360	2.650
1	215.000	1050.000	10.000	10.000	.337	.550	.337	2.450
1	190.000	900.000	9.000	9.000	.345	.550	.345	2.550
1	280.000	900.000	9.000	9.000	.325	.550	.325	2.350
1	170.000	800.000	8.000	8.000	.320	.550	.320	2.400
1	195.000	950.000	9.000	9.000	.365	.600	.365	2.700
1	185.000	900.000	9.000	9.000	.345	.550	.345	2.550
1	190.000	900.000	9.000	9.000	.335	.550	.335	2.450

000241

data file: g:/project/539-02/bg/soil/ADDBGSS2.CSS
[16 cases with 31 variables]

	17	18	19	20	21	22
	LOG_CD	LOG_HG	LOG_MC	LOG_ACET	LOG_ANTH	LOG_BENZ
1	-.36653	-.85387	.47712	.77815	2.27875	2.27875
2	-.35164	-.65758	1.98227	2.11394	2.24304	1.86923
3	0.00000	-.95861	1.33244	1.24304	2.27875	2.27875
4	-.35164	-.92082	.47712	.74036	2.24304	1.75587
5	-.35164	-1.25964	.47712	.77815	2.29003	2.29003
6	-.34199	-1.25964	1.38917	1.21748	2.24304	2.24304
7	-.33724	-1.22185	2.07918	1.29003	2.26717	2.26717
8	-.35164	-1.25964	.47712	1.61278	2.25527	2.25527
9	-.31876	-1.22185	1.50515	1.38021	2.27875	2.27875
1	-.34679	-1.25964	2.27875	2.25527	2.33244	2.33244
1	-.33724	-1.25964	1.55630	1.23045	2.27875	2.27875
1	-.36653	-1.25964	1.48430	1.13033	2.04139	2.76343
1	-.36151	-1.25964	.39794	.69897	2.23045	2.23045
1	-.31876	-1.22185	1.30103	1.31175	2.29003	2.29003
1	-.33724	-1.25964	1.50515	1.26717	2.26717	2.26717
1	-.34679	-1.25964	1.49136	1.38021	2.27875	2.27875

data file: g:/project/539-02/bg/soil/ADDBGSS2.CSS
[16 cases with 31 variables]

0	23	24	25	26	27	28
C	LOG_BIS2	LOG_DIBE	LOG_PCP	LOG_DDT	LOG_DDE	LOG_SE
1	2.27875	2.27875	2.95424	2.23045	2.60206	-.48812
2	2.24304	2.24304	2.92942	.95424	.95424	-.47496
3	2.27875	2.27875	2.97772	.95424	.95424	-.48812
4	2.24304	2.24304	2.92942	.90309	.90309	.51851
5	2.29003	2.29003	2.97772	.97772	.97772	-.47496
6	2.24304	2.24304	2.92942	2.07918	2.66276	-.46852
7	2.26717	2.26717	2.95424	1.49136	1.54407	-.45593
8	2.25527	2.25527	2.92942	.95424	.95424	-.47496
9	2.27875	2.27875	1.69020	.95424	.95424	-.44370
1	2.33244	2.33244	3.02119	1.00000	1.00000	-.47237
1	2.27875	2.27875	2.95424	.95424	.95424	-.46218
1	1.76343	2.44716	2.95424	.95424	.95424	-.48812
1	2.23045	2.23045	2.90309	.90309	.90309	-.49485
1	1.82607	2.29003	2.97772	.95424	.95424	-.43771
1	2.26717	2.26717	2.95424	.95424	.95424	-.46218
1	2.27875	2.27875	2.95424	.95424	.95424	-.47496

000243

data file: g:/project/539-02/bg/soil/ADDBGSS2.CSS
[16 cases with 31 variables]

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ÖáôáááááááááááôáááááááááááôáááááááááááááÇ
°0°          29°          30°          31°
°C°     LOG_AG°      LOG_TH°   LOG_ANTI°
ûáéáááááááááááéáááááááááááéáááááááááááááÇ
°1°    -.25964°     -.48812°      .37107°
°2°    -.25964°     -.47496°      .38917°
°3°    -.25964°     -.48812°      .38021°
°4°    -.25964°     -.48149°      .38917°
°5°    -.25964°     -.47496°      .38917°
°6°    -.25964°     -.46852°      .39794°
°7°    -.22185°     -.45593°      .40654°
°8°    -.25964°     -.47496°      .38917°
°9°    -.22185°     -.44370°      .42325°
°1°    -.25964°     -.47237°      .38917°
°1°    -.25964°     -.46218°      .40654°
°1°    -.25964°     -.48812°      .37107°
°1°    -.25964°     -.49485°      .38021°
°1°    -.22185°     -.43771°      .43136°
°1°    -.25964°     -.46218°      .40654°
°1°    -.25964°     -.47496°      .38917°
ááêáááááááááááêáááááááááááêáááááááááááááì
```

css/3: basic stats

Descriptive Statistics
N. of Cases = 16
(MD pairwise deleted)

	N	Min	Max	Mean	St. Err.	St. Dev.
SAMPLE	16	101.0000	116.000	108.5000	1.19024	4.7610
CADMIUM	16	.4300	1.000	.4856	.03449	.1379
MERCURY	16	.0550	.220	.0791	.01164	.0466
METH_CHL	16	2.5000	190.000	40.5000	12.94411	51.7764
ACETONE	16	5.0000	180.000	34.0313	12.23430	48.9372
ANTHRACE	16	110.0000	215.000	181.8750	5.49384	21.9754
BENZO_GH	16	57.0000	580.000	197.5625	27.67218	110.6887
BIS_2_ET	16	58.0000	215.000	170.6250	10.88228	43.5291
DIBENZO	16	170.0000	280.000	192.5000	6.42262	25.6905
PCP	16	49.0000	1050.000	846.8125	55.11119	220.4448
DDT	16	8.0000	170.000	27.3438	11.78724	47.1490
DDE	16	8.0000	460.000	63.2188	35.93550	143.7420
SELENIUM	16	.3200	3.300	.5236	.18512	.7405
SILVER	16	.5500	.600	.5594	.00504	.0202
THALLIUM	16	.3200	.365	.3379	.00316	.0126
ANTIMONY	16	2.3500	2.700	2.4813	.02453	.0981
LOG_CD	16	-.3665	0.000	-.3241	.02189	.087[illegible]
LOG_HG	16	-1.2596	-.658	-1.1496	.04757	.1903
LOG_MC	16	.3979	2.279	1.2632	.15493	.6197
LOG_ACET	16	.6990	2.255	1.2768	.11070	.4428
LOG_ANTH	16	2.0414	2.332	2.2561	.01557	.0623
LOG_BENZ	16	1.7559	2.763	2.2474	.05275	.2110
LOG_BIS2	16	1.7634	2.332	2.2097	.04104	.1641
LOG_DIBE	16	2.2304	2.447	2.2814	.01264	.0506
LOG_PCP	16	1.6902	3.021	2.8744	.07924	.3170
LOG_DDT	16	.9031	2.230	1.1358	.10534	.4214
LOG_DDE	16	.9031	2.663	1.1988	.14481	.5793
LOG_SE	16	-.4949	.519	-.4089	.06196	.2478
LOG_AG	16	-.2596	-.222	-.2526	.00381	.0152
LOG_TH	16	-.4949	-.438	-.4714	.00401	.0160
LOG_ANTI	16	.3711	.431	.3944	.00424	.0169

000245

css/3: basic stats	Descriptive Statistics N. of Cases = 16 (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
SAMPLE	111.0508	105.9492
CADMIUM	.5595	.4117
MERCURY	.1040	.0541
METH_CHL	68.2403	12.7597
ACETONE	60.2504	7.8121
ANTHRACE	193.6488	170.1012
BENZO_GH	256.8663	138.2587
BIS_2_ET	193.9466	147.3034
DIBENZO	206.2642	178.7358
PCP	964.9205	728.7045
DDT	52.6048	2.0827
DDE	140.2316	-13.7941
SELENIUM	.9203	.1268
SILVER	.5702	.5486
THALLIUM	.3447	.3312
ANTIMONY	2.5338	2.4287
LOG_CD	-.2772	-.3710
LOG_HG	-1.0476	-1.2515
LOG_MC	1.5952	.9312
LOG_ACET	1.5140	1.0395
LOG_ANTH	2.2894	2.2227
LOG_BENZ	2.3604	2.1343
LOG_BIS2	2.2976	2.1217
LOG_DIBE	2.3085	2.2543
LOG_PCP	3.0442	2.7046
LOG_DDT	1.3616	.9101
LOG_DDE	1.5092	.8885
LOG_SE	-.2762	-.5417
LOG_AG	-.2444	-.2607
LOG_TH	-.4628	-.4800
LOG_ANTI	.4034	.3853

data file: g:/project/539-02/bg/soil/ORGBDLB.CSS
[16 cases with 9 variables]

0 CASE	1 VOC1	2 VOC2	3 PHENOL1	4 PHENOL2
BG1	3.00000	6.00000	900.00000	190.00000
BG2	3.00000	5.50000	850.00000	175.00000
BG3	3.00000	6.00000	950.00000	190.00000
BG4	3.00000	5.50000	850.00000	175.00000
BG5	3.00000	6.00000	950.00000	195.00000
BG6	2.50000	5.50000	850.00000	175.00000
BG7	3.00000	5.50000	900.00000	185.00000
BG8	3.00000	5.50000	850.00000	180.00000
BG9	3.00000	6.00000	950.00000	190.00000
BG10	3.50000	6.50000	1050.00000	215.00000
BG11	3.00000	5.50000	900.00000	190.00000
BG12	3.00000	5.50000	900.00000	185.00000
BG13	2.50000	5.00000	800.00000	170.00000
BG14	3.00000	6.00000	950.00000	195.00000
BG15	3.00000	5.50000	900.00000	185.00000
BG16	3.00000	5.50000	900.00000	190.00000

000247

data file: g:/project/539-02/bg/soil/ORGBDLB.CSS
[16 cases with 9 variables]

0	5	6	7	8
CASE	PEST1	ENDRIN	PPMETCH	CHLORIDE
BG1	4.65000	9.50000	46.50000	5.00000
BG2	4.50000	9.00000	45.00000	5.00000
BG3	4.55000	9.00000	45.50000	5.00000
BG4	4.00000	8.00000	40.00000	5.00000
BG5	4.80000	9.50000	48.00000	5.00000
BG6	4.20000	8.50000	42.00000	5.00000
BG7	4.40000	9.00000	44.00000	5.00000
BG8	4.55000	9.00000	45.50000	5.00000
BG9	4.60000	9.00000	46.00000	5.00000
BG10	5.00000	10.00000	50.00000	5.00000
BG11	4.45000	9.00000	44.50000	5.00000
BG12	4.45000	9.00000	44.50000	5.00000
BG13	4.10000	8.00000	41.00000	5.00000
BG14	4.60000	9.00000	46.00000	5.00000
BG15	4.50000	9.00000	45.00000	5.00000
BG16	4.55000	9.00000	45.50000	5.00000

data file: g:/project/539-02/bg/soil/ORGBDLB.CSS
[16 cases with 9 variables]

0	9
CASE	LOG10PH2
BG1	2.2787536
BG2	2.2430380
BG3	2.2787536
BG4	2.2430380
BG5	2.2900346
BG6	2.2430380
BG7	2.2671717
BG8	2.2552725
BG9	2.2787536
BG10	2.3324385
BG11	2.2787536
BG12	2.2671717
BG13	2.2304489
BG14	2.2900346
BG15	2.2671717
BG16	2.2787536

000249

css/3: basic stats — Descriptive Statistics, N. of Cases = 16 (MD pairwise deleted)

	N	Min	Max	Mean	St. Err.	St. Dev.
VOC1	16	2.5000	3.500	2.9688	.05532	.22127
VOC2	16	5.0000	6.500	5.6875	.08985	.35940
PHENOL1	16	800.0000	1050.000	903.1250	14.76817	59.07269
PHENOL2	16	170.0000	215.000	186.5625	2.68944	10.75775
PEST1	16	4.0000	5.000	4.4938	.06139	.24554
ENDRIN	16	8.0000	10.000	8.9688	.12474	.49896
PPMETCH	16	40.0000	50.000	44.9375	.61386	2.45544
CHLORIDE	16	5.0000	5.000	5.0000	0.00000	0.00000
LOG10PH2	16	2.2304	2.332	2.2702	.00615	.02459

css/3: basic stats — Descriptive Statistics, N. of Cases = 16 (MD pairwise deleted)

	p=.9500 Up.limit	p=.9500 Dn.limit
VOC1	3.0873	2.8502
VOC2	5.8801	5.4949
PHENOL1	934.7745	871.4755
PHENOL2	192.3262	180.7988
PEST1	4.6253	4.3622
ENDRIN	9.2361	8.7014
PPMETCH	46.2531	43.6219
CHLORIDE	5.0000	5.0000
LOG10PH2	2.2833	2.2570

data file: g:/project/539-02/bg/soil/BGSSND.CSS
[16 cases with 15 variables]

0 CASE	1 SEMIVOLS	2 L10SEMI	3 BIS2ETHY	4 BENZOIC	5 BETABHC	6 PESTIC_3
BG1	380.00	2.2787536	380.00	1800.00	9.30000	19.00
BG2	350.00	2.2430380	350.00	1700.00	9.00000	18.00
BG3	380.00	2.2787536	380.00	1900.00	9.10000	18.00
BG4	350.00	2.2430380	350.00	1700.00	8.00000	16.00
BG5	390.00	2.2900346	390.00	1900.00	9.60000	19.00
BG6	350.00	2.2430380	350.00	1700.00	8.40000	17.00
BG7	370.00	2.2671717	370.00	1800.00	8.80000	18.00
BG8	360.00	2.2552725	360.00	1700.00	9.10000	18.00
BG9	380.00	2.2787536	380.00	1900.00	9.20000	18.00
BG10	430.00	2.3324385	430.00	2100.00	10.00000	20.00
BG11	380.00	2.2787536	380.00	1800.00	8.90000	18.00
BG12	370.00	2.2671717	58.00	1800.00	8.90000	18.00
BG13	340.00	2.2304489	340.00	1600.00	8.20000	16.00
BG14	390.00	2.2900346	67.00	1900.00	9.20000	18.00
BG15	370.00	2.2671717	370.00	1800.00	9.00000	18.00
BG16	380.00	2.2787536	380.00	1800.00	9.10000	18.00

000251

data file: g:/project/539-02/bg/soil/BGSSND.CSS
[16 cases with 15 variables]

0 CASE	7 PCB1260	8 PCB1016	9 SEMIS	10 BIS2	11 BENZ_ACI
BG1	190.00	93.00	190.0000000	190.0000000	900.0000000
BG2	180.00	90.00	175.0000000	175.0000000	850.0000000
BG3	180.00	91.00	190.0000000	190.0000000	950.0000000
BG4	160.00	80.00	175.0000000	175.0000000	850.0000000
BG5	190.00	96.00	195.0000000	195.0000000	950.0000000
BG6	170.00	84.00	175.0000000	175.0000000	850.0000000
BG7	180.00	88.00	185.0000000	185.0000000	900.0000000
BG8	180.00	91.00	180.0000000	180.0000000	850.0000000
BG9	180.00	92.00	190.0000000	190.0000000	950.0000000
BG10	200.00	100.00	215.0000000	215.0000000	1050.0000000
BG11	180.00	89.00	190.0000000	190.0000000	900.0000000
BG12	180.00	89.00	185.0000000	58.0000000	900.0000000
BG13	160.00	82.00	170.0000000	170.0000000	800.0000000
BG14	180.00	92.00	195.0000000	67.0000000	950.0000000
BG15	180.00	90.00	185.0000000	185.0000000	900.0000000
BG16	180.00	91.00	190.0000000	190.0000000	900.0000000

data file: g:/project/539-02/bg/soil/BGSSND.CSS
[16 cases with 15 variables]

0 CASE	12 BET_BHC	13 PTEST_3	14 ARO_1260	15 ARO_1016
BG1	4.6500000	9.5000000	95.0000000	46.5000000
BG2	4.5000000	9.0000000	90.0000000	45.0000000
BG3	4.5500000	9.0000000	90.0000000	45.5000000
BG4	4.0000000	8.0000000	80.0000000	40.0000000
BG5	4.8000000	9.5000000	95.0000000	48.0000000
BG6	4.2000000	8.5000000	85.0000000	42.0000000
BG7	4.4000000	9.0000000	90.0000000	44.0000000
BG8	4.5500000	9.0000000	90.0000000	45.5000000
BG9	4.6000000	9.0000000	90.0000000	46.0000000
BG10	5.0000000	10.0000000	100.0000000	50.0000000
BG11	4.4500000	9.0000000	90.0000000	44.5000000
BG12	4.4500000	9.0000000	90.0000000	44.5000000
BG13	4.1000000	8.0000000	80.0000000	41.0000000
BG14	4.6000000	9.0000000	90.0000000	46.0000000
BG15	4.5000000	9.0000000	90.0000000	45.0000000
BG16	4.5500000	9.0000000	90.0000000	45.5000000

000253

css/3: basic stats — Descriptive Statistics
N. of Cases = 16
(MD pairwise deleted)

	N	Min	Max	Mean	St. Err.	St. Dev.
SEMIVOLS	16	340.000	430.000	373.125	5.37887	21.5155
L10SEMI	16	2.230	2.332	2.270	.00615	.0246
BIS2ETHY	16	58.000	430.000	333.438	26.96170	107.8468
BENZOIC	16	1600.000	2100.000	1806.250	29.53635	118.1454
BETABHC	16	8.000	10.000	8.988	.12277	.4911
PESTIC_3	16	16.000	20.000	17.938	.24948	.9979
PCB1260	16	160.000	200.000	179.375	2.49479	9.9791
PCB1016	16	80.000	100.000	89.875	1.22772	4.9109
SEMIS	16	170.000	215.000	186.563	2.68944	10.7577
BIS2	16	58.000	215.000	170.625	10.88228	43.5291
BENZ_ACI	16	800.000	1050.000	903.125	14.76817	59.0727
BET_BHC	16	4.000	5.000	4.494	.06139	.2455
PTEST_3	16	8.000	10.000	8.969	.12474	.4990
ARO_1260	16	80.000	100.000	89.688	1.24739	4.9896
ARO_1016	16	40.000	50.000	44.938	.61386	2.4554

css/3: basic stats — Descriptive Statistics
N. of Cases = 16
(MD pairwise deleted)

	p=.9500 Up.limit	p=.9500 Dn.limit
SEMIVOLS	384.652	361.598
L10SEMI	2.283	2.257
BIS2ETHY	391.219	275.656
BENZOIC	1869.549	1742.951
BETABHC	9.251	8.724
PESTIC_3	18.472	17.403
PCB1260	184.722	174.028
PCB1016	92.506	87.244
SEMIS	192.326	180.799
BIS2	193.947	147.303
BENZ_ACI	934.774	871.476
BET_BHC	4.625	4.362
PTEST_3	9.236	8.701
ARO_1260	92.361	87.014
ARO_1016	46.253	43.622

data file: g:/project/539-02/bg/soil/BGREV.CSS
[25 cases with 8 variables]

0 CASE NAME	1 AMMONIA	2 PH	3 TOT_PHOS	4 SULFATE	5 LOG10AMM	6 LOG10PH
BG-01-01	11.630	7.700	109.300	1860.470	1.066	.886
BG-02-01	28.090	7.600	76.400	651.690	1.449	.881
BG-03-01	87.210	7.500	151.160	825.580	1.941	.875
BG-04-01	43.820	7.400	134.830	640.450	1.642	.869
BG-05-01	83.130	7.300	566.270	361.450	1.920	.863
BG-06-01	53.760	7.400	129.030	838.710	1.730	.869
BG-07-01	19.100	7.400	111.240	157.300	1.281	.869
BG-08-01	19.320	6.600	556.820	125.000	1.286	.820
BG-09-01	15.120	6.200	441.860	93.020	1.180	.792
BG-10-01	121.050	7.400	109.210	81.580	2.083	.869
BG-11-01	52.870	7.000	172.410	108.050	1.723	.845
BG-12-01	39.560	6.900	32.580	20.220	1.597	.839
BG-13-01	12.370	7.600	917.530	28.870	1.092	.881
BG-14-01	32.940	7.200	141.180	164.710	1.518	.857
BG-15-01	37.500	6.900	1477.270	181.820	1.574	.839
BG-16-01	60.920	7.100	597.700	195.400	1.785	.851

000255

data file: g:/project/539-02/bg/soil/BGREV.CSS
[25 cases with 8 variables]

CASE NAME	LOG10PHO	LOG10SUL
BG-01-01	2.039	3.270
BG-02-01	1.883	2.814
BG-03-01	2.179	2.917
BG-04-01	2.130	2.806
BG-05-01	2.753	2.558
BG-06-01	2.111	2.924
BG-07-01	2.046	2.197
BG-08-01	2.746	2.097
BG-09-01	2.645	1.969
BG-10-01	2.038	1.912
BG-11-01	2.237	2.034
BG-12-01	1.513	1.306
BG-13-01	2.963	1.460
BG-14-01	2.150	2.217
BG-15-01	3.169	2.260
BG-16-01	2.776	2.291

css/3: basic stats

Descriptive Statistics
N. of Cases = 16 [from 25]
(MD pairwise deleted)

	N	Min	Max	Mean	St. Err.	St. Dev.
AMMONIA	16	11.63000	121.050	44.8994	7.7274	30.9097
PH	16	6.20000	7.700	7.2000	.1004	.4017
TOT_PHOS	16	32.58000	1477.270	357.7994	98.0973	392.3891
SULFATE	16	20.22000	1860.470	395.8950	120.2623	481.0492
LOG10AMM	16	1.06558	2.083	1.5541	.0774	.3095
LOG10PH	16	.79239	.886	.8567	.0063	.0250
LOG10PHO	16	1.51295	3.169	2.3361	.1123	.4491
LOG10SUL	16	1.30578	3.270	2.3143	.1351	.5403

css/3: basic stats

Descriptive Statistics
N. of Cases = 16 [from 25]
(MD pairwise deleted)

	p=.9500 Up.limit	p=.9500 Dn.limit
AMMONIA	61.4599	28.3389
PH	7.4152	6.9848
TOT_PHOS	568.0302	147.5686
SULFATE	653.6273	138.1627
LOG10AMM	1.7199	1.3883
LOG10PH	.8701	.8433
LOG10PHO	2.5767	2.0955
LOG10SUL	2.6038	2.0249

000257

APPENDIX B

GROUNDWATER RESULTS SUMMARY

data file: g:\project\539-02\bg\gw\gwdisrev.CSS
[63 cases with 46 variables]

	0	1	2	3	4	5	6
CASE NAME		ANTIM	ARSENIC	BERYLL	CADMIUM	CHROM	COPPER
RND1 2095		19.500	1.500	.500	2.500	3.500	2.500
RND1 3095		19.500	1.500	.500	2.500	3.500	2.500
RND1 ESTES		19.500	1.500	.500	2.500	3.500	44.300
RND1 MW-01S		19.500	1.500	.500	2.500	3.500	2.500
RND2 2002		.	.	.	.	.	.
RND2 2095		17.500	1.000	.500	2.500	3.000	4.000
RND2 3095		17.500	1.000	.500	2.500	3.000	4.000
RND2 ESTES		17.500	1.000	.500	2.500	3.000	47.300
RND2 MW-01S		17.500	2.200	.500	2.500	3.000	4.000
RND3 2002		14.000	1.500	.500	2.000	2.500	1.500
RND3 2095		14.000	1.500	.500	2.000	2.500	1.500
RND3 3095		14.000	1.500	.500	2.000	2.500	4.100
RND3 ESTES		14.000	1.500	.500	2.000	2.500	58.800
RND3 MW-01S		14.000	1.500	.500	2.000	2.500	1.500
RND4 2002		11.000	1.500	.500	2.000	2.500	2.000
RND4 2095		11.000	1.500	.500	2.000	2.500	2.000
RND4 3095		11.000	1.500	.500	2.000	2.500	2.000
D4 ESTES		11.000	.	.500	2.000	2.500	76.300
RND4 MW-01S		11.000	1.500	.500	2.000	2.500	2.000
1DOE 2015		.	.	.	.	.	.
2DOE 2015		.	.	.	.	.	.
3DOE 2015		.	.	.	.	.	.
1DOE 2017		.	.	.	.	.	.
2DOE 2017		.	.	.	.	.	.
3DOE 2017		.	.	.	.	.	.
2DOE 2093		.	.	.	.	.	.
3DOE 2093		.	.	.	.	.	.
3DOE 2095		.	.	.	.	.	.
1DOE 3015		.	.	.	.	.	.
2DOE 3015		.	.	.	.	.	.
3DOE 3015		.	.	.	.	.	.
1DOE 3017		.	.	.	.	.	.
2DOE 3017		.	.	.	.	.	.
3DOE 3017		.	.	.	.	.	.
2DOE 3093		.	.	.	.	.	.
3DOE 3093		.	.	.	.	.	.
2DOE 3095		.	.	.	.	.	.
3DOE 3095		.	.	.	.	.	.
1DOE 4015		.	.	.	.	.	.
2DOE 4015		.	.	.	.	.	.
3DOE 4015		.	.	.	.	.	.
6-90DOE 3095		12.500	1.250	5.000	.500	2.500	12.500
11-91DOE 3095		10.000	2.500	2.500	.500	1.000	10.000
90DOE 2061		.	1.250	.	.500	2.500	39.000
6-90DOE 2095		.	.	.	.	.	.
11-91DOE 2096		10.000	2.500	2.500	.500	1.000	10.000

0	1	2	3	4	5	6
CASE NAME	ANTIM	ARSENIC	BERYLL	CADMIUM	CHROM	COPPER
12-91DOE 2125						
12-91DOE 2396	10.000	2.500	2.500	.500	2.000	10.000
6-19-90DOE 3062						
11-91DOE 3096	10.000	2.500	2.500	.500	1.000	10.000
11-91DOE 4096	10.000	2.500	2.500	.500	1.900	10.000
11-91DOE 4015	10.000	2.500	2.500	.500	1.000	10.000
RND1 A&W1	19.500	1.500	.500	2.500	3.500	2.500
RND1 A&W2	19.500	1.500	.500	2.500	3.500	2.500
RND1 MW-01D	19.500	1.500	.500	2.500	3.500	2.500
RND2 A&W1	19.500	2.600	.500	2.500	3.000	4.000
RND2 A&W2	17.500	2.800	.500	2.500	3.000	4.000
RND2 MW-01D	17.500	1.000	.500	2.500	3.000	4.000
RND3 A&W1	14.000	1.500	.500	2.000	2.500	1.500
RND4 A&W1	11.000		.500	2.000	2.500	2.000
RND4 A&W2	11.000		.500	2.000	2.500	2.000
RND4 MW-01D	11.000	1.500	.500	2.000	2.500	2.000

000260

data file: g:\project\539-02\bg\gw\gwdisrev.CSS
[63 cases with 46 variables]

0 CASE NAME	7 NICKEL	8 SELENIUM	9 SILVER	10 THALLIUM	11 DIS_ZN	12 DIS_BA
RND1 2095	17.000	1.000	2.000	1.500	17.800	36.000
RND1 3095	17.000	5.000	2.000	1.500	.	76.700
RND1 ESTES	17.000	1.000	2.000	1.500	132.000	52.100
RND1 MW-01S	17.000	.	2.000	1.500	.	45.700
RND2 2002	.	.	.	.	6.200	49.300
RND2 2095	19.500	1.000	8.000	1.000	15.200	50.200
RND2 3095	19.500	1.000	4.000	1.000	23.900	95.300
RND2 ESTES	19.500	1.000	13.800	2.300	298.000	63.600
RND2 MW-01S	19.500	1.000	4.000	1.000	8.500	50.500
RND3 2002	5.500	1.500	2.000	1.500	1.500	47.800
RND3 2095	5.500	1.500	2.000	1.500	1.500	45.400
RND3 3095	5.500	1.500	2.000	1.500	14.500	79.500
RND3 ESTES	5.500	1.500	2.000	1.500	188.000	69.300
RND3 MW-01S	5.500	1.500	2.000	1.500	1.500	52.900
RND4 2002	3.500	1.500	2.500	1.500	51.300	46.700
RND4 2095	3.500	1.500	2.500	15.000	1.000	53.800
RND4 3095	3.500	1.500	2.500	1.500	1.000	86.100
D4 ESTES	9.300	.	.	1.500	466.000	83.600
RND4 MW-01S	30.400	1.500	2.500	1.500	12.600	44.400
1DOE 2015	.	.	.	.	19.400	34.000
2DOE 2015	.	.	.	.	.	100.000
3DOE 2015	.	.	.	.	.	40.000
1DOE 2017	.	.	.	.	.	31.000
2DOE 2017	.	.	.	.	.	100.000
3DOE 2017	.	.	.	.	.	30.000
2DOE 2093	.	.	.	.	.	10.000
3DOE 2093	.	.	.	.	.	60.000
3DOE 2095	.	.	.	.	.	50.000
1DOE 3015	.	.	.	.	.	23.000
2DOE 3015	.	.	.	.	.	100.000
3DOE 3015	.	.	.	.	.	40.000
1DOE 3017	.	.	.	.	.	110.000
2DOE 3017	.	.	.	.	.	100.000
3DOE 3017	.	.	.	.	.	60.000
2DOE 3093	.	.	.	.	.	100.000
3DOE 3093	.	.	.	.	.	50.000
2DOE 3095	.	.	.	.	.	20.000
3DOE 3095	.	.	.	.	.	91.000
1DOE 4015	.	.	.	.	.	64.000
2DOE 4015	.	.	.	.	.	100.000
3DOE 4015	.	.	.	.	.	88.000
6-90DOE 3095	2.500	1.250	.500	5.000	10.000	100.000
11-91DOE 3095	5.000	2.500	.500	5.000	10.000	100.000
90DOE 2061	2.500	1.250	.500	.	36.000	100.000
6-90DOE 2095	.	.	.	.	10.000	100.000
11-91DOE 2096	5.000	2.500	.500	5.000	10.000	100.000

	0	7	8	9	10	11	12
CASE NAME	NICKEL	SELENIUM	SILVER	THALLIUM	DIS_ZN	DIS_BA
12-91DOE 2125					10.000	100.000
12-91DOE 2396	5.000	2.500	.500	5.000	27.000	100.000
6-19-90DOE 3062					10.000	100.000
11-91DOE 3096	5.000	2.500	.500	5.000	10.000	100.000
11-91DOE 4096	5.000	2.500	.500	5.000	10.000	100.000
11-91DOE 4015	5.000	2.500	.500	5.000	27.000	100.000
RND1 A&W1	17.000		2.000	1.500		59.600
RND1 A&W2	17.000		2.000	1.500	6.500	61.400
RND1 MW-01D	17.000		2.000	1.500		57.900
RND2 A&W1	19.500	1.000	4.000	1.000	13.900	56.200
RND2 A&W2	19.500	1.000	4.000	1.000	26.800	60.700
RND2 MW-01D	19.500	1.000	4.000	1.000	10.300	78.400
RND3 A&W1	5.500	1.500	2.000	1.500	13.500	62.700
RND4 A&W1	3.500			1.500	25.000	75.900
RND4 A&W2	3.500			1.500	3.900	65.000
RND4 MW-01D	3.500	1.500	2.500	1.500	28.300	80.800

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Data file: g:\project\539-02\bg\gw\gwdisrev.CSS
[63 cases with 46 variables]

0 CASE NAME	13 DIS_FE	14 DIS_MN	15 VANADI	16 DIS_AL	17 COBALT	18 DIS_PB
RND1 2095	5.800	2.000	2.500	11.500	3.500	1.000
RND1 3095	1600.000	272.000	2.500	23.500	3.500	1.000
RND1 ESTES	2.500	2.000	2.500	11.500	3.500	2.700
RND1 MW-01S		2.000	2.500	28.400	3.500	1.000
RND2 2002	121.000	78.200		125.000		1.000
RND2 2095	11.700	1.500	2.000	143.000	2.000	1.000
RND2 3095	1840.000	329.000	2.000	155.000	2.000	1.000
RND2 ESTES	20.800	1.500	2.000	44.000	2.000	3.200
RND2 MW-01S	11.300	1.500	2.000	119.000	2.000	1.000
RND3 2002	10.000	71.400	2.000	16.500	3.500	1.500
RND3 2095	10.000	.500	2.000	16.500	3.500	1.500
RND3 3095	152.000	276.000	2.000	87.000	3.500	1.500
RND3 ESTES	10.000	.500	2.000	43.300	3.500	1.500
RND3 MW-01S	10.000	16.500	2.000	74.500	3.500	1.500
RND4 2002	21.000	66.400	2.000	80.700	2.500	1.000
RND4 2095	21.000	2.300	2.000	75.000	2.500	1.000
RND4 3095	1720.000	351.000	2.000	68.200	2.500	1.000
D4 ESTES	21.000	1.600	2.000	71.200	2.500	3.400
RND4 MW-01S	21.000	.500	2.000	70.200	2.500	1.000
1DOE 2015	2.500	4.000		70.000		1.000
2DOE 2015	.050	10.000				2.500
3DOE 2015	10.000	.500				21.000
1DOE 2017	21.000	86.000				15.000
2DOE 2017	400.000	240.000				100.000
3DOE 2017	100.000	200.000				26.000
2DOE 2093	50.000	30.000				2.500
3DOE 2093	200.000	20.000				3.000
3DOE 2095	32.000	3.000				1.000
1DOE 3015	26.000	83.000				25.000
2DOE 3015	800.000	250.000				2.500
3DOE 3015	700.000	200.000				56.000
1DOE 3017	5.000	550.000				15.000
2DOE 3017	2200.000	350.000				100.000
3DOE 3017	2200.000	300.000				78.000
2DOE 3093	2400.000	490.000				100.000
3DOE 3093	1700.000	200.000				3.000
2DOE 3095	2.500	30.000				70.000
3DOE 3095	2310.000	329.000				1.000
1DOE 4015	2650.000	318.000				25.000
2DOE 4015	2700.000	340.000				2.500
3DOE 4015	2560.000	338.000				3.000
6-90DOE 3095	1800.000	294.000	25.000	55.000	12.500	2.500
-91DOE 3095	195.000	157.000	25.000	100.000	2.500	1.500
90DOE 2061	25.000	10.000				2.500
6-90DOE 2095	242.000	21.000		339.000		2.500
11-91DOE 2096	3420.000	561.000	25.000	100.000	2.500	1.500

0	13	14	15	16	17	18
CASE NAME	DIS_FE	DIS_MN	VANADI	DIS_AL	COBALT	DIS_PB
12-91DOE 2125	50.000	7.500		100.000		1.500
12-91DOE 2396	50.000	7.500	25.000	100.000	2.500	1.500
6-19-90DOE 3062	1160.000	376.000		25.000		2.500
11-91DOE 3096	400.000	67.000	25.000	100.000	2.500	1.500
11-91DOE 4096	50.000	31.000	25.000	100.000	2.500	1.500
11-91DOE 4015	4010.000	322.000	25.000	100.000	1.500	1.500
RND1 A&W1	1100.000	394.000	2.500	25.900	3.500	1.000
RND1 A&W2	1330.000	408.000	2.500	11.500	3.500	1.000
RND1 MW-01D		284.000	2.500	11.500	3.500	1.000
RND2 A&W1	110.000	352.000	2.000	141.000	2.000	2.500
RND2 A&W2	1430.000	369.000	5.100	90.000	2.000	1.000
RND2 MW-01D	2240.000	358.000	2.000	159.000	2.000	3.800
RND3 A&W1	10.000	401.000	2.000	47.000	3.500	1.500
RND4 A&W1	898.000	497.000	2.000	68.500	2.500	1.000
RND4 A&W2	1250.000	401.000	2.000	66.600	2.500	1.000
RND4 MW-01D	2400.000	363.000	2.000	65.600	2.500	1.000

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[63 cases with 46 variables]

CASE NAME	0	19 DIS_HG	20 DIS_MG	21 DIS_CA	22 DIS_NA	23 DIS_K	24 LOGANTIM
RND1 2095	.100	19100.00	81500.00	19800.00	1985.000		1.2900346
RND1 3095	.100	25900.00	94600.00	14100.00	1985.000		1.2900346
RND1 ESTES	.100	26500.00	90700.00	38300.00	1985.000		1.2900346
RND1 MW-01S	.100	24900.00	114000.0	52900.00	1985.000		1.2900346
RND2 2002	.100	26000.00	96200.00	18100.00	4140.000		
RND2 2095	.100	25200.00	105000.0	23500.00	4310.000		1.2430380
RND2 3095	.100	32500.00	115000.0	17500.00	4930.000		1.2430380
RND2 ESTES	.100	29800.00	104000.0	51200.00	3970.000		1.2430380
RND2 MW-01S	.100	28200.00	122000.0	35900.00	3050.000		1.2430380
RND3 2002	.100	27100.00	101000.0	16800.00	3460.000		1.1461280
RND3 2095	.100	25600.00	108000.0	15200.00	2250.000		1.1461280
RND3 3095	.100	30300.00	107000.0	13500.00	3210.000		1.1461280
RND3 ESTES	.100	29200.00	103000.0	79500.00	3460.000		1.1461280
RND3 MW-01S	.100	29900.00	130000.0	37300.00	2850.000		1.1461280
RND4 2002	.100	26100.00	98700.00	16300.00	3170.000		1.0413927
RND4 2095	.100	26300.00	111000.0	26200.00	2990.000		1.0413927
RND4 3095	.100	31000.00	113000.0	14400.00	1870.000		1.0413927
D4 ESTES	.100	33700.00	120000.0	115000.0	3990.000		1.0413927
RND4 MW-01S	.100	26000.00	115000.0	25700.00	1810.000		1.0413927
1DOE 2015	.100	20000.00	70100.00	10400.00	3400.000		
2DOE 2015	.100	18000.00	82000.00	11000.00	2500.000		
3DOE 2015	.100	19400.00	76900.00	9900.000	2370.000		
1DOE 2017	.500	29700.00	140000.0	9800.000	2000.000		
2DOE 2017	.400	33000.00	140000.0	12000.00	2500.000		
3DOE 2017	.100	30200.00	148000.0	8300.000	1920.000		
2DOE 2093	.100	28000.00	100000.0	53000.00	2500.000		
3DOE 2093	.100	27600.00	97100.00	51700.00	3730.000		
3DOE 2095	.400	23300.00	100000.0	24600.00	2500.000		
1DOE 3015	.100	21800.00	60100.00	21700.00	6240.000		
2DOE 3015	.100	19000.00	83000.00	11000.00	2500.000		
3DOE 3015	.100	20500.00	83700.00	10400.00	2230.000		
1DOE 3017	.500	17100.00	83500.00	16100.00	2000.000		
2DOE 3017	.500	28000.00	120000.0	11000.00	2500.000		
3DOE 3017	.200	26000.00	123000.0	9700.000	2090.000		
2DOE 3093	.500	25000.00	91000.00	9000.000	2500.000		
3DOE 3093	.100	22000.00	86100.00	7400.000	1840.000		
2DOE 3095	.100	26500.00	41100.00	27400.00	5020.000		
3DOE 3095	.200	30700.00	111000.0	15600.00	2890.000		
1DOE 4015	.100	25400.00	102000.0	6470.000	1740.000		
2DOE 4015	.150	27000.00	110000.0	7000.000	2500.000		
3DOE 4015	.100	25600.00	102000.0	6630.000	1450.000		
6-90DOE 3095	.100	30100.00	109000.0	21900.00	3080.000		1.0969100
11-91DOE 3095	.100	30300.00	98600.00	10800.00	2600.000		1.0000000
90DOE 2061		24100.00	95900.00	21000.00	3500.000		
6-90DOE 2095	.100	23700.00	99800.00	26800.00	2830.000		
11-91DOE 2096	.100	34100.00	149000.0	5900.000	1700.000		1.0000000

0	19	20	21	22	23	24
CASE NAME	DIS_HG	DIS_MG	DIS_CA	DIS_NA	DIS_K	LOGANTIM
12-91DOE 2125	.100	21400.00	97000.00	13500.00	2200.000	
12-91DOE 2396	.100	26300.00	91800.00	21100.00	3200.000	1.0000000
6-19-90DOE 3062	.100	22200.00	91200.00	20400.00	2840.000	
11-91DOE 3096	.100	22700.00	83400.00	2900.000	1200.000	1.0000000
11-91DOE 4096	.100	21100.00	79700.00	6300.000	1100.000	1.0000000
11-91DOE 4015	.100	24700.00	92800.00	9700.000	1800.000	1.0000000
RND1 A&W1	.100	21800.00	91200.00	11800.00	1985.000	1.2900346
RND1 A&W2	.100	22500.00	94500.00	13000.00	1985.000	1.2900346
RND1 MW-01D	.100	19900.00	79400.00	11600.00	1985.000	1.2900346
RND2 A&W1	.100	20600.00	82200.00	11600.00	3230.000	1.2900346
RND2 A&W2	.100	21100.00	85800.00	12400.00	1490.000	1.2430380
RND2 MW-01D	.100	26200.00	102000.0	17300.00	3780.000	1.2430380
RND3 A&W1	.100	22600.00	94400.00	13000.00	2740.000	1.1461280
RND4 A&W1	.100	25400.00	104000.0	16500.00	3200.000	1.0413927
RND4 A&W2	.100	23100.00	97100.00	12700.00	2920.000	1.0413927
RND4 MW-01D	.100	27000.00	105000.0	16900.00	2950.000	1.0413927

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[63 cases with 46 variables]

0 CASE NAME	25 LOGARSEN	26 LOGBERYL	27 LOGCADMI
RND1 2095	.1760913	-.3010300	.3979400
RND1 3095	.1760913	-.3010300	.3979400
RND1 ESTES	.1760913	-.3010300	.3979400
RND1 MW-01S	.1760913	-.3010300	.3979400
RND2 2002	.	.	.
RND2 2095	0.0000000	-.3010300	.3979400
RND2 3095	0.0000000	-.3010300	.3979400
RND2 ESTES	0.0000000	-.3010300	.3979400
RND2 MW-01S	.3424227	-.3010300	.3979400
RND3 2002	.1760913	-.3010300	.3010300
RND3 2095	.1760913	-.3010300	.3010300
RND3 3095	.1760913	-.3010300	.3010300
RND3 ESTES	.1760913	-.3010300	.3010300
RND3 MW-01S	.1760913	-.3010300	.3010300
RND4 2002	.1760913	-.3010300	.3010300
RND4 2095	.1760913	-.3010300	.3010300
RND4 3095	.1760913	-.3010300	.3010300
D4 ESTES	.	-.3010300	.3010300
RND4 MW-01S	.1760913	-.3010300	.3010300
1DOE 2015	.	.	.
2DOE 2015	.	.	.
3DOE 2015	.	.	.
1DOE 2017	.	.	.
2DOE 2017	.	.	.
3DOE 2017	.	.	.
2DOE 2093	.	.	.
3DOE 2093	.	.	.
3DOE 2095	.	.	.
1DOE 3015	.	.	.
2DOE 3015	.	.	.
3DOE 3015	.	.	.
1DOE 3017	.	.	.
2DOE 3017	.	.	.
3DOE 3017	.	.	.
2DOE 3093	.	.	.
3DOE 3093	.	.	.
2DOE 3095	.	.	.
3DOE 3095	.	.	.
1DOE 4015	.	.	.
2DOE 4015	.	.	.
3DOE 4015	.	.	.
6-90DOE 3095	.0969100	.6989700	-.3010300
12-91DOE 3095	.3979400	.3979400	-.3010300
90DOE 2061	.0969100	.	-.3010300
6-90DOE 2095	.	.	.
11-91DOE 2096	.3979400	.3979400	-.3010300

0	25	26	27
CASE NAME	LOGARSEN	LOGBERYL	LOGCADMI
12-91DOE 2125			
12-91DOE 2396	.3979400	.3979400	-.3010300
6-19-90DOE 3062			
11-91DOE 3096	.3979400	.3979400	-.3010300
11-91DOE 4096	.3979400	.3979400	-.3010300
11-91DOE 4015	.3979400	.3979400	-.3010300
RND1 A&W1	.1760913	-.3010300	.3979400
RND1 A&W2	.1760913	-.3010300	.3979400
RND1 MW-01D	.1760913	-.3010300	.3979400
RND2 A&W1	.4149733	-.3010300	.3979400
RND2 A&W2	.4471580	-.3010300	.3979400
RND2 MW-01D	0.0000000	-.3010300	.3979400
RND3 A&W1	.1760913	-.3010300	.3010300
RND4 A&W1		-.3010300	.3010300
RND4 A&W2		-.3010300	.3010300
RND4 MW-01D	.1760913	-.3010300	.3010300

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[63 cases with 46 variables]

0 CASE NAME	28 LOGCHROM	29 LOGCOPPE	30 LOGNICKE
RND1 2095	.5440680	.3979400	1.2304489
RND1 3095	.5440680	.3979400	1.2304489
RND1 ESTES	.5440680	1.6464037	1.2304489
RND1 MW-01S	.5440680	.3979400	1.2304489
RND2 2002	.	.	.
RND2 2095	.4771213	.6020600	1.2900346
RND2 3095	.4771213	.6020600	1.2900346
RND2 ESTES	.4771213	1.6748611	1.2900346
RND2 MW-01S	.4771213	.6020600	1.2900346
RND3 2002	.3979400	.1760913	.7403627
RND3 2095	.3979400	.1760913	.7403627
RND3 3095	.3979400	.6127839	.7403627
RND3 ESTES	.3979400	1.7693773	.7403627
RND3 MW-01S	.3979400	.1760913	.7403627
RND4 2002	.3979400	.3010300	.5440680
RND4 2095	.3979400	.3010300	.5440680
RND4 3095	.3979400	.3010300	.5440680
D4 ESTES	.3979400	1.8825245	.9684829
RND4 MW-01S	.3979400	.3010300	1.4828736
1DOE 2015	.	.	.
2DOE 2015	.	.	.
3DOE 2015	.	.	.
1DOE 2017	.	.	.
2DOE 2017	.	.	.
3DOE 2017	.	.	.
2DOE 2093	.	.	.
3DOE 2093	.	.	.
3DOE 2095	.	.	.
1DOE 3015	.	.	.
2DOE 3015	.	.	.
3DOE 3015	.	.	.
1DOE 3017	.	.	.
2DOE 3017	.	.	.
3DOE 3017	.	.	.
2DOE 3093	.	.	.
3DOE 3093	.	.	.
2DOE 3095	.	.	.
3DOE 3095	.	.	.
1DOE 4015	.	.	.
2DOE 4015	.	.	.
3DOE 4015	.	.	.
6-90DOE 3095	.3979400	1.0969100	.3979400
11-91DOE 3095	0.0000000	1.0000000	.6989700
90DOE 2061	.3979400	1.5910646	.3979400
6-90DOE 2095	.	.	.
11-91DOE 2096	0.0000000	1.0000000	.6989700

0	28	29	30
CASE NAME	LOGCHROM	LOGCOPPE	LOGNICKE
12-91DOE 2125			
12-91DOE 2396	.3010300	1.0000000	.6989700
6-19-90DOE 3062			
11-91DOE 3096	0.0000000	1.0000000	.6989700
11-91DOE 4096	.2787536	1.0000000	.6989700
11-91DOE 4015	0.0000000	1.0000000	.6989700
RND1 A&W1	.5440680	.3979400	1.2304489
RND1 A&W2	.5440680	.3979400	1.2304489
RND1 MW-01D	.5440680	.3979400	1.2304489
RND2 A&W1	.4771213	.6020600	1.2900346
RND2 A&W2	.4771213	.6020600	1.2900346
RND2 MW-01D	.4771213	.6020600	1.2900346
RND3 A&W1	.3979400	.1760913	.7403627
RND4 A&W1	.3979400	.3010300	.5440680
RND4 A&W2	.3979400	.3010300	.5440680
RND4 MW-01D	.3979400	.3010300	.5440680

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ata file: g:\project\539-02\bg\gw\gwdisrev.CSS
[63 cases with 46 variables]

0 CASE NAME	31 LOGSELEN	32 LOGSILVE	33 LOGTHALL
RND1 2095	0.0000000	.3010300	.1760913
RND1 3095	.6989700	.3010300	.1760913
RND1 ESTES	0.0000000	.3010300	.1760913
RND1 MW-01S	.	.3010300	.1760913
RND2 2002	.	.	.
RND2 2095	0.0000000	.9030900	0.0000000
RND2 3095	0.0000000	.6020600	0.0000000
RND2 ESTES	0.0000000	1.1398791	.3617278
RND2 MW-01S	0.0000000	.6020600	0.0000000
RND3 2002	.1760913	.3010300	.1760913
RND3 2095	.1760913	.3010300	.1760913
RND3 3095	.1760913	.3010300	.1760913
RND3 ESTES	.1760913	.3010300	.1760913
RND3 MW-01S	.1760913	.3010300	.1760913
RND4 2002	.1760913	.3979400	.1760913
RND4 2095	.1760913	.3979400	1.1760913
RND4 3095	.1760913	.3979400	.1760913
RND4 ESTES	.	.	.1760913
RND4 MW-01S	.1760913	.3979400	.1760913
1DOE 2015	.	.	.
2DOE 2015	.	.	.
3DOE 2015	.	.	.
1DOE 2017	.	.	.
2DOE 2017	.	.	.
3DOE 2017	.	.	.
2DOE 2093	.	.	.
3DOE 2093	.	.	.
3DOE 2095	.	.	.
1DOE 3015	.	.	.
2DOE 3015	.	.	.
3DOE 3015	.	.	.
1DOE 3017	.	.	.
2DOE 3017	.	.	.
3DOE 3017	.	.	.
2DOE 3093	.	.	.
3DOE 3093	.	.	.
2DOE 3095	.	.	.
3DOE 3095	.	.	.
1DOE 4015	.	.	.
2DOE 4015	.	.	.
3DOE 4015	.	.	.
6-90DOE 3095	.0969100	-.3010300	.6989700
12-91DOE 3095	.3979400	-.3010300	.6989700
-90DOE 2061	.0969100	-.3010300	.
6-90DOE 2095	.	.	.
11-91DOE 2096	.3979400	-.3010300	.6989700

0	31	32	33
CASE NAME	LOGSELEN	LOGSILVE	LOGTHALL
12-91DOE 2125			
12-91DOE 2396	.3979400	-.3010300	.6989700
6-19-90DOE 3062			
11-91DOE 3096	.3979400	-.3010300	.6989700
11-91DOE 4096	.3979400	-.3010300	.6989700
11-91DOE 4015	.3979400	-.3010300	.6989700
RND1 A&W1		.3010300	.1760913
RND1 A&W2		.3010300	.1760913
RND1 MW-01D		.3010300	.1760913
RND2 A&W1	0.0000000	.6020600	0.0000000
RND2 A&W2	0.0000000	.6020600	0.0000000
RND2 MW-01D	0.0000000	.6020600	0.0000000
RND3 A&W1	.1760913	.3010300	.1760913
RND4 A&W1			.1760913
RND4 A&W2			.1760913
RND4 MW-01D	.1760913	.3979400	.1760913

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[63 cases with 46 variables]

0 CASE NAME	34 LOGZINC	35 LOGBARI	36 LOGIRON
RND1 2095	1.2504200	1.5563025	.7634280
RND1 3095		1.8847954	3.2041200
RND1 ESTES	2.1205739	1.7168377	.3979400
RND1 MW-01S		1.6599162	
RND2 2002	.7923917	1.6928469	2.0827854
RND2 2095	1.1818436	1.7007037	1.0681859
RND2 3095	1.3783979	1.9790929	3.2648178
RND2 ESTES	2.4742163	1.8034571	1.3180633
RND2 MW-01S	.9294189	1.7032914	1.0530784
RND3 2002	.1760913	1.6794279	1.0000000
RND3 2095	.1760913	1.6570559	1.0000000
RND3 3095	1.1613680	1.9003671	2.1818436
RND3 ESTES	2.2741578	1.8407332	1.0000000
RND3 MW-01S	.1760913	1.7234557	1.0000000
RND4 2002	1.7101174	1.6693169	1.3222193
RND4 2095	0.0000000	1.7307823	1.3222193
RND4 3095	0.0000000	1.9350032	3.2355284
RND4 ESTES	2.6683859	1.9222063	1.3222193
RND4 MW-01S	1.1003705	1.6473830	1.3222193
1DOE 2015	1.2878017	1.5314789	.3979400
2DOE 2015		2.0000000	-1.3010300
3DOE 2015		1.6020600	1.0000000
1DOE 2017		1.4913617	1.3222193
2DOE 2017		2.0000000	2.6020600
3DOE 2017		1.4771213	2.0000000
2DOE 2093		1.0000000	1.6989700
3DOE 2093		1.7781513	2.3010300
3DOE 2095		1.6989700	1.5051500
1DOE 3015		1.3617278	1.4149733
2DOE 3015		2.0000000	2.9030900
3DOE 3015		1.6020600	2.8450980
1DOE 3017		2.0413927	.6989700
2DOE 3017		2.0000000	3.3424227
3DOE 3017		1.7781513	3.3424227
2DOE 3093		2.0000000	3.3802112
3DOE 3093		1.6989700	3.2304489
2DOE 3095		1.3010300	.3979400
3DOE 3095		1.9590414	3.3636120
1DOE 4015		1.8061800	3.4232459
2DOE 4015		2.0000000	3.4313638
3DOE 4015		1.9444827	3.4082400
6-90DOE 3095	1.0000000	2.0000000	3.2552725
12-91DOE 3095	1.0000000	2.0000000	2.2900346
-90DOE 2061	1.5563025	2.0000000	1.3979400
6-90DOE 2095	1.0000000	2.0000000	2.3838154
11-91DOE 2096	1.0000000	2.0000000	3.5340261

0	34	35	36
CASE NAME	LOGZINC	LOGBARI	LOGIRON
12-91DOE 2125	1.0000000	2.0000000	1.6989700
12-91DOE 2396	1.4313638	2.0000000	1.6989700
6-19-90DOE 3062	1.0000000	2.0000000	3.0644580
11-91DOE 3096	1.0000000	2.0000000	2.6020600
11-91DOE 4096	1.0000000	2.0000000	1.6989700
11-91DOE 4015	1.4313638	2.0000000	3.6031444
RND1 A&W1		1.7752463	3.0413927
RND1 A&W2	.8129134	1.7881684	3.1238516
RND1 MW-01D		1.7626786	
RND2 A&W1	1.1430148	1.7497363	2.0413927
RND2 A&W2	1.4281348	1.7831887	3.1553360
RND2 MW-01D	1.0128372	1.8943161	3.3502480
RND3 A&W1	1.1303338	1.7972675	1.0000000
RND4 A&W1	1.3979400	1.8802418	2.9532763
RND4 A&W2	.5910646	1.8129134	3.0969100
RND4 MW-01D	1.4517864	1.9074114	3.3802112

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[63 cases with 46 variables]

0 CASE NAME	37 LOG_MANG	38 LOG_VANA	39 LOG_ALUM
RND1 2095	.3010300	.3979400	1.0606978
RND1 3095	2.4345689	.3979400	1.3710679
RND1 ESTES	.3010300	.3979400	1.0606978
RND1 MW-01S	.3010300	.3979400	1.4533183
RND2 2002	1.8932068	.	2.0969100
RND2 2095	.1760913	.3010300	2.1553360
RND2 3095	2.5171959	.3010300	2.1903317
RND2 ESTES	.1760913	.3010300	1.6434527
RND2 MW-01S	.1760913	.3010300	2.0755470
RND3 2002	1.8536982	.3010300	1.2174839
RND3 2095	-.3010300	.3010300	1.2174839
RND3 3095	2.4409091	.3010300	1.9395193
RND3 ESTES	-.3010300	.3010300	1.6364879
RND3 MW-01S	1.2174839	.3010300	1.8721563
RND4 2002	1.8221681	.3010300	1.9068735
RND4 2095	.3617278	.3010300	1.8750613
RND4 3095	2.5453071	.3010300	1.8337844
RND4 ESTES	.2041200	.3010300	1.8524800
RND4 MW-01S	-.3010300	.3010300	1.8463371
1DOE 2015	.6020600	.	1.8450980
2DOE 2015	1.0000000	.	.
3DOE 2015	-.3010300	.	.
1DOE 2017	1.9344985	.	.
2DOE 2017	2.3802112	.	.
3DOE 2017	2.3010300	.	.
2DOE 2093	1.4771213	.	.
3DOE 2093	1.3010300	.	.
3DOE 2095	.4771213	.	.
1DOE 3015	1.9190781	.	.
2DOE 3015	2.3979400	.	.
3DOE 3015	2.3010300	.	.
1DOE 3017	2.7403627	.	.
2DOE 3017	2.5440680	.	.
3DOE 3017	2.4771213	.	.
2DOE 3093	2.6901961	.	.
3DOE 3093	2.3010300	.	.
2DOE 3095	1.4771213	.	.
3DOE 3095	2.5171959	.	.
1DOE 4015	2.5024271	.	.
2DOE 4015	2.5314789	.	.
3DOE 4015	2.5289167	.	.
6-90DOE 3095	2.4683473	1.3979400	1.7403627
2-91DOE 3095	2.1958997	1.3979400	2.0000000
-90DOE 2061	1.0000000	.	.
6-90DOE 2095	1.3222193	.	2.5301997
11-91DOE 2096	2.7489629	1.3979400	2.0000000

0	37	38	39
CASE NAME	LOG_MANG	LOG_VANA	LOG_ALUM
12-91DOE 2125	.8750613		2.0000000
12-91DOE 2396	.8750613	1.3979400	2.0000000
6-19-90DOE 3062	2.5751878		1.3979400
11-91DOE 3096	1.8260748	1.3979400	2.0000000
11-91DOE 4096	1.4913617	1.3979400	2.0000000
11-91DOE 4015	2.5078559	1.3979400	2.0000000
RND1 A&W1	2.5954962	.3979400	1.4132998
RND1 A&W2	2.6106602	.3979400	1.0606978
RND1 MW-01D	2.4533183	.3979400	1.0606978
RND2 A&W1	2.5465427	.3010300	2.1492191
RND2 A&W2	2.5670264	.7075702	1.9542425
RND2 MW-01D	2.5538830	.3010300	2.2013971
RND3 A&W1	2.6031444	.3010300	1.6720979
RND4 A&W1	2.6963564	.3010300	1.8356906
RND4 A&W2	2.6031444	.3010300	1.8234742
RND4 MW-01D	2.5599066	.3010300	1.8169038

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[63 cases with 46 variables]

0 CASE NAME	40 LOGCOBAL	41 LOG_LEAD	42 LOG_MERC
RND1 2095	.5440680	0.0000000	-1.0000000
RND1 3095	.5440680	0.0000000	-1.0000000
RND1 ESTES	.5440680	.4313638	-1.0000000
RND1 MW-01S	.5440680	0.0000000	-1.0000000
RND2 2002		0.0000000	-1.0000000
RND2 2095	.3010300	0.0000000	-1.0000000
RND2 3095	.3010300	0.0000000	-1.0000000
RND2 ESTES	.3010300	.5051500	-1.0000000
RND2 MW-01S	.3010300	0.0000000	-1.0000000
RND3 2002	.5440680	.1760913	-1.0000000
RND3 2095	.5440680	.1760913	-1.0000000
RND3 3095	.5440680	.1760913	-1.0000000
RND3 ESTES	.5440680	.1760913	-1.0000000
RND3 MW-01S	.5440680	.1760913	-1.0000000
RND4 2002	.3979400	0.0000000	-1.0000000
RND4 2095	.3979400	0.0000000	-1.0000000
RND4 3095	.3979400	0.0000000	-1.0000000
RND4 ESTES	.3979400	.5314789	-1.0000000
RND4 MW-01S	.3979400	0.0000000	-1.0000000
1DOE 2015		0.0000000	-1.0000000
2DOE 2015		.3979400	-1.0000000
3DOE 2015		1.3222193	-1.0000000
1DOE 2017		1.1760913	-.3010300
2DOE 2017		2.0000000	-.3979400
3DOE 2017		1.4149733	-1.0000000
2DOE 2093		.3979400	-1.0000000
3DOE 2093		.4771213	-1.0000000
3DOE 2095		0.0000000	-.3979400
1DOE 3015		1.3979400	-1.0000000
2DOE 3015		.3979400	-1.0000000
3DOE 3015		1.7481880	-1.0000000
1DOE 3017		1.1760913	-.3010300
2DOE 3017		2.0000000	-.3010300
3DOE 3017		1.8920946	-.6989700
2DOE 3093		2.0000000	-.3010300
3DOE 3093		.4771213	-1.0000000
2DOE 3095		1.8450980	-1.0000000
3DOE 3095		0.0000000	-.6989700
1DOE 4015		1.3979400	-1.0000000
2DOE 4015		.3979400	-.8239087
3DOE 4015		.4771213	-1.0000000
6-90DOE 3095	1.0969100	.3979400	-1.0000000
2-91DOE 3095	.3979400	.1760913	-1.0000000
-90DOE 2061		.3979400	
6-90DOE 2095		.3979400	-1.0000000
11-91DOE 2096	.3979400	.1760913	-1.0000000

0	40	41	42
CASE NAME	LOGCOBAL	LOG_LEAD	LOG_MERC
12-91DOE 2125		.1760913	-1.0000000
12-91DOE 2396	.3979400	.1760913	-1.0000000
6-19-90DOE 3062		.3979400	-1.0000000
11-91DOE 3096	.3979400	.1760913	-1.0000000
11-91DOE 4096	.3979400	.1760913	-1.0000000
11-91DOE 4015	.1760913	.1760913	-1.0000000
RND1 A&W1	.5440680	0.0000000	-1.0000000
RND1 A&W2	.5440680	0.0000000	-1.0000000
RND1 MW-01D	.5440680	0.0000000	-1.0000000
RND2 A&W1	.3010300	.3979400	-1.0000000
RND2 A&W2	.3010300	0.0000000	-1.0000000
RND2 MW-01D	.3010300	.5797836	-1.0000000
RND3 A&W1	.5440680	.1760913	-1.0000000
RND4 A&W1	.3979400	0.0000000	-1.0000000
RND4 A&W2	.3979400	0.0000000	-1.0000000
RND4 MW-01D	.3979400	0.0000000	-1.0000000

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[63 cases with 46 variables]

0	43	44	45
CASE NAME	LOG_MAGN	LOG_CALC	LOG_SODI
RND1 2095	4.2810334	4.9111576	4.2966652
RND1 3095	4.4132998	4.9758911	4.1492191
RND1 ESTES	4.4232459	4.9576073	4.5831988
RND1 MW-01S	4.3961993	5.0569049	4.7234557
RND2 2002	4.4149733	4.9831751	4.2576786
RND2 2095	4.4014005	5.0211893	4.3710679
RND2 3095	4.5118834	5.0606978	4.2430380
RND2 ESTES	4.4742163	5.0170333	4.7092700
RND2 MW-01S	4.4502491	5.0863598	4.5550944
RND3 2002	4.4329693	5.0043214	4.2253093
RND3 2095	4.4082400	5.0334238	4.1818436
RND3 3095	4.4814426	5.0293838	4.1303338
RND3 ESTES	4.4653829	5.0128372	4.9003671
RND3 MW-01S	4.4756712	5.1139434	4.5717088
RND4 2002	4.4166405	4.9943172	4.2121876
RND4 2095	4.4199557	5.0453230	4.4183013
RND4 3095	4.4913617	5.0530784	4.1583625
ID4 ESTES	4.5276299	5.0791812	5.0606978
ND4 MW-01S	4.4149733	5.0606978	4.4099331
1DOE 2015	4.3010300	4.8457180	4.0170333
2DOE 2015	4.2552725	4.9138139	4.0413927
3DOE 2015	4.2878017	4.8859263	3.9956352
1DOE 2017	4.4727564	5.1461280	3.9912261
2DOE 2017	4.5185139	5.1461280	4.0791812
3DOE 2017	4.4800069	5.1702617	3.9190781
2DOE 2093	4.4471580	5.0000000	4.7242759
3DOE 2093	4.4409091	4.9872192	4.7134905
3DOE 2095	4.3673559	5.0000000	4.3909351
1DOE 3015	4.3384565	4.7788745	4.3364597
2DOE 3015	4.2787536	4.9190781	4.0413927
3DOE 3015	4.3117539	4.9227255	4.0170333
1DOE 3017	4.2329961	4.9216865	4.2068259
2DOE 3017	4.4471580	5.0791812	4.0413927
3DOE 3017	4.4149733	5.0899051	3.9867717
2DOE 3093	4.3979400	4.9590414	3.9542425
3DOE 3093	4.3424227	4.9350032	3.8692317
2DOE 3095	4.4232459	4.6138418	4.4377506
3DOE 3095	4.4871384	5.0453230	4.1931246
1DOE 4015	4.4048337	5.0086002	3.8109043
2DOE 4015	4.4313638	5.0413927	3.8450980
3DOE 4015	4.4082400	5.0086002	3.8215135
6-90DOE 3095	4.4785665	5.0374265	4.3404441
12-91DOE 3095	4.4814426	4.9938769	4.0334238
-90DOE 2061	4.3820170	4.9818186	4.3222193
6-90DOE 2095	4.3747483	4.9991305	4.4281348
11-91DOE 2096	4.5327544	5.1731863	3.7708520

0	43	44	45
CASE NAME	LOG_MAGN	LOG_CALC	LOG_SODI
12-91DOE 2125	4.3304138	4.9867717	4.1303338
12-91DOE 2396	4.4199557	4.9628427	4.3242825
6-19-90DOE 3062	4.3463530	4.9599948	4.3096302
11-91DOE 3096	4.3560259	4.9211661	3.4623980
11-91DOE 4096	4.3242825	4.9014583	3.7993405
11-91DOE 4015	4.3926970	4.9675480	3.9867717
RND1 A&W1	4.3384565	4.9599948	4.0718820
RND1 A&W2	4.3521825	4.9754318	4.1139434
RND1 MW-01D	4.2988531	4.8998205	4.0644580
RND2 A&W1	4.3138672	4.9148718	4.0644580
RND2 A&W2	4.3242825	4.9334873	4.0934217
RND2 MW-01D	4.4183013	5.0086002	4.2380461
RND3 A&W1	4.3541084	4.9749720	4.1139434
RND4 A&W1	4.4048337	5.0170333	4.2174839
RND4 A&W2	4.3636120	4.9872192	4.1038037
RND4 MW-01D	4.4313638	5.0211893	4.2278867

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[63 cases with 46 variables]

CASE NAME	LOG_POTA
RND1 2095	3.2977605
RND1 3095	3.2977605
RND1 ESTES	3.2977605
RND1 MW-01S	3.2977605
RND2 2002	3.6170003
RND2 2095	3.6344773
RND2 3095	3.6928469
RND2 ESTES	3.5987905
RND2 MW-01S	3.4842998
RND3 2002	3.5390761
RND3 2095	3.3521825
RND3 3095	3.5065050
RND3 ESTES	3.5390761
RND3 MW-01S	3.4548449
RND4 2002	3.5010593
RND4 2095	3.4756712
RND4 3095	3.2718416
D4 ESTES	3.6009729
RND4 MW-01S	3.2576786
1DOE 2015	3.5314789
2DOE 2015	3.3979400
3DOE 2015	3.3747483
1DOE 2017	3.3010300
2DOE 2017	3.3979400
3DOE 2017	3.2833012
2DOE 2093	3.3979400
3DOE 2093	3.5717088
3DOE 2095	3.3979400
1DOE 3015	3.7951846
2DOE 3015	3.3979400
3DOE 3015	3.3483049
1DOE 3017	3.3010300
2DOE 3017	3.3979400
3DOE 3017	3.3201463
2DOE 3093	3.3979400
3DOE 3093	3.2648178
2DOE 3095	3.7007037
3DOE 3095	3.4608978
1DOE 4015	3.2405492
2DOE 4015	3.3979400
3DOE 4015	3.1613680
6-90DOE 3095	3.4885507
12-91DOE 3095	3.4149733
-90DOE 2061	3.5440680
6-90DOE 2095	3.4517864
11-91DOE 2096	3.2304489

0 CASE NAME	46 LOG_POTA
12-91DOE 2125	3.3424227
12-91DOE 2396	3.5051500
6-19-90DOE 3062	3.4533183
11-91DOE 3096	3.0791812
11-91DOE 4096	3.0413927
11-91DOE 4015	3.2552725
RND1 A&W1	3.2977605
RND1 A&W2	3.2977605
RND1 MW-01D	3.2977605
RND2 A&W1	3.5092025
RND2 A&W2	3.1731863
RND2 MW-01D	3.5774918
RND3 A&W1	3.4377506
RND4 A&W1	3.5051500
RND4 A&W2	3.4653829
RND4 MW-01D	3.4698220

000282

css/3: basic stats	Descriptive Statistics N. of Cases = 62 [from 63] (MD pairwise deleted)					
	N	Min	Max	Mean	St. Err.	St. Dev.
ANTIM	35	10.00	19.5	14.4	.634	3.75
ARSENIC	33	1.00	2.8	1.7	.093	.54
BERYLL	35	.50	5.0	1.0	.175	1.04
CADMIUM	36	.50	2.5	1.9	.129	.77
CHROM	36	1.00	3.5	2.6	.120	.72
COPPER	36	1.50	76.3	11.1	3.017	18.10
NICKEL	36	2.50	30.4	10.7	1.264	7.58
SELENIUM	29	1.00	5.0	1.7	.157	.84
SILVER	33	.50	13.8	2.6	.440	2.53
THALLIUM	35	1.00	15.0	2.5	.443	2.62
DIS_ZN	37	1.00	466.0	42.1	15.106	91.89
DIS_BA	62	10.00	110.0	69.2	3.311	26.07
DIS_FE	60	.05	4010.0	814.1	136.400	1056.55
DIS_MN	62	.50	561.0	186.0	22.252	175.21
VANADI	35	2.00	25.0	6.8	1.564	9.25
DIS_AL	40	11.50	339.0	78.5	9.372	59.27
COBALT	35	1.50	12.5	3.0	.298	1.77
DIS_PB	62	1.00	100.0	11.6	3.205	25.23
DIS_HG	61	.10	.5	.1	.014	.11
DIS_MG	62	17100.00	34100.0	25451.6	515.424	4058.46
DIS_CA	62	41100.00	149000.0	100066.1	2437.557	19193.34
DIS_NA	62	2900.00	115000.0	20619.4	2362.095	18599.16
DIS_K	62	1100.00	6240.0	2719.9	122.310	963.07
LOGANTIM	35	1.00	1.3	1.1	.019	.11
LOGARSEN	33	0.00	.4	.2	.023	.13
LOGBERYL	35	-.30	.7	-.2	.052	.30
LOGCADMI	36	-.30	.4	.2	.046	.28
LOGCHROM	36	0.00	.5	.4	.026	.16
LOGCOPPE	36	.18	1.9	.7	.083	.50
LOGNICKE	36	.40	1.5	.9	.055	.33
LOGSELEN	29	0.00	.7	.2	.033	.18
LOGSILVE	33	-.30	1.1	.3	.065	.37
LOGTHALL	35	0.00	1.2	.3	.048	.28
LOGZINC	37	0.00	2.7	1.1	.101	.61
LOGBARI	62	1.00	2.0	1.8	.026	.20
LOGIRON	60	-1.30	3.6	2.1	.143	1.11
LOG_MANG	62	-.30	2.7	1.7	.126	1.00
LOG_VANA	35	.30	1.4	.6	.074	.44
LOG_ALUM	40	1.06	2.5	1.8	.057	.36
LOGCOBAL	35	.18	1.1	.4	.026	.15

css/3: basic stats	Descriptive Statistics N. of Cases = 62 [from 63] (MD pairwise deleted)					
	N	Min	Max	Mean	St. Err.	St. Dev.
LOG_LEAD	62	0.00	2.0	.5	.078	.61
LOG_MERC	61	-1.00	-.3	-.9	.026	.20
LOG_MAGN	62	4.23	4.5	4.4	.009	.07
LOG_CALC	62	4.61	5.2	5.0	.011	.09
LOG_SODI	62	3.46	5.1	4.2	.037	.29
LOG_POTA	62	3.04	3.8	3.4	.019	.15

css/3: basic stats	Descriptive Statistics N. of Cases = 62 [from 63] (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
ANTIM	15.7	13.15
ARSENIC	1.9	1.51
BERYLL	1.3	.62
CADMIUM	2.1	1.60
CHROM	2.8	2.35
COPPER	17.3	5.01
NICKEL	13.2	8.10
SELENIUM	2.0	1.33
SILVER	3.5	1.66
THALLIUM	3.4	1.62
DIS_ZN	72.8	11.41
DIS_BA	75.8	62.55
DIS_FE	1086.7	541.53
DIS_MN	230.4	141.50
VANADI	10.0	3.61
DIS_AL	97.5	59.49
COBALT	3.6	2.42
DIS_PB	18.0	5.15
DIS_HG	.2	.11
DIS_MG	26481.2	24422.04
DIS_CA	104935.2	95197.04
DIS_NA	25337.7	15901.00
DIS_K	2964.2	2475.60
LOGANTIM	1.2	1.11
LOGARSEN	.3	.16
LOGBERYL	-.0	-.26
LOGCADMI	.3	.11
LOGCHROM	.4	.34
LOGCOPPE	.9	.53
LOGNICKE	1.0	.80
LOGSELEN	.2	.11
LOGSILVE	.4	.13
LOGTHALL	.4	.19
LOGZINC	1.3	.94
LOGBARI	1.9	1.75
LOGIRON	2.4	1.83
LOG_MANG	2.0	1.45
LOG_VANA	.7	.40
LOG_ALUM	1.9	1.65
LOGCOBAL	.5	.39

css/3: basic stats	Descriptive Statistics N. of Cases = 62 [from 63] (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
LOG_LEAD	.6	.31
LOG_MERC	-.9	-.97
LOG_MAGN	4.4	4.38
LOG_CALC	5.0	4.97
LOG_SODI	4.3	4.13
LOG_POTA	3.4	3.37

data file: g:/project/539-02/bg/gw/GWBGTOTR.CSS
[31 cases with 40 variables]

0 CASE NAME	1 ANTIM	2 TOT_AS	3 BERYLL	4 CADMIUM
RND3 2002	14.00000	9.000	.50000	2.00000
RND3 2095	14.00000	3.200	.50000	2.00000
RND3 ESTES	14.00000	1.500	.50000	2.00000
RND4 2002	11.00000	4.300	.50000	2.00000
RND4 2095	11.00000	1.500	.50000	2.00000
RND4 ESTES	11.00000	1.500	.50000	2.00000
RND4 MW-01S	11.00000	1.500	.50000	2.00000
6-90DOE 3095	12.50000	1.250	5.00000	.50000
3-91DOE 3095	12.50000	1.250	5.00000	.50000
6-90DOE 2061	.	1.250	.	.50000
3-91DOE 2061	12.50000	1.250	5.00000	.50000
6-90DOE 2095	12.50000	42.000	5.00000	.50000
3-91DOE 2095	.	10.000	5.00000	.50000
3-91DOE 2125	12.50000	1.250	5.00000	.50000
6-19-90DOE 3062	.	1.250	.	.
3-91DOE 3062	.	1.250	.	.
3-91DOE 4015	12.50000	4.000	5.00000	.50000
RND3 A&W1	14.00000	6.300	.50000	2.00000
RND3 A&W2	14.00000	1.500	2.00000	2.00000
RND3 MW-01D	14.00000	6.200	2.00000	2.00000
RND4 A&W1	11.00000	1.500	2.00000	2.00000
RND4 A&W2	11.00000	1.500	2.00000	2.00000
RND4 MW-01D	11.00000	1.500	2.00000	2.00000
RND3 3095	14.00000	1.500	.50000	2.00000
RND4 3095	11.00000	68.700	.50000	2.00000
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data file: g:/project/539-02/bg/gw/GWBGTOTR.CSS
[31 cases with 40 variables]

0	5	6	7	8	9	10
CASE NAME	TOT_CR	TOT_CU	TOT_PB	MERCURY	TOT_NI	TOT_ZN
RND3 2002	46.900	22.100	8.900	.100	38.400	54.200
RND3 2095	55.400	65.800	89.400	.100	62.500	165.000
RND3 ESTES	2.500	45.500	.	.100	5.500	166.000
RND4 2002	15.300	14.400	5.100	.100	15.800	218.000
RND4 2095	7.300	7.000	4.200	.100	13.200	26.000
RND4 ESTES	2.500	67.000	3.100	.100	9.200	418.000
RND4 MW-01S	65.400	40.100	4.800	.100	157.000	131.000
6-90DOE 3095	2.500	12.500	2.500	.100	2.500	10.000
3-91DOE 3095	13.000	12.500	2.500	.100	8.000	59.000
6-90DOE 2061	2.500	22.500	2.500	.	.	20.000
3-91DOE 2061	2.500	55.000	2.500	.100	2.500	27.000
6-90DOE 2095	29.000	68.000	27.000	.100	36.000	81.000
3-91DOE 2095	17.000	12.500	3.500	.100	12.000	38.000
3-91DOE 2125	197.000	12.500	8.000	.100	18.000	10.000
6-19-90DOE 3062	2.500	12.500	2.500	.	2.500	10.000
3-91DOE 3062	2.500	12.500	2.500	.100	2.500	10.000
3-91DOE 4015	2.500	12.500	2.500	.100	2.500	68.000
RND3 A&W1	2.500	8.300	1.500	.100	5.500	22.500
RND3 A&W2	2.500	1.500	1.500	.100	5.500	13.000
RND3 MW-01D	2.500	1.500	80.800	.100	5.500	16.000
RND4 A&W1	2.500	15.600	2.100	.100	3.500	23.600
RND4 A&W2	2.500	2.000	1.000	.100	3.500	5.700
RND4 MW-01D	2.500	2.000	1.000	.100	3.500	13.300
RND3 3095	41.700	6.600	1.500	.100	29.200	19.600
RND4 3095	7.500	2.000	14.000	.100	15.800	26.700

000288

data file: g:/project/539-02/bg/gw/GWBGTOTR.CSS
[31 cases with 40 variables]

0 CASE NAME	11 TOT_BA	12 TOT_FE	13 TOT_MN	14 TOT_V	15 TOT_AL	16 COBALT
RND3 2002	72.300	15900.00	674.000	8.600	2780.000	3.50000
RND3 2095	155.000	68000.00	1660.000	41.100	10800.00	23.80000
RND3 ESTES	67.000	157.000	9.500	2.000	40.300	3.50000
RND4 2002	56.700	7990.000	245.000	2.000	982.000	2.50000
RND4 2095	59.900	3810.000	78.100	4.300	1780.000	2.50000
RND4 ESTES	76.400	21.000	1.300	2.000	109.000	2.50000
RND4 MW-01S	239.000	10900.00	1970.000	19.100	2750.000	9.00000
6-90DOE 3095	100.000	2150.000	287.000	25.000	63.000	12.50000
3-91DOE 3095	100.000	1320.000	376.000	25.000	250.000	.
6-90DOE 2061	100.000	104.000	10.000	.	.	.
3-91DOE 2061	100.000	55.000	10.000	25.000	250.000	12.50000
6-90DOE 2095	100.000	39500.00	1340.000	25.000	9560.000	12.50000
3-91DOE 2095	100.000	17000.00	396.000	25.000	2270.000	12.50000
3-91DOE 2125	100.000	5470.000	154.000	25.000	1370.000	12.50000
6-19-90DOE 3062	100.000	1380.000	375.000	25.000	25.000	.
3-91DOE 3062	100.000	1360.000	403.000	25.000	250.000	.
3-91DOE 4015	100.000	3300.000	319.000	25.000	250.000	12.50000
RND3 A&W1	72.900	5570.000	407.000	2.000	105.000	3.50000
RND3 A&W2	62.100	1300.000	380.000	2.000	79.400	3.50000
RND3 MW-01D	1.300	166.000	6.900	2.000	67.200	3.50000
RND4 A&W1	75.900	2980.000	473.000	2.000	68.400	2.50000
RND4 A&W2	62.000	1280.000	374.000	2.000	68.600	2.50000
RND4 MW-01D	75.600	2360.000	338.000	2.000	140.000	2.50000
RND3 3095	84.300	780.000	288.000	2.000	146.000	3.50000
RND4 3095	84.600	1930.000	342.000	2.000	273.000	2.50000
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data file: g:/project/539-02/bg/gw/GWBGTOTR.CSS
[31 cases with 40 variables]

0	17	18	19	20	21
CASE NAME	TOT_MG	TOT_CA	TOT_NA	TOT_K	LGANTIM
RND3 2002	40800.00	131000.0	15100.00	4280.000	1.1461280
RND3 2095	89500.00	276000.0	15400.00	5410.000	1.1461280
RND3 ESTES	27600.00	97300.00	74900.00	3570.000	1.1461280
RND4 2002	28400.00	104000.0	14900.00	3170.000	1.0413927
RND4 2095	27500.00	113000.0	23800.00	3630.000	1.0413927
RND4 ESTES	30100.00	107000.0	104000.0	3240.000	1.0413927
RND4 MW-01S	64300.00	221000.0	26300.00	2700.000	1.0413927
6-90DOE 3095	33400.00	111000.0	21400.00	3110.000	1.0969100
3-91DOE 3095	34200.00	86500.00	16100.00	3550.000	1.0969100
6-90DOE 2061	26800.00	104000.0	21100.00	3780.000	.
3-91DOE 2061	24700.00	73800.00	14400.00	3610.000	1.0969100
6-90DOE 2095	80000.00	227000.0	23800.00	6910.000	1.0969100
3-91DOE 2095	40700.00	112000.0	22800.00	4180.000	.
3-91DOE 2125	33800.00	118000.0	51600.00	3460.000	1.0969100
6-19-90DOE 3062	25500.00	96200.00	19800.00	4230.000	.
3-91DOE 3062	24900.00	72600.00	12800.00	2780.000	.
3-91DOE 4015	26200.00	75700.00	10400.00	2320.000	1.0969100
RND3 A&W1	21500.00	89900.00	12600.00	3130.000	1.1461280
RND3 A&W2	21500.00	89900.00	12600.00	3430.000	1.1461280
RND3 MW-01D	99.700	411.000	192.000	436.500	1.1461280
RND4 A&W1	23700.00	97300.00	15300.00	3590.000	1.0413927
RND4 A&W2	21500.00	90600.00	11700.00	3300.000	1.0413927
RND4 MW-01D	25100.00	97400.00	16100.00	3190.000	1.0413927
RND3 3095	30400.00	108000.0	13700.00	2920.000	1.1461280
RND4 3095	29800.00	109000.0	14100.00	3150.000	1.0413927
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data file: g:/project/539-02/bg/gw/GWBGTOTR.CSS
[31 cases with 40 variables]

0 CASE NAME	22 LGARSEN	23 LGBERYL	24 LGCADMIU
RND3 2002	.9542425	-.3010300	.3010300
RND3 2095	.5051500	-.3010300	.3010300
RND3 ESTES	.1760913	-.3010300	.3010300
RND4 2002	.6334685	-.3010300	.3010300
RND4 2095	.1760913	-.3010300	.3010300
RND4 ESTES	.1760913	-.3010300	.3010300
RND4 MW-01S	.1760913	-.3010300	.3010300
6-90DOE 3095	.0969100	.6989700	-.3010300
3-91DOE 3095	.0969100	.6989700	-.3010300
6-90DOE 2061	.0969100	.	-.3010300
3-91DOE 2061	.0969100	.6989700	-.3010300
6-90DOE 2095	1.6232493	.6989700	-.3010300
3-91DOE 2095	1.0000000	.6989700	-.3010300
3-91DOE 2125	.0969100	.6989700	-.3010300
6-19-90DOE 3062	.0969100	.	.
3-91DOE 3062	.0969100	.	.
3-91DOE 4015	.6020600	.6989700	-.3010300
RND3 A&W1	.7993405	-.3010300	.3010300
RND3 A&W2	.1760913	.3010300	.3010300
RND3 MW-01D	.7923917	.3010300	.3010300
RND4 A&W1	.1760913	.3010300	.3010300
RND4 A&W2	.1760913	.3010300	.3010300
RND4 MW-01D	.1760913	.3010300	.3010300
RND3 3095	.1760913	-.3010300	.3010300
RND4 3095	1.8369567	-.3010300	.3010300
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data file: g:/project/539-02/bg/gw/GWBGTOTR.CSS
[31 cases with 40 variables]

0	25	26	27
CASE NAME	LGCHROM	LGCOPPER	LGLEAD
RND3 2002	1.6711728	1.3443923	.9493900
RND3 2095	1.7435098	1.8182259	1.9513375
RND3 ESTES	.3979400	1.6580114	.
RND4 2002	1.1846914	1.1583625	.7075702
RND4 2095	.8633229	.8450980	.6232493
RND4 ESTES	.3979400	1.8260748	.4913617
RND4 MW-01S	1.8155777	1.6031444	.6812412
6-90DOE 3095	.3979400	1.0969100	.3979400
3-91DOE 3095	1.1139434	1.0969100	.3979400
6-90DOE 2061	.3979400	1.3521825	.3979400
3-91DOE 2061	.3979400	1.7403627	.3979400
6-90DOE 2095	1.4623980	1.8325089	1.4313638
3-91DOE 2095	1.2304489	1.0969100	.5440680
3-91DOE 2125	2.2944662	1.0969100	.9030900
6-19-90DOE 3062	.3979400	1.0969100	.3979400
3-91DOE 3062	.3979400	1.0969100	.3979400
3-91DOE 4015	.3979400	1.0969100	.3979400
RND3 A&W1	.3979400	.9190781	.1760913
RND3 A&W2	.3979400	.1760913	.1760913
RND3 MW-01D	.3979400	.1760913	1.9074114
RND4 A&W1	.3979400	1.1931246	.3222193
RND4 A&W2	.3979400	.3010300	0.0000000
RND4 MW-01D	.3979400	.3010300	0.0000000
RND3 3095	1.6201361	.8195439	.1760913
RND4 3095	.8750613	.3010300	1.1461280
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data file: g:/project/539-02/bg/gw/GWBGTOTR.CSS
[31 cases with 40 variables]

0	28	29	30
CASE NAME	LG_MERC	LGNICKEL	LG_ZINC
RND3 2002	-1.0000000	1.5843312	1.7339993
RND3 2095	-1.0000000	1.7958800	2.2174839
RND3 ESTES	-1.0000000	.7403627	2.2201081
RND4 2002	-1.0000000	1.1986571	2.3384565
RND4 2095	-1.0000000	1.1205739	1.4149733
RND4 ESTES	-1.0000000	.9637878	2.6211763
RND4 MW-01S	-1.0000000	2.1958997	2.1172713
6-90DOE 3095	-1.0000000	.3979400	1.0000000
3-91DOE 3095	-1.0000000	.9030900	1.7708520
6-90DOE 2061	.	.	1.3010300
3-91DOE 2061	-1.0000000	.3979400	1.4313638
6-90DOE 2095	-1.0000000	1.5563025	1.9084850
3-91DOE 2095	-1.0000000	1.0791812	1.5797836
3-91DOE 2125	-1.0000000	1.2552725	1.0000000
6-19-90DOE 3062	.	.3979400	1.0000000
3-91DOE 3062	-1.0000000	.3979400	1.0000000
3-91DOE 4015	-1.0000000	.3979400	1.8325089
RND3 A&W1	-1.0000000	.7403627	1.3521825
RND3 A&W2	-1.0000000	.7403627	1.1139434
RND3 MW-01D	-1.0000000	.7403627	1.2041200
RND4 A&W1	-1.0000000	.5440680	1.3729120
RND4 A&W2	-1.0000000	.5440680	.7558749
RND4 MW-01D	-1.0000000	.5440680	1.1238516
RND3 3095	-1.0000000	1.4653829	1.2922561
RND4 3095	-1.0000000	1.1986571	1.4265113

data file: g:/project/539-02/bg/gw/GWBGTOTR.CSS
[31 cases with 40 variables]

0 CASE NAME	31 LG_BARIU	32 LG_IRON	33 LG_MANGA
RND3 2002	1.8591383	4.2013971	2.8286599
RND3 2095	2.1903317	4.8325089	3.2201081
RND3 ESTES	1.8260748	2.1958997	.9777236
RND4 2002	1.7535831	3.9025468	2.3891661
RND4 2095	1.7774268	3.5809250	1.8926510
RND4 ESTES	1.8830934	1.3222193	.1139434
RND4 MW-01S	2.3783979	4.0374265	3.2944662
6-90DOE 3095	2.0000000	3.3324385	2.4578819
3-91DOE 3095	2.0000000	3.1205739	2.5751878
6-90DOE 2061	2.0000000	2.0170333	1.0000000
3-91DOE 2061	2.0000000	1.7403627	1.0000000
6-90DOE 2095	2.0000000	4.5965971	3.1271048
3-91DOE 2095	2.0000000	4.2304489	2.5976952
3-91DOE 2125	2.0000000	3.7379873	2.1875207
6-19-90DOE 3062	2.0000000	3.1398791	2.5740313
3-91DOE 3062	2.0000000	3.1335389	2.6053050
3-91DOE 4015	2.0000000	3.5185139	2.5037907
RND3 A&W1	1.8627275	3.7458552	2.6095944
RND3 A&W2	1.7930916	3.1139434	2.5797836
RND3 MW-01D	.1139434	2.2201081	.8388491
RND4 A&W1	1.8802418	3.4742163	2.6748611
RND4 A&W2	1.7923917	3.1072100	2.5728716
RND4 MW-01D	1.8785218	3.3729120	2.5289167
RND3 3095	1.9258276	2.8920946	2.4593925
RND4 3095	1.9273704	3.2855573	2.5340261
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000294

data file: g:/project/539-02/bg/gw/GWBGTOTR.CSS
[31 cases with 40 variables]

0	34	35	36
CASE NAME	LG_VANAD	LG_ALUM	LG_COBAL
RND3 2002	.9344985	3.4440448	.5440680
RND3 2095	1.6138418	4.0334238	1.3765770
RND3 ESTES	.3010300	1.6053050	.5440680
RND4 2002	.3010300	2.9921115	.3979400
RND4 2095	.6334685	3.2504200	.3979400
RND4 ESTES	.3010300	2.0374265	.3979400
RND4 MW-01S	1.2810334	3.4393327	.9542425
6-90DOE 3095	1.3979400	1.7993405	1.0969100
3-91DOE 3095	1.3979400	2.3979400	.
6-90DOE 2061	.	.	.
3-91DOE 2061	1.3979400	2.3979400	1.0969100
6-90DOE 2095	1.3979400	3.9804579	1.0969100
3-91DOE 2095	1.3979400	3.3560259	1.0969100
3-91DOE 2125	1.3979400	3.1367206	1.0969100
6-19-90DOE 3062	1.3979400	1.3979400	.
3-91DOE 3062	1.3979400	2.3979400	.
3-91DOE 4015	1.3979400	2.3979400	1.0969100
RND3 A&W1	.3010300	2.0211893	.5440680
RND3 A&W2	.3010300	1.8998205	.5440680
RND3 MW-01D	.3010300	1.8273693	.5440680
RND4 A&W1	.3010300	1.8350561	.3979400
RND4 A&W2	.3010300	1.8363241	.3979400
RND4 MW-01D	.3010300	2.1461280	.3979400
RND3 3095	.3010300	2.1643529	.5440680
RND4 3095	.3010300	2.4361626	.3979400
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data file: g:/project/539-02/bg/gw/GWBGTOTR.CSS
[31 cases with 40 variables]

0	37	38	39
CASE NAME	LG_MAGNE	LG_CALCI	LG_SODI
RND3 2002	4.6106602	5.1172713	4.1789769
RND3 2095	4.9518230	5.4409091	4.1875207
RND3 ESTES	4.4409091	4.9881128	4.8744818
RND4 2002	4.4533183	5.0170333	4.1731863
RND4 2095	4.4393327	5.0530784	4.3765770
RND4 ESTES	4.4785665	5.0293838	5.0170333
RND4 MW-01S	4.8082110	5.3443923	4.4199557
6-90DOE 3095	4.5237465	5.0453230	4.3304138
3-91DOE 3095	4.5340261	4.9370161	4.2068259
6-90DOE 2061	4.4281348	5.0170333	4.3242825
3-91DOE 2061	4.3926970	4.8680564	4.1583625
6-90DOE 2095	4.9030900	5.3560259	4.3765770
3-91DOE 2095	4.6095944	5.0492180	4.3579348
3-91DOE 2125	4.5289167	5.0718820	4.7126497
6-19-90DOE 3062	4.4065402	4.9831751	4.2966652
3-91DOE 3062	4.3961993	4.8609366	4.1072100
3-91DOE 4015	4.4183013	4.8790959	4.0170333
RND3 A&W1	4.3324385	4.9537597	4.1003705
RND3 A&W2	4.3324385	4.9537597	4.1003705
RND3 MW-01D	1.9986952	2.6138418	2.2833012
RND4 A&W1	4.3747483	4.9881128	4.1846914
RND4 A&W2	4.3324385	4.9571282	4.0681859
RND4 MW-01D	4.3996737	4.9885590	4.2068259
RND3 3095	4.4828736	5.0334238	4.1367206
RND4 3095	4.4742163	5.0374265	4.1492191
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000296

data file: g:/project/539-02/bg/gw/GWBGTOTR.CSS
[31 cases with 40 variables]

CASE NAME	LG_POTAS
RND3 2002	3.6314438
RND3 2095	3.7331973
RND3 ESTES	3.5526682
RND4 2002	3.5010593
RND4 2095	3.5599066
RND4 ESTES	3.5105450
RND4 MW-01S	3.4313638
6-90DOE 3095	3.4927604
3-91DOE 3095	3.5502284
6-90DOE 2061	3.5774918
3-91DOE 2061	3.5575072
6-90DOE 2095	3.8394780
3-91DOE 2095	3.6211763
3-91DOE 2125	3.5390761
6-19-90DOE 3062	3.6263404
3-91DOE 3062	3.4440448
3-91DOE 4015	3.3654880
RND3 A&W1	3.4955443
RND3 A&W2	3.5352941
RND3 MW-01D	2.6399842
RND4 A&W1	3.5550944
RND4 A&W2	3.5185139
RND4 MW-01D	3.5037907
RND3 3095	3.4653829
RND4 3095	3.4983106

css/3: basic stats	Descriptive Statistics N. of Cases = 25 [from 31] (MD pairwise deleted)					
	N	Min	Max	Mean	St. Err.	St. Dev.
ANTIM	21	11.0000	14.0	12.4	.28	1.30
TOT_AS	25	1.2500	68.7	7.0	3.05	15.25
BERYLL	22	.5000	5.0	2.3	.43	2.00
CADMIUM	23	.5000	2.0	1.5	.15	.73
TOT_CR	25	2.5000	197.0	21.2	8.22	41.11
TOT_CU	25	1.5000	68.0	21.4	4.37	21.83
TOT_PB	24	1.0000	89.4	11.5	4.77	23.39
MERCURY	23	.1000	.1	.1	0.00	0.00
TOT_NI	24	2.5000	157.0	19.2	6.71	32.86
TOT_ZN	25	5.7000	418.0	66.1	18.67	93.35
TOT_BA	25	1.3000	239.0	89.8	8.23	41.16
TOT_FE	25	21.0000	68000.0	7791.3	3030.33	15151.65
TOT_MN	25	1.3000	1970.0	436.7	99.86	499.28
TOT_V	24	2.0000	41.1	13.3	2.53	12.42
TOT_AL	24	25.0000	10800.0	1436.5	579.50	2838.97
COBALT	21	2.5000	23.8	7.0	1.28	5.84
TOT_MG	25	99.7000	89500.0	33280.0	3766.26	18831.31
TOT_CA	25	411.0000	276000.0	112344.4	10980.09	54900.45
TOT_NA	25	192.0000	104000.0	23395.7	4435.51	22177.54
TOT_K	25	436.5000	6910.0	3483.1	223.60	1118.01
LGANTIM	21	1.0414	1.1	1.1	.01	.05
LGARSEN	25	.0969	1.8	.4	.10	.49
LGBERYL	22	-.3010	.7	.2	.10	.45
LGCADMIU	23	-.3010	.3	.1	.06	.29
LGCHROM	25	.3979	2.3	.9	.12	.60
LGCOPPER	25	.1761	1.8	1.1	.10	.52
LGLEAD	24	0.0000	2.0	.6	.11	.53
LG_MERC	23	-1.0000	-1.0	-1.0	0.00	0.00
LGNICKEL	24	.3979	2.2	1.0	.10	.50
LG_ZINC	25	.7559	2.6	1.5	.10	.49
LG_BARIU	25	.1139	2.4	1.9	.08	.39
LG_IRON	25	1.3222	4.8	3.3	.17	.86
LG_MANGA	25	.1139	3.3	2.2	.16	.81
LG_VANAD	24	.3010	1.6	.8	.11	.55
LG_ALUM	24	1.3979	4.0	2.5	.15	.76
LG_COBAL	21	.3979	1.4	.7	.07	.34
LG_MAGNE	25	1.9987	5.0	4.4	.11	.53
LG_CALCI	25	2.6138	5.4	4.9	.10	.51
LG_SODI	25	2.2833	5.0	4.2	.09	.47
LG_POTAS	25	2.6400	3.8	3.5	.04	.20

000298

css/3: basic stats	Descriptive Statistics N. of Cases = 25 [from 31] (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
ANTIM	13.0	11.84
TOT_AS	13.4	.72
BERYLL	3.2	1.38
CADMIUM	1.8	1.16
TOT_CR	38.3	4.18
TOT_CU	30.4	12.33
TOT_PB	21.4	1.53
MERCURY	.1	.10
TOT_NI	33.1	5.23
TOT_ZN	104.7	27.38
TOT_BA	106.9	72.74
TOT_FE	14070.1	1512.57
TOT_MN	643.6	229.77
TOT_V	18.6	8.07
TOT_AL	2640.5	232.56
COBALT	9.6	4.29
TOT_MG	41083.6	25476.41
TOT_CA	135094.8	89594.04
TOT_NA	32585.9	14205.45
TOT_K	3946.4	3019.77
LGANTIM	1.1	1.07
LGARSEN	.6	.24
LGBERYL	.4	-.05
LGCADMIU	.2	-.04
LGCHROM	1.1	.61
LGCOPPER	1.3	.87
LGLEAD	.8	.40
LG_MERC	-1.0	-1.00
LGNICKEL	1.2	.74
LG_ZINC	1.7	1.32
LG_BARIU	2.0	1.71
LG_IRON	3.6	2.92
LG_MANGA	2.6	1.91
LG_VANAD	1.1	.62
LG_ALUM	2.8	2.19
LG_COBAL	.9	.56
LG_MAGNE	4.6	4.18
LG_CALCI	5.2	4.73
LG_SODI	4.4	4.02
LG_POTAS	3.6	3.42

data file: G:\project\539-15\BG\GW\\GWSEMI2.CSS
[26 cases with 6 variables]

0 CASE	1 DATE	2 DCB14
AW-1	100000	1.00
AW-2	100000	1.00
DOE-2095	100000	1.00
ESTES	100000	1.00
MW-01D	100000	1.00
MW-01S	100000	1.00
AW-1	200000	1.00
AW-2	200000	1.00
DOE-2002	200000	1.00
DOE-2095	200000	1.00
ESTES	200000	1.00
MW-01D	200000	1.00
MW-01S	200000	1.00
AW-1	300000	1.00
AW-2	300000	1.00
DOE-2002	300000	1.00
DOE-2095	300000	1.00
ESTES	300000	1.00
MW-01D	300000	1.00
MW-01S	300000	1.00
AW-1	400000	1.00
AW-2	400000	7.00
DOE-2002	400000	1.00
DOE-2095	400000	1.00
MW-01D	400000	1.00
MW-01S	400000	1.00

000300

data file: G:\project\539-15\BG\GW\\GWSEMI2.CSS
[26 cases with 6 variables]

VARIABLE LIST and missing data values:

2	DCB14	(-9999.)

SD = SQRT (SUM (d**2)/(n-1))

css/3: basic stats	Descriptive Statistics N. of Cases = 26 (MD pairwise deleted)					
	N	Min	Max	Mean	St. Err.	St. Dev.
DCB14	26	1.000000	7.000000	1.230769	.230769	1.176697

ss/3: basic stats	Descriptive Statistics N. of Cases = 26 (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
DCB14	1.708181	.753358

data file: g:\project\539-02\bg\gw\GWBGGEN.CSS
[92 cases with 29 variables]

0 CASE NAME	1 AMMONIA	2 CHLORIDE	3 PH	4 DIS_PHOS	5 SULFATE	6 TOT_PHOS
RND1 2095	50.000	40000.00	7.200	60.000	41000.00	
RND1 3095	50.000	41000.00		50.000	67000.00	
RND1 ESTES	100.000	100000.0		50.000	110000.0	
RND1 MW-01S	200.000	75000.00	6.200	5.000	54000.00	200.000
RND2 2002	50.000	28000.00	7.400	40.000	72000.00	
RND2 2095	50.000	37000.00	6.850	80.000	44000.00	
RND2 3095	50.000	37000.00			78000.00	
RND2 ESTES	50.000	95000.00		50.000	59000.00	
RND2 MW-01S	50.000	52000.00	7.150	50.000	62000.00	40.000
RND3 2002	200.000	31000.00	6.570	50.000	62000.00	460.000
RND3 2095	50.000	36000.00	7.230	50.000	38000.00	2000.000
RND3 3095	50.000	35000.00		50.000		
RND3 ESTES	50.000	93000.00		50.000	46000.00	50.000
RND3 MW-01S	50.000	57000.00	6.960	10.000	52000.00	10000.00
RND4 2002	50.000	26000.00	7.620	50.000	80000.00	100.000
RND4 2095	400.000	43000.00	7.670	50.000	46000.00	110.000
RND4 3095	50.000	36000.00			88000.00	50.000
RND4 ESTES	50.000	150000.0		50.000	50000.00	50.000
RND4 MW-01S	50.000	42000.00	7.070	50.000	80000.00	1900.000
1DOE 2015	50.000	19600.00		25.000	52000.00	
2DOE 2015	50.000	23000.00		30.000	61000.00	
3DOE 2015	50.000	22500.00		10.000	122000.0	
1DOE 2017	50.000	32000.00		10.000	120000.0	
2DOE 2017	50.000	33000.00		5.000	110000.0	
3DOE 2017	50.000	30000.00		10.000	70900.00	
2DOE 2093	50.000	92000.00		50.000	70000.00	
3DOE 2093	50.000	101000.0		10.000	133000.0	
2DOE 2095	50.000	29500.00		5.000	56000.00	
3DOE 2095	50.000	4000.000		63.000	17500.00	
1DOE 3015	230.000	23300.00		460.000	100000.0	
2DOE 3015	50.000	24000.00		10.000	81000.00	
3DOE 3015	50.000	18000.00		10.000	39400.00	
1DOE 3017	50.000	22000.00		10.000	68000.00	
2DOE 3017	50.000	34000.00		10.000	92000.00	
3DOE 3017	50.000	37500.00		10.000	181000.0	
2DOE 3093	50.000	20000.00		10.000	77000.00	
3DOE 3093	50.000	19500.00		10.000	125000.0	
2DOE 3095	50.000	27000.00		25.000	104000.0	
3DOE 3095	50.000	5500.000		132.000	17800.00	
1DOE 4015	160.000	50800.00		25.000	85000.00	
2DOE 4015	50.000	23500.00		280.000	93000.00	
3DOE 4015	170.000	24500.00		10.000	139000.0	
6-90DOE 3095		40000.00			84000.00	
9-90DOE 3095		34000.00	7.190		76000.00	
3-91DOE 3095	10.000	44000.00	7.240	140.000	83000.00	
12-91DOE 3095	60.000	38000.00	7.230	210.000	71000.00	

000302

0 CASE NAME	1 AMMONIA	2 CHLORIDE	3 PH	4 DIS_PHOS	5 SULFATE	6 TOT_PHOS
6-90DOE 2060		22000.00			53000.00	
9-90DOE 2060		20000.00	7.400		62000.00	
11-90DOE 2060	10.000	20000.00	7.580	160.000	51000.00	
6-90DOE 2061		33000.00			57000.00	
9-90DOE 2061		29000.00	7.370		61000.00	
11-90DOE 2061	150.000	25000.00	7.390	90.000	57000.00	
3-91DOE 2061	20.000	28000.00	7.440	50.000	66000.00	
4-90DOE 2093		64000.00			75000.00	
10-90DOE 2093	330.000	74000.00	7.250	270.000	79000.00	
6-90DOE 2095		28000.00			40000.00	
9-90DOE 2095		45000.00	7.190		54000.00	
3-91DOE 2095	10.000	43000.00	7.300	290.000	45000.00	
5-90DOE 2125		21000.00			65000.00	
9-90DOE 2125		40000.00	7.140		54000.00	
3-91DOE 2125	10.000	89000.00	7.110	180.000	50000.00	
12-91DOE 2125	10.000	25000.00	7.170	250.000	55000.00	
8-91DOE 2396	10.000	25000.00	7.270	190.000	58000.00	
6-14-90DOE 3062		25000.00			60000.00	
6-19-90DOE 3062		26000.00			76000.00	
9-90DOE 3062		29000.00	7.240		72000.00	
11-90DOE 3062	170.000	25000.00	7.270	100.000	68000.00	
[illegible]-91DOE 3062	110.000	26000.00	7.350	110.000	74000.00	
[illegible]90DOE 3093		21000.00			81000.00	
10-90DOE 3093	120.000	20000.00	7.380	180.000	72000.00	
11-91DOE 3096		6000.000	7.330		49000.00	
5-90DOE 3125		21000.00			76000.00	
9-90DOE 3125		20000.00	7.250		83000.00	
11-90DOE 3125	10.000	15000.00	7.420	60.000	65000.00	
11-91DOE 4096		8000.000	7.480		18000.00	
3-90DOE 4015		23000.00			84000.00	
6-90DOE 4015		24000.00	7.320		95000.00	
11-90DOE 4015	25.000	23000.00	7.300	160.000	80000.00	
3-91DOE 4015	50.000	24000.00	7.430	50.000	94000.00	
11-91DOE 4015		28000.00	7.380		95000.00	
RND1 A&W1	200.000	26000.00		10.000	73000.00	
RND1 A&W2	600.000	26000.00		20.000	74000.00	
RND1 MW-01D	300.000	25000.00		5.000	77000.00	10.000
RND2 A&W1	200.000	27000.00		20.000	72000.00	
RND2 A&W2	100.000	27000.00		20.000	68000.00	
RND2 MW-01D	200.000	35000.00		50.000	74000.00	30.000
RND3 A&W1	50.000	26000.00		50.000	62000.00	110.000
RND3 A&W2	50.000	26000.00		50.000	65000.00	50.000
RND3 MW-01D	200.000	44000.00		5.000	75000.00	850.000
RND4 A&W1	200.000	32000.00		400.000	74000.00	200.000
RND4 A&W2	50.000	25000.00		50.000	58000.00	50.000
RND4 MW-01D	200.000	38000.00		50.000	84000.00	100.000

data file: g:\project\539-02\bg\gw\GWBGGEN.CSS
[92 cases with 29 variables]

0 CASE NAME	7 FLOURIDE	8 TKN	9 NITRATES	10 PHENOLS	11 TOC	12 ALKALIN
RND1 2095						
RND1 3095						
RND1 ESTES						
RND1 MW-01S						
RND2 2002						
RND2 2095						
RND2 3095						
RND2 ESTES						
RND2 MW-01S						
RND3 2002						
RND3 2095						
RND3 3095						
RND3 ESTES				.00100		
RND3 MW-01S						
RND4 2002						
RND4 2095					3000.000	
RND4 3095					4000.000	450000.0
D4 ESTES						
RND4 MW-01S				.00100	500.000	
1DOE 2015	.6200		.950	.00500		
2DOE 2015	1.8000		3.600	.02500		
3DOE 2015	.2600	.0500	1.350	.00500		
1DOE 2017	.9000		2.500	.00500		
2DOE 2017	1.1000		.050	.02500		
3DOE 2017	1.3000	.3400	.162	.00500		
2DOE 2093	.9900		3.100	.02500		
3DOE 2093	.1200	.0500	7.060	.00500		
2DOE 2095	.3000		1.720	.05000		
3DOE 2095	.2400	.6000	17.500	.02900		
1DOE 3015	.4100		.300	.01000		
2DOE 3015	.7000		.110	.02500		
3DOE 3015	.0500	.1500	.403	.00500		
1DOE 3017	.4000		2.500	.00500		
2DOE 3017	.9000		.050	.02500		
3DOE 3017	.1100	.0500	.050	.00500		
2DOE 3093	.7800		.050	.02500		
3DOE 3093	.1300	.1000	.267	.01400		
2DOE 3095	.6200		.050	.06000		
3DOE 3095	.2000	.4500	.050	.02300		
1DOE 4015	.6200		.200	.01000		
2DOE 4015	.1600		.050	.02000		
3DOE 4015	.0500	.2300	.103	.01000		
1-90DOE 3095			.010		7000.000	
90DOE 3095	.1200		.010	.00300	2000.000	275000.0
3-91DOE 3095	.1600		.040	.00500	6000.000	308000.0
12-91DOE 3095	.1600		.010		18000.00	306000.0

000304

0 CASE NAME	7 FLOURIDE	8 TKN	9 NITRATES	10 PHENOLS	11 TOC	12 ALKALIN
6-90DOE 2060			3.020		500.000	
9-90DOE 2060	.5000		2.040	.02700		215000.0
11-90DOE 2060	.4100		1.990	.00700	1000.000	202000.0
6-90DOE 2061			2.480		500.000	
9-90DOE 2061	.4200		4.310	.00300	2000.000	243000.0
11-90DOE 2061	.3200		1.990	.00300	3000.000	243000.0
3-91DOE 2061	.2700		5.100	.00300	6000.000	242000.0
4-90DOE 2093			3.170		1000.000	
10-90DOE 2093	.1300		3.590		2000.000	246000.0
6-90DOE 2095			6.600		3000.000	
9-90DOE 2095	.3100		10.700		4000.000	276000.0
3-91DOE 2095	.1700		8.980		3000.000	284000.0
5-90DOE 2125			1.960		56000.00	
9-90DOE 2125	.4000		2.070		2000.000	342000.0
3-91DOE 2125	.1600		3.540		6000.000	372000.0
12-91DOE 2125	.2600		2.000		13000.00	268000.0
8-91DOE 2396	.1600		2.160		12000.00	275000.0
6-14-90DOE 3062			.010		500.000	
6-19-90DOE 3062			.090		2000.000	
9-90DOE 3062	.1900		.020	.00600	3000.000	249000.0
11-90DOE 3062	.3200		.050	.01600	3000.000	228000.0
3-91DOE 3062	.2400		.410		5000.000	257000.0
90DOE 3093			.040		3000.000	
10-90DOE 3093	.1700		.020			208000.0
11-91DOE 3096			.010		11000.00	250000.0
5-90DOE 3125			.010		15000.00	
9-90DOE 3125	.2800		.020		3000.000	171000.0
11-90DOE 3125	.3200		.070	.01800	2000.000	177000.0
11-91DOE 4096			.030		13000.00	264000.0
3-90DOE 4015			.010		500.000	
6-90DOE 4015	.1400		.010	.00800	2000.000	247000.0
11-90DOE 4015	.1000		.010		2000.000	242000.0
3-91DOE 4015	.1300		.010		2000.000	255000.0
11-91DOE 4015			.010		10000.00	244000.0
RND1 A&W1						
RND1 A&W2						
RND1 MW-01D						
RND2 A&W1						
RND2 A&W2						
RND2 MW-01D						
RND3 A&W1						
RND3 A&W2						
RND3 MW-01D				.00100		
RND4 A&W1				.00100		
RND4 A&W2						
RND4 MW-01D		300.0000			1000.000	

data file: g:\project\539-02\bg\gw\GWBGGEN.CSS
[92 cases with 29 variables]

0 CASE NAME	13 SPEC_CON	14 TDS	15 SURFACT	16 LOG_AMMO	17 LOG10_CL
RND1 2095		450000.0	100.000	1.6989700	4.6020600
RND1 3095		480000.0	100.000	1.6989700	4.6127839
RND1 ESTES		670000.0	100.000	2.0000000	5.0000000
RND1 MW-01S		530000.0	100.000	2.3010300	4.8750613
RND2 2002				1.6989700	4.4471580
RND2 2095		420000.0	100.000	1.6989700	4.5682017
RND2 3095		48000.00	100.000	1.6989700	4.5682017
RND2 ESTES		550000.0	100.000	1.6989700	4.9777236
RND2 MW-01S		480000.0	400.000	1.6989700	4.7160033
RND3 2002		450000.0	400.000	2.3010300	4.4913617
RND3 2095		410000.0	400.000	1.6989700	4.5563025
RND3 3095			100.000	1.6989700	4.5440680
RND3 ESTES		550000.0	100.000	1.6989700	4.9684829
RND3 MW-01S		530000.0	500.000	1.6989700	4.7558749
RND4 2002		480000.0	200.000	1.6989700	4.4149733
RND4 2095		420000.0	100.000	2.6020600	4.6334685
RND4 3095			100.000	1.6989700	4.5563025
D4 ESTES		730000.0	100.000	1.6989700	5.1760913
RND4 MW-01S		530000.0	400.000	1.6989700	4.6232493
1DOE 2015				1.6989700	4.2922561
2DOE 2015				1.6989700	4.3617278
3DOE 2015				1.6989700	4.3521825
1DOE 2017				1.6989700	4.5051500
2DOE 2017				1.6989700	4.5185139
3DOE 2017				1.6989700	4.4771213
2DOE 2093				1.6989700	4.9637878
3DOE 2093				1.6989700	5.0043214
2DOE 2095				1.6989700	4.4698220
3DOE 2095				1.6989700	3.6020600
1DOE 3015				2.3617278	4.3673559
2DOE 3015				1.6989700	4.3802112
3DOE 3015				1.6989700	4.2552725
1DOE 3017				1.6989700	4.3424227
2DOE 3017				1.6989700	4.5314789
3DOE 3017				1.6989700	4.5740313
2DOE 3093				1.6989700	4.3010300
3DOE 3093				1.6989700	4.2900346
2DOE 3095				1.6989700	4.4313638
3DOE 3095				1.6989700	3.7403627
1DOE 4015				2.2041200	4.7058637
2DOE 4015				1.6989700	4.3710679
3DOE 4015				2.2304489	4.3891661
-90DOE 3095					4.6020600
90DOE 3095	738.000	410000.0			4.5314789
3-91DOE 3095	788.000	428000.0		1.0000000	4.6434527
12-91DOE 3095	781.000	315000.0		1.7781513	4.5797836

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0 CASE NAME	13 SPEC_CON	14 TDS	15 SURFACT	16 LOG_AMMO	17 LOG10_CL
6-90DOE 2060					4.3424227
9-90DOE 2060	567.000	355000.0			4.3010300
11-90DOE 2060	424.000	446000.0		1.0000000	4.3010300
6-90DOE 2061					4.5185139
9-90DOE 2061	671.000	465000.0			4.4623980
11-90DOE 2061	436.000	514000.0		2.1760913	4.3979400
3-91DOE 2061	652.000	384000.0		1.3010300	4.4471580
4-90DOE 2093					4.8061800
10-90DOE 2093	845.000	498000.0		2.5185139	4.8692317
6-90DOE 2095					4.4471580
9-90DOE 2095	757.000	510000.0			4.6532125
3-91DOE 2095	748.000	390000.0		1.0000000	4.6334685
5-90DOE 2125					4.3222193
9-90DOE 2125	786.000	615000.0			4.6020600
3-91DOE 2125	1030.000	556000.0		1.0000000	4.9493900
12-91DOE 2125	661.000	364000.0		1.0000000	4.3979400
8-91DOE 2396	700.000	383000.0		1.0000000	4.3979400
6-14-90DOE 3062					4.3979400
6-19-90DOE 3062					4.4149733
9-90DOE 3062	652.000	425000.0			4.4623980
11-90DOE 3062	492.000	462000.0		2.2304489	4.3979400
3-91DOE 3062	647.000	408000.0		2.0413927	4.4149733
90DOE 3093					4.3222193
10-90DOE 3093	610.000	378000.0		2.0791812	4.3010300
11-91DOE 3096	549.000	336000.0			3.7781513
5-90DOE 3125					4.3222193
9-90DOE 3125	518.000	385000.0			4.3010300
11-90DOE 3125	476.000	352000.0		1.0000000	4.1760913
11-91DOE 4096	536.000	334000.0			3.9030900
3-90DOE 4015					4.3617278
6-90DOE 4015	672.000	400000.0			4.3802112
11-90DOE 4015	532.000	438000.0		1.3979400	4.3617278
3-91DOE 4015	663.000	378000.0		1.6989700	4.3802112
11-91DOE 4015	654.000	426000.0			4.4471580
RND1 A&W1		480000.0	100.000	2.3010300	4.4149733
RND1 A&W2		370000.0	100.000	2.7781513	4.4149733
RND1 MW-01D		370000.0		2.4771213	4.3979400
RND2 A&W1		380000.0	400.000	2.3010300	4.4313638
RND2 A&W2		420000.0	100.000	2.0000000	4.4313638
RND2 MW-01D		390000.0	100.000	2.3010300	4.5440680
RND3 A&W1		360000.0	100.000	1.6989700	4.4149733
RND3 A&W2		370000.0	100.000	1.6989700	4.4149733
RND3 MW-01D		430000.0	400.000	2.3010300	4.6434527
RND4 A&W1		440000.0	100.000	2.3010300	4.5051500
RND4 A&W2		400000.0	100.000	1.6989700	4.3979400
RND4 MW-01D		450000.0	100.000	2.3010300	4.5797836

data file: g:\project\539-02\bg\gw\GWBGGEN.CSS
[92 cases with 29 variables]

0 CASE NAME	18 LOG10_DP	19 LOG10SUL	20 LOG10_TP
RND1 2095	1.7781513	4.6127839	
RND1 3095	1.6989700	4.8260748	
RND1 ESTES	1.6989700	5.0413927	
RND1 MW-01S	.6989700	4.7323938	2.3010300
RND2 2002	1.6020600	4.8573325	
RND2 2095	1.9030900	4.6434527	
RND2 3095		4.8920946	
RND2 ESTES	1.6989700	4.7708520	
RND2 MW-01S	1.6989700	4.7923917	1.6020600
RND3 2002	1.6989700	4.7923917	2.6627578
RND3 2095	1.6989700	4.5797836	3.3010300
RND3 3095	1.6989700		
RND3 ESTES	1.6989700	4.6627578	1.6989700
RND3 MW-01S	1.0000000	4.7160033	4.0000000
RND4 2002	1.6989700	4.9030900	2.0000000
RND4 2095	1.6989700	4.6627578	2.0413927
RND4 3095		4.9444827	1.6989700
D4 ESTES	1.6989700	4.6989700	1.6989700
RND4 MW-01S	1.6989700	4.9030900	3.2787536
1DOE 2015	1.3979400	4.7160033	
2DOE 2015	1.4771213	4.7853298	
3DOE 2015	1.0000000	5.0863598	
1DOE 2017	1.0000000	5.0791812	
2DOE 2017	.6989700	5.0413927	
3DOE 2017	1.0000000	4.8506462	
2DOE 2093	1.6989700	4.8450980	
3DOE 2093	1.0000000	5.1238516	
2DOE 2095	.6989700	4.7481880	
3DOE 2095	1.7993405	4.2430380	
1DOE 3015	2.6627578	5.0000000	
2DOE 3015	1.0000000	4.9084850	
3DOE 3015	1.0000000	4.5954962	
1DOE 3017	1.0000000	4.8325089	
2DOE 3017	1.0000000	4.9637878	
3DOE 3017	1.0000000	5.2576786	
2DOE 3093	1.0000000	4.8864907	
3DOE 3093	1.0000000	5.0969100	
2DOE 3095	1.3979400	5.0170333	
3DOE 3095	2.1205739	4.2504200	
1DOE 4015	1.3979400	4.9294189	
2DOE 4015	2.4471580	4.9684829	
3DOE 4015	1.0000000	5.1430148	
-90DOE 3095		4.9242793	
90DOE 3095		4.8808136	
3-91DOE 3095	2.1461280	4.9190781	
12-91DOE 3095	2.3222193	4.8512583	

000308

0 CASE NAME	18 LOG10_DP	19 LOG10SUL	20 LOG10_TP
6-90DOE 2060		4.7242759	
9-90DOE 2060		4.7923917	
11-90DOE 2060	2.2041200	4.7075702	
6-90DOE 2061		4.7558749	
9-90DOE 2061		4.7853298	
11-90DOE 2061	1.9542425	4.7558749	
3-91DOE 2061	1.6989700	4.8195439	
4-90DOE 2093		4.8750613	
10-90DOE 2093	2.4313638	4.8976271	
6-90DOE 2095		4.6020600	
9-90DOE 2095		4.7323938	
3-91DOE 2095	2.4623980	4.6532125	
5-90DOE 2125		4.8129134	
9-90DOE 2125		4.7323938	
3-91DOE 2125	2.2552725	4.6989700	
12-91DOE 2125	2.3979400	4.7403627	
8-91DOE 2396	2.2787536	4.7634280	
6-14-90DOE 3062		4.7781513	
6-19-90DOE 3062		4.8808136	
9-90DOE 3062		4.8573325	
11-90DOE 3062	2.0000000	4.8325089	
3-91DOE 3062	2.0413927	4.8692317	
90DOE 3093		4.9084850	
10-90DOE 3093	2.2552725	4.8573325	
11-91DOE 3096		4.6901961	
5-90DOE 3125		4.8808136	
9-90DOE 3125		4.9190781	
11-90DOE 3125	1.7781513	4.8129134	
11-91DOE 4096		4.2552725	
3-90DOE 4015		4.9242793	
6-90DOE 4015		4.9777236	
11-90DOE 4015	2.2041200	4.9030900	
3-91DOE 4015	1.6989700	4.9731279	
11-91DOE 4015		4.9777236	
RND1 A&W1	1.0000000	4.8633229	
RND1 A&W2	1.3010300	4.8692317	
RND1 MW-01D	.6989700	4.8864907	1.0000000
RND2 A&W1	1.3010300	4.8573325	
RND2 A&W2	1.3010300	4.8325089	
RND2 MW-01D	1.6989700	4.8692317	1.4771213
RND3 A&W1	1.6989700	4.7923917	2.0413927
RND3 A&W2	1.6989700	4.8129134	1.6989700
RND3 MW-01D	.6989700	4.8750613	2.9294189
RND4 A&W1	2.6020600	4.8692317	2.3010300
RND4 A&W2	1.6989700	4.7634280	1.6989700
RND4 MW-01D	1.6989700	4.9242793	2.0000000

data file: g:\project\539-02\bg\gw\GWBGGEN.CSS
[92 cases with 29 variables]

0 CASE NAME	21 LOG10_FL	22 LOG10TKN	23 LOG10NIT
RND1 2095			
RND1 3095			
RND1 ESTES			
RND1 MW-01S			
RND2 2002			
RND2 2095			
RND2 3095			
RND2 ESTES			
RND2 MW-01S			
RND3 2002			
RND3 2095			
RND3 3095			
RND3 ESTES			
RND3 MW-01S			
RND4 2002			
RND4 2095			
RND4 3095			
D4 ESTES			
RND4 MW-01S			
1DOE 2015	-.2076083		-.0222764
2DOE 2015	.2552725		.5563025
3DOE 2015	-.5850267	-1.3010300	.1303338
1DOE 2017	-.0457575		.3979400
2DOE 2017	.0413927		-1.3010300
3DOE 2017	.1139434	-.4685211	-.7904850
2DOE 2093	-.0043648		.4913617
3DOE 2093	-.9208188	-1.3010300	.8488047
2DOE 2095	-.5228787		.2355284
3DOE 2095	-.6197888	-.2218487	1.2430380
1DOE 3015	-.3872161		-.5228787
2DOE 3015	-.1549020		-.9586073
3DOE 3015	-1.3010300	-.8239087	-.3946950
1DOE 3017	-.3979400		.3979400
2DOE 3017	-.0457575		-1.3010300
3DOE 3017	-.9586073	-1.3010300	-1.3010300
2DOE 3093	-.1079054		-1.3010300
3DOE 3093	-.8860566	-1.0000000	-.5734887
2DOE 3095	-.2076083		-1.3010300
3DOE 3095	-.6989700	-.3467875	-1.3010300
1DOE 4015	-.2076083		-.6989700
2DOE 4015	-.7958800		-1.3010300
3DOE 4015	-1.3010300	-.6382722	-.9871628
1-90DOE 3095			-2.0000000
90DOE 3095	-.9208188		-2.0000000
3-91DOE 3095	-.7958800		-1.3979400
12-91DOE 3095	-.7958800		-2.0000000

000310

0 CASE NAME	21 LOG10_FL	22 LOG10TKN	23 LOG10NIT
6-90DOE 2060			.4800069
9-90DOE 2060	-.3010300		.3096302
11-90DOE 2060	-.3872161		.2988531
6-90DOE 2061			.3944517
9-90DOE 2061	-.3767507		.6344773
11-90DOE 2061	-.4948500		.2988531
3-91DOE 2061	-.5686362		.7075702
4-90DOE 2093			.5010593
10-90DOE 2093	-.8860566		.5550944
6-90DOE 2095			.8195439
9-90DOE 2095	-.5086383		1.0293838
3-91DOE 2095	-.7695511		.9532763
5-90DOE 2125			.2922561
9-90DOE 2125	-.3979400		.3159703
3-91DOE 2125	-.7958800		.5490033
12-91DOE 2125	-.5850267		.3010300
8-91DOE 2396	-.7958800		.3344538
6-14-90DOE 3062			-2.0000000
6-19-90DOE 3062			-1.0457575
9-90DOE 3062	-.7212464		-1.6989700
11-90DOE 3062	-.4948500		-1.3010300
3-91DOE 3062	-.6197888		-.3872161
90DOE 3093			-1.3979400
10-90DOE 3093	-.7695511		-1.6989700
11-91DOE 3096			-2.0000000
5-90DOE 3125			-2.0000000
9-90DOE 3125	-.5528420		-1.6989700
11-90DOE 3125	-.4948500		-1.1549020
11-91DOE 4096			-1.5228787
3-90DOE 4015			-2.0000000
6-90DOE 4015	-.8538720		-2.0000000
11-90DOE 4015	-1.0000000		-2.0000000
3-91DOE 4015	-.8860566		-2.0000000
11-91DOE 4015			-2.0000000
RND1 A&W1			
RND1 A&W2			
RND1 MW-01D			
RND2 A&W1			
RND2 A&W2			
RND2 MW-01D			
RND3 A&W1			
RND3 A&W2			
RND3 MW-01D			
RND4 A&W1			
RND4 A&W2			
RND4 MW-01D		2.4771213	

data file: g:\project\539-02\bg\gw\GWBGGEN.CSS
[92 cases with 29 variables]

0 CASE NAME	24 LOG10PHE	25 LOG10TOC	26 LOG10ALK
RND1 2095			
RND1 3095			
RND1 ESTES			
RND1 MW-01S			
RND2 2002			
RND2 2095			
RND2 3095			
RND2 ESTES			
RND2 MW-01S			
RND3 2002			
RND3 2095			
RND3 3095			
RND3 ESTES	-3.0000000		
RND3 MW-01S			
RND4 2002			
RND4 2095		3.4771213	
RND4 3095		3.6020600	5.6532125
D4 ESTES			
RND4 MW-01S	-3.0000000	2.6989700	
1DOE 2015	-2.3010300		
2DOE 2015	-1.6020600		
3DOE 2015	-2.3010300		
1DOE 2017	-2.3010300		
2DOE 2017	-1.6020600		
3DOE 2017	-2.3010300		
2DOE 2093	-1.6020600		
3DOE 2093	-2.3010300		
2DOE 2095	-1.3010300		
3DOE 2095	-1.5376020		
1DOE 3015	-2.0000000		
2DOE 3015	-1.6020600		
3DOE 3015	-2.3010300		
1DOE 3017	-2.3010300		
2DOE 3017	-1.6020600		
3DOE 3017	-2.3010300		
2DOE 3093	-1.6020600		
3DOE 3093	-1.8538720		
2DOE 3095	-1.2218487		
3DOE 3095	-1.6382722		
1DOE 4015	-2.0000000		
2DOE 4015	-1.6989700		
3DOE 4015	-2.0000000		
-90DOE 3095		3.8450980	
90DOE 3095	-2.5228787	3.3010300	5.4393327
3-91DOE 3095	-2.3010300	3.7781513	5.4885507
12-91DOE 3095		4.2552725	5.4857214

000312

0 CASE NAME	24 LOG10PHE	25 LOG10TOC	26 LOG10ALK
6-90DOE 2060		2.6989700	
9-90DOE 2060	-1.5686362		5.3324385
11-90DOE 2060	-2.1549020	3.0000000	5.3053514
6-90DOE 2061		2.6989700	
9-90DOE 2061	-2.5228787	3.3010300	5.3856063
11-90DOE 2061	-2.5228787	3.4771213	5.3856063
3-91DOE 2061	-2.5228787	3.7781513	5.3838154
4-90DOE 2093		3.0000000	
10-90DOE 2093		3.3010300	5.3909351
6-90DOE 2095		3.4771213	
9-90DOE 2095		3.6020600	5.4409091
3-91DOE 2095		3.4771213	5.4533183
5-90DOE 2125		4.7481880	
9-90DOE 2125		3.3010300	5.5340261
3-91DOE 2125		3.7781513	5.5705429
12-91DOE 2125		4.1139434	5.4281348
8-91DOE 2396		4.0791812	5.4393327
6-14-90DOE 3062		2.6989700	
6-19-90DOE 3062		3.3010300	
9-90DOE 3062	-2.2218487	3.4771213	5.3961993
11-90DOE 3062	-1.7958800	3.4771213	5.3579348
3-91DOE 3062		3.6989700	5.4099331
90DOE 3093		3.4771213	
10-90DOE 3093			5.3180633
11-91DOE 3096		4.0413927	5.3979400
5-90DOE 3125		4.1760913	
9-90DOE 3125		3.4771213	5.2329961
11-90DOE 3125	-1.7447275	3.3010300	5.2479733
11-91DOE 4096		4.1139434	5.4216039
3-90DOE 4015		2.6989700	
6-90DOE 4015	-2.0969100	3.3010300	5.3926970
11-90DOE 4015		3.3010300	5.3838154
3-91DOE 4015		3.3010300	5.4065402
11-91DOE 4015		4.0000000	5.3873898
RND1 A&W1			
RND1 A&W2			
RND1 MW-01D			
RND2 A&W1			
RND2 A&W2			
RND2 MW-01D			
RND3 A&W1			
RND3 A&W2			
RND3 MW-01D	-3.0000000		
RND4 A&W1	-3.0000000		
RND4 A&W2			
RND4 MW-01D		3.0000000	

data file: g:\project\539-02\bg\gw\GWBGGEN.CSS
[92 cases with 29 variables]

0 CASE NAME	27 LOG10_SC	28 LOG10TDS	29 LOG10SUR
RND1 2095		5.6532125	2.0000000
RND1 3095		5.6812412	2.0000000
RND1 ESTES		5.8260748	2.0000000
RND1 MW-01S		5.7242759	2.0000000
RND2 2002			
RND2 2095		5.6232493	2.0000000
RND2 3095		4.6812412	2.0000000
RND2 ESTES		5.7403627	2.0000000
RND2 MW-01S		5.6812412	2.6020600
RND3 2002		5.6532125	2.6020600
RND3 2095		5.6127839	2.6020600
RND3 3095			2.0000000
RND3 ESTES		5.7403627	2.0000000
RND3 MW-01S		5.7242759	2.6989700
RND4 2002		5.6812412	2.3010300
RND4 2095		5.6232493	2.0000000
RND4 3095			2.0000000
D4 ESTES		5.8633229	2.0000000
RND4 MW-01S		5.7242759	2.6020600
1DOE 2015			
2DOE 2015			
3DOE 2015			
1DOE 2017			
2DOE 2017			
3DOE 2017			
2DOE 2093			
3DOE 2093			
2DOE 2095			
3DOE 2095			
1DOE 3015			
2DOE 3015			
3DOE 3015			
1DOE 3017			
2DOE 3017			
3DOE 3017			
2DOE 3093			
3DOE 3093			
2DOE 3095			
3DOE 3095			
1DOE 4015			
2DOE 4015			
3DOE 4015			
-90DOE 3095			
90DOE 3095	2.8680564	5.6127839	
3-91DOE 3095	2.8965262	5.6314438	
12-91DOE 3095	2.8926510	5.4983106	

0 CASE NAME	27 LOG10_SC	28 LOG10TDS	29 LOG10SUR
6-90DOE 2060			
9-90DOE 2060	2.7535831	5.5502284	
11-90DOE 2060	2.6273659	5.6493349	
6-90DOE 2061			
9-90DOE 2061	2.8267225	5.6674530	
11-90DOE 2061	2.6394865	5.7109631	
3-91DOE 2061	2.8142476	5.5843312	
4-90DOE 2093			
10-90DOE 2093	2.9268567	5.6972293	
6-90DOE 2095			
9-90DOE 2095	2.8790959	5.7075702	
3-91DOE 2095	2.8739016	5.5910646	
5-90DOE 2125			
9-90DOE 2125	2.8954225	5.7888751	
3-91DOE 2125	3.0128372	5.7450748	
12-91DOE 2125	2.8202015	5.5611014	
8-91DOE 2396	2.8450980	5.5831988	
6-14-90DOE 3062			
6-19-90DOE 3062			
9-90DOE 3062	2.8142476	5.6283889	
11-90DOE 3062	2.6919651	5.6646420	
3-91DOE 3062	2.8109043	5.6106602	
90DOE 3093			
10-90DOE 3093	2.7853298	5.5774918	
11-91DOE 3096	2.7395723	5.5263393	
5-90DOE 3125			
9-90DOE 3125	2.7143298	5.5854607	
11-90DOE 3125	2.6776070	5.5465427	
11-91DOE 4096	2.7291648	5.5237465	
3-90DOE 4015			
6-90DOE 4015	2.8273693	5.6020600	
11-90DOE 4015	2.7259116	5.6414741	
3-91DOE 4015	2.8215135	5.5774918	
11-91DOE 4015	2.8155777	5.6294096	
RND1 A&W1		5.6812412	2.0000000
RND1 A&W2		5.5682017	2.0000000
RND1 MW-01D		5.5682017	
RND2 A&W1		5.5797836	2.6020600
RND2 A&W2		5.6232493	2.0000000
RND2 MW-01D		5.5910646	2.0000000
RND3 A&W1		5.5563025	2.0000000
RND3 A&W2		5.5682017	2.0000000
RND3 MW-01D		5.6334685	2.6020600
RND4 A&W1		5.6434527	2.0000000
RND4 A&W2		5.6020600	2.0000000
RND4 MW-01D		5.6532125	2.0000000

css/3: basic stats	Descriptive Statistics N. of Cases = 92 (MD pairwise deleted)					
	N	Min	Max	Mean	St. Err.	St. Dev.
AMMONIA	70	10.0	600.0	95.2	12.14	101.61
CHLORIDE	92	4000.0	150000.0	35632.6	2449.75	23497.16
PH	38	6.2	7.7	7.2	.04	.27
DIS_PHOS	68	5.0	460.0	77.0	11.52	94.99
SULFATE	91	17500.0	181000.0	71841.8	2684.46	25608.07
TOT_PHOS	19	10.0	10000.0	861.1	525.93	2292.46
FLOURIDE	47	.1	1.8	.4	.05	.36
TKN	10	.1	300.0	30.2	29.98	94.80
NITRATES	61	.0	17.5	1.8	.39	3.07
PHENOLS	38	.0	.1	.0	.00	.01
TOC	40	500.0	56000.0	5837.5	1465.67	9269.74
ALKALIN	28	171000.0	450000.0	262107.1	10730.88	56782.45
SPEC_CON	27	424.0	1030.0	651.3	26.28	136.55
TDS	55	48000.0	730000.0	435327.3	13190.42	97822.79
SURFACT	29	100.0	500.0	179.3	25.49	137.27
LOG_AMMO	70	1.0	2.8	1.8	.05	.40
LOG10_CL	92	3.6	5.2	4.5	.03	.25
LOG10_DP	68	.7	2.7	1.6	.06	.52
LOG10SUL	91	4.2	5.3	4.8	.02	.17
LOG10_TP	19	1.0	4.0	2.2	.17	.75
LOG10_FL	47	-1.3	.3	-.5	.05	.36
LOG10TKN	10	-1.3	2.5	-.5	.35	1.12
LOG10NIT	61	-2.0	1.2	-.6	.13	1.05
LOG10PHE	38	-3.0	-1.2	-2.1	.08	.48
LOG10TOC	40	2.7	4.7	3.5	.08	.48
LOG10ALK	28	5.2	5.7	5.4	.02	.09
LOG10_SC	27	2.6	3.0	2.8	.02	.09
LOG10TDS	55	4.7	5.9	5.6	.02	.15
LOG10SUR	29	2.0	2.7	2.2	.05	.27

000316

css/3: basic stats	Descriptive Statistics N. of Cases = 92 (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
AMMONIA	119.4	71.0
CHLORIDE	40497.7	30767.5
PH	7.3	7.2
DIS_PHOS	100.0	54.0
SULFATE	77174.4	66509.2
TOT_PHOS	1972.5	-250.3
FLOURIDE	.5	.3
TKN	99.3	-38.9
NITRATES	2.6	1.0
PHENOLS	.0	.0
TOC	8809.5	2865.5
ALKALIN	284133.8	240080.5
SPEC_CON	705.3	597.3
TDS	461729.9	408924.7
SURFACT	231.6	127.1
LOG_AMMO	1.9	1.7
LOG10_CL	4.5	4.4
LOG10_DP	1.7	1.5
LOG10SUL	4.9	4.8
LOG10_TP	2.5	1.8
LOG10_FL	-.4	-.7
LOG10TKN	.3	-1.3
LOG10NIT	-.3	-.9
LOG10PHE	-1.9	-2.2
LOG10TOC	3.6	3.3
LOG10ALK	5.4	5.4
LOG10_SC	2.8	2.8
LOG10TDS	5.7	5.6
LOG10SUR	2.3	2.1

Data file: g:\project\539-02\bg\gw\gwrad.CSS
[57 cases with 8 variables]

0 CASE NAME	1 TOT_URAN	2 GROSS_BE	3 GROSS_AL		5 LOG10UR
RND1 2095	67.000	59.000	42.000		1.82607
RND1 ESTES	1.600	5.600	2.000		.20412
RND1 MW-01S	3.000	150.000	190.000		.47712
RND2 2002	2.200	10.000	4.300		.34242
RND2 2095	60.000	31.000	51.000		1.77815
RND2 ESTES	1.700	3.000	2.000		.23045
RND2 MW-01S	27.000	230.000	210.000		1.43136
RND3 2002	2.700	18.000	7.200		.43136
RND3 2095	26.000	91.000	92.000		1.41497
RND3 ESTES	.150	3.000	2.000		-.82391
RND3 MW-01S	.150	610.000	690.000		-.82391
RND4 2002	2.100	8.800	6.600		.32222
RND4 2095	71.000	76.000	90.000		1.85126
RND4 ESTES	2.900	9.900	2.000		.46240
RND4 MW-01S	43.000	60.000	45.000		1.63347
6-90DOE 3095	2.277	72.300	6.000		.35736
9-90DOE 3095	5.288	7.360	3.000		.72329
91DOE 3095					
5-90DOE 2060	155.000				2.19033
11-90DOE 2060	90.410	66.500	70.500		1.95622
6-90DOE 2061	208.000	53.700	189.000		2.31806
9-90DOE 2061	205.300	113.000	130.000		2.31239
11-90DOE 2061	206.000	118.000	111.000		2.31387
4-90DOE 2093	1.061	18.500	11.200		.02572
6-90DOE 2095	48.200	63.900	57.000		1.68305
9-90DOE 2095	35.550	87.600	96.100		1.55084
11-91DOE 2096	.612				-.21325
9-90DOE 2125	40.380	43.700	52.200		1.60617
11-90DOE 2125	40.720	37.700	43.300		1.60981
8-91DOE 2125	2.855				.45561
12-91DOE 2125	27.190				1.43441
8-91DOE 2396	.612				-.21325
12-91DOE 2396	.748				-.12610
6-19-90DOE 3062	35.080	21.500	33.000		1.54506
9-90DOE 3062	39.630	21.500	20.100		1.59802
11-90DOE 3062		16.700	19.300		
4-90DOE 3093	.340	13.000	3.650		-.46852
11-91DOE 3096	.478				-.32057
9-90DOE 3125	23.250	18.800	16.600		1.36642
11-90DOE 3125	13.120	15.200	10.300		1.11793
11-91DOE 4096	.408				-.38934
3-90DOE 4015	.224				-.64975
9-90DOE 4015	.340	3.060	2.050		-.46852
-90DOE 4015	.120	4.260	.255		-.92082
11-91DOE 4015	.034				-1.46852
RND1 A&W1	18.350	13.000	13.000		1.26364

000318

0 CASE NAME	1 TOT_URAN	2 GROSS_BE	3 GROSS_AL		5 LOG10UR
RND1 A&W2	19.710	210.000	4.800		1.29469
RND1 MW-01D	.136	3.000	2.000		-.86646
RND2 A&W1	21.070	12.000	19.000		1.32366
RND2 A&W2	27.190	18.000	25.000		1.43441
RND2 MW-01D	.136	5.600	1.500		-.86646
RND3 A&W1	12.240	13.000	38.000		1.08778
RND3 A&W2	11.560	11.000	32.000		1.06296
RND3 MW-01D	.102	51.000	31.000		-.99140
RND4 A&W1	21.070	31.000	31.000		1.32366
RND4 A&W2	23.790	32.000	24.000		1.37639
RND4 MW-01D	.272	3.000	1.500		-.56543

data file: g:\project\539-02\bg\gw\gwrad.CSS
[57 cases with 8 variables]

0 CASE NAME	6 LOG10BET	7 LOG10ALP
RND1 2095	1.77085	1.62325
RND1 ESTES	.74819	.30103
RND1 MW-01S	2.17609	2.27875
RND2 2002	1.00000	.63347
RND2 2095	1.49136	1.70757
RND2 ESTES	.47712	.30103
RND2 MW-01S	2.36173	2.32222
RND3 2002	1.25527	.85733
RND3 2095	1.95904	1.96379
RND3 ESTES	.47712	.30103
RND3 MW-01S	2.78533	2.83885
RND4 2002	.94448	.81954
RND4 2095	1.88081	1.95424
RND4 ESTES	.99564	.30103
RND4 MW-01S	1.77815	1.65321
6-90DOE 3095	1.85914	.77815
9-90DOE 3095	.86688	.47712
91DOE 3095		
3-90DOE 2060		
11-90DOE 2060	1.82282	1.84819
6-90DOE 2061	1.72997	2.27646
9-90DOE 2061	2.05308	2.11394
11-90DOE 2061	2.07188	2.04532
4-90DOE 2093	1.26717	1.04922
6-90DOE 2095	1.80550	1.75587
9-90DOE 2095	1.94250	1.98272
11-91DOE 2096		
9-90DOE 2125	1.64048	1.71767
11-90DOE 2125	1.57634	1.63649
8-91DOE 2125		
12-91DOE 2125		
8-91DOE 2396		
12-91DOE 2396		
6-19-90DOE 3062	1.33244	1.51851
9-90DOE 3062	1.33244	1.30320
11-90DOE 3062	1.22272	1.28556
4-90DOE 3093	1.11394	.56229
11-91DOE 3096		
9-90DOE 3125	1.27416	1.22011
11-90DOE 3125	1.18184	1.01284
11-91DOE 4096		
3-90DOE 4015		
[illegible]-90DOE 4015	.48572	.31175
[illegible]-90DOE 4015	.62941	-.59346
11-91DOE 4015		
RND1 A&W1	1.11394	1.11394

000320

0 CASE NAME	6 LOG10BET	7 LOG10ALP
RND1 A&W2	2.32222	.68124
RND1 MW-01D	.47712	.30103
RND2 A&W1	1.07918	1.27875
RND2 A&W2	1.25527	1.39794
RND2 MW-01D	.74819	.17609
RND3 A&W1	1.11394	1.57978
RND3 A&W2	1.04139	1.50515
RND3 MW-01D	1.70757	1.49136
RND4 A&W1	1.49136	1.49136
RND4 A&W2	1.50515	1.38021
RND4 MW-01D	.47712	.17609

data file: g:\project\539-15\bg\gw\GWRAD.CSS
[57 cases with 8 variables]

VARIABLE LIST and missing data values:

1 TOT_URAN (-9999.)	2 GROSS_BE (-9999.)	3 GROSS_AL (-9999.)
4 POTAS40 (-9999.)	5 LOG10UR (-9999.)	6 LOG10BET (-9999.)
7 LOG10ALP (-9999.)	8 LOG10K40 (-9999.)	

SD = SQRT (SUM (d**2)/(n-1))

css/3: basic stats	Descriptive Statistics N. of Cases = 56 [from 57] (MD pairwise deleted)					
	N	Min	Max	Mean	St. Err.	St. Dev.
TOT_URAN	55	.03400	208.0000	29.98824	6.89958	51.1687
GROSS_BE	46	3.00000	610.0000	55.74304	14.47420	98.1688
GROSS_AL	46	.25500	690.0000	55.07511	16.08308	109.0808
POTAS40	27	25.00000	200.0000	58.14815	8.18304	42.5203
LOG10UR	55	-1.46852	2.3181	.70111	.13982	1.0369
LOG10BET	46	.47712	2.7853	1.38352	.08311	.5637
LOG10ALP	46	-.59346	2.8388	1.23329	.10798	.7323
LOG10K40	27	1.39794	2.3010	1.69322	.04398	.2285

css/3: basic stats	Descriptive Statistics N. of Cases = 56 [from 57] (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
TOT_URAN	43.79878	16.17770
GROSS_BE	84.97896	26.50712
GROSS_AL	87.56075	22.58946
POTAS40	74.96830	41.32800
LOG10UR	.98098	.42123
LOG10BET	1.55139	1.21566
LOG10ALP	1.45139	1.01519
LOG10K40	1.78361	1.60283

000322

data file: g:\project\539-15\bg\K40GW-BG.CSS
[36 cases with 2 variables]

0 CASE NAME	1 K40	2 LOG10K40
RND1 2095	45	1.6532125
RND1 ESTES	45	1.6532125
RND1 MW-01S	150	2.1760913
RND2 2002	45	1.6532125
RND2 2095	45	1.6532125
RND2 ESTES	45	1.6532125
RND2 MW-01S	200	2.3010300
RND3 2002	40	1.6020600
RND3 2095	40	1.6020600
RND3 ESTES	25	1.3979400
RND3 MW-01S	55	1.7403627
RND4 2002	35	1.5440680
RND4 2095	40	1.6020600
RND4 ESTES	130	2.1139434
RND4 MW-01S	35	1.5440680
RND1 A&W1	40	1.6020600
RND1 A&W2	130	2.1139434
RND1 MW-01D	45	1.6532125
RND2 A&W1	45	1.6532125
RND2 A&W2	45	1.6532125
RND2 MW-01D	45	1.6532125
RND3 A&W1	40	1.6020600
RND3 A&W2	25	1.3979400
RND3 MW-01D	35	1.5440680
RND4 A&W1	60	1.7781513
RND4 A&W2	60	1.7781513
RND4 MW-01D	25	1.3979400
RND10 MW-01S	130	2.1139434
RND10 MW-01D	110	2.0413927
RND10 2106	40	1.6020600
RND10 2550	110	2.0413927
RND10 2095	130	2.1139434
RND10 2002	86	1.9344985
RND10 A&W1	99	1.9956352
RND10 ESTES	35	1.5440680
RND10 A&W2	91	1.9590414

data file: g:\project\539-15\bg\K40GW-BG.CSS
[36 cases with 2 variables]

VARIABLE LIST and missing data values:

var. 1:	K40	MD:	-9999.
var. 2:	LOG10K40 =LOG10(K40)	MD:	-9999.

SD = SQRT (SUM (d**2)/(n-1))

css/3: basic stats	Descriptive Statistics N. of Cases = 36 (MD pairwise deleted)					
	N	Min	Max	Mean	St. Err.	St. Dev.
K40	36	25.00000	200.0000	66.69444	7.153068	42.91841
LOG10K40	36	1.39794	2.3010	1.75175	.040645	.24387

css/3: basic stats	Descriptive Statistics N. of Cases = 36 (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
K40	81.24299	52.14590
LOG10K40	1.83441	1.66908

000324

APPENDIX C

SURFACE WATER RESULTS SUMMARY

data file: G:\project\539-15\bg\sw\SWMETALS.CSS
[9 cases with 22 variables]

0 CASE NAME	1 ANTIMONY	2 LEAD	3 ZINC	4 BARIUM
SW-05-01	.01050	.00100	.01480	.03630
SW-08-02	.01100	.00100	.00100	.05090
ASIT-3		.00260		.03990
W-10(1/89)	.00250	.00270		.06580
W-10(5/89)		.00210		.02880
W-11(1/89)	.00250	.00100		.05520
W-11(5/89)		.00930		.03130
W-7(5/89)		.01000		.03740
W-7(1/89)	.00125	.00100	.01860	.03830

data file: G:\project\539-15\bg\sw\SWMETALS.CSS
[9 cases with 22 variables]

0 CASE NAME	5 IRON	6 MANGANES	7 ALUMINUM	8 MAGNESIU
SW-05-01	.19000	.03240	.09600	22.40000
SW-08-02	.04200	.03880	.07930	23.80000
ASIT-3	.06950	.00970	.08660	19.90000
W-10(1/89)	.55600	.02650	.45100	13.70000
W-10(5/89)	.46400	.02780		9.97000
W-11(1/89)	.20000	.01990	.15000	12.70000
W-11(5/89)	.04150	.01210	.07640	20.90000
W-7(5/89)	.02860	.01520	.03000	21.40000
W-7(1/89)	2.84000	.04710	2.95000	

000327

data file: G:\project\539-15\bg\sw\SWMETALS.CSS
[9 cases with 22 variables]

0 CASE NAME	9 CALCIUM	10 SODIUM	11 POTASSIU	12 LOG10ANT
SW-05-01	89.50000	11.90000	.63000	-1.9788107
SW-08-02	97.90000	14.10000	3.45000	-1.9586073
ASIT-3	72.30000	14.60000	1.84000	
W-10(1/89)	56.60000	9.23000	3.19000	-2.6020600
W-10(5/89)	45.20000	5.90300	2.72000	
W-11(1/89)	52.30000	8.39000	2.77000	-2.6020600
W-11(5/89)	71.80000	9.69000	1.68000	
W-7(5/89)	84.70000	9.93000	1.55000	
W-7(1/89)			3.95000	-2.9030900

data file: G:\project\539-15\bg\sw\SWMETALS.CSS
[9 cases with 22 variables]

0 CASE NAME	13 LOG10PB	14 LOG10ZN	15 LOG10BA	16 LOG10FE
SW-05-01	-3.0000000	-1.8297383	-1.4400934	-.7212464
SW-08-02	-3.0000000	-3.0000000	-1.2932822	-1.3767507
ASIT-3	-2.5850267		-1.3990271	-1.1580152
W-10(1/89)	-2.5686362		-1.1817741	-.2549252
W-10(5/89)	-2.6777807		-1.5406075	-.3334820
W-11(1/89)	-3.0000000		-1.2580609	-.6989700
W-11(5/89)	-2.0315171		-1.5044557	-1.3819519
W-7(5/89)	-2.0000000		-1.4271284	-1.5436340
W-7(1/89)	-3.0000000	-1.7304871	-1.4168012	.4533183

000329

data file: G:\project\539-15\bg\sw\SWMETALS.CSS
[9 cases with 22 variables]

0 CASE NAME	17 LOG10MN	18 LOG10AL	19 LOG10MG	20 LOG10CA
SW-05-01	-1.4894550	-1.0177288	1.3502480	1.9518230
SW-08-02	-1.4111683	-1.1007268	1.3765770	1.9907827
ASIT-3	-2.0132283	-1.0624821	1.2988531	1.8591383
W-10(1/89)	-1.5767541	-.3458235	1.1367206	1.7528164
W-10(5/89)	-1.5559552		.9986952	1.6551384
W-11(1/89)	-1.7011469	-.8239087	1.1038037	1.7185017
W-11(5/89)	-1.9172146	-1.1169066	1.3201463	1.8561244
W-7(5/89)	-1.8181564	-1.5228787	1.3304138	1.9278834
W-7(1/89)	-1.3269791	.4698220		

data file: G:\project\539-15\bg\sw\SWMETALS.CSS
[9 cases with 22 variables]

0 CASE NAME	21 LOG10NA	22 LOG10K
SW-05-01	1.0755470	-.2006595
SW-08-02	1.1492191	.5378191
ASIT-3	1.1643529	.2648178
W-10(1/89)	.9652017	.5037907
W-10(5/89)	.7710728	.4345689
W-11(1/89)	.9237620	.4424798
W-11(5/89)	.9863238	.2253093
W-7(5/89)	.9969492	.1903317
W-7(1/89)		.5965971

000331

data file: G:\project\539-15\bg\sw\SWMETALS.CSS
[9 cases with 22 variables]

0 CASE NAME	3 ZINC
SW-05-01	.01480
SW-08-02	.00100
ASIT-3	
W-10(1/89)	
W-10(5/89)	
W-11(1/89)	
W-11(5/89)	
W-7(5/89)	
W-7(1/89)	.01860

data file: G:\project\539-15\bg\sw\SWMETALS.CSS
[9 cases with 22 variables]

VARIABLE LIST and missing data values:

var. 3:	ZINC	MD:	-9999.

SD = SQRT (SUM (d**2)/(n-1))

css/3: basic stats	Descriptive Statistics N. of Cases = 3 [from 9] (MD pairwise deleted)					
	N	Min	Max	Mean	St. Err.	St. Dev.
ZINC	3	.001000	.018600	.011467	.005347	.009261

css/3: basic stats	Descriptive Statistics N. of Cases = 3 [from 9] (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
ZINC	.011467	.011467

000333

css/3: basic stats	Descriptive Statistics N. of Cases = 9 (MD pairwise deleted)					
	N	Min	Max	Mean	St. Err.	St. Dev.
ANTIMONY	5	.00125	.01100	.00555	.002137	.00478
LEAD	9	.00100	.01000	.00341	.001203	.00361
ZINC	3	.00100	.01860	.01147	.005347	.00926
BARIUM	9	.02880	.06580	.04266	.004042	.01213
IRON	9	.02860	2.84000	.49240	.300304	.90091
MANGANES	9	.00970	.04710	.02550	.004190	.01257
ALUMINUM	8	.03000	2.95000	.48991	.354512	1.00271
MAGNESIU	8	9.97000	23.80000	18.09625	1.830138	5.17641
CALCIUM	8	45.20000	97.90000	71.28750	6.651945	18.81454
SODIUM	8	5.90300	14.60000	10.46788	1.034237	2.92526
POTASSIU	9	.63000	3.95000	2.42000	.354577	1.06373
LOG10ANT	5	-2.90309	-1.95861	-2.40893	.187961	.42029
LOG10PB	9	-3.00000	-2.00000	-2.65144	.134712	.40414
LOG10ZN	3	-3.00000	-1.73049	-2.18674	.407637	.70605
LOG10BA	9	-1.54061	-1.18177	-1.38458	.039145	.11743
LOG10FE	9	-1.54363	.45332	-.77952	.218920	.65676
LOG10MN	9	-2.01323	-1.32698	-1.64556	.077766	.23330
LOG10AL	8	-1.52288	.46982	-.81508	.217420	.61496
LOG10MG	8	.99870	1.37658	1.23943	.049337	.13955
LOG10CA	8	1.65514	1.99078	1.83903	.042283	.11959
LOG10NA	8	.77107	1.16435	1.00405	.045214	.12788
LOG10K	9	-.20066	.59660	.33278	.082014	.24604

css/3: basic stats	Descriptive Statistics N. of Cases = 9 (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
ANTIMONY	.01236	-.00126
LEAD	.00614	.00063
ZINC	--	--
BARIUM	.05432	.03208
IRON	.37611	.02179
MANGANES	.03170	.01390
ALUMINUM	.27689	.00006
MAGNESIU	22.57862	13.61388
CALCIUM	87.57943	54.99557
SODIUM	13.00093	7.93482
POTASSIU	3.05794	1.39956
LOG10ANT	-1.80970	-3.00816
LOG10PB	-2.29271	-2.95572
LOG10ZN	--	--
LOG10BA	-1.27242	-1.48869
LOG10FE	-.50180	-1.36544
LOG10MN	-1.49988	-1.87088
LOG10AL	-.65226	-1.34502
LOG10MG	1.36027	1.11860
LOG10CA	1.94258	1.73547
LOG10NA	1.11479	.89332
LOG10K	.50835	.09127

data file: G:\project\539-15\bg\sw\SWADDT.CSS
[9 cases with 7 variables]

0 CASE NAME	1 BERYLLIU	2 CHROMIUM	3 COPPER	4 VANADIUM
SW-05-01	.00050	.00250	.00490	.00710
SW-08-02	.00050	.00250	.00200	.00200
ASIT-3		.00500	.00500	.00500
W-10(1/89)	.00120	.01730	.01470	.01770
W-10(5/89)		.02000	.00500	
W-11(1/89)	.00110	.01390	.01000	.01360
W-11(5/89)		.00500	.00500	.00500
W-7(5/89)		.00500	.00500	.00500
W-7(1/89)	.00500	.01610	.00500	.01270

data file: G:\project\539-15\bg\sw\SWADDT.CSS
[9 cases with 7 variables]

0 CASE NAME	5 COBALT	6 METH_CHL	7 ACETONE
SW-05-01	.00150	.00070	.00500
SW-08-02	.00250	.00100	.00250
ASIT-3			
W-10(1/89)	.00500	.00250	.00500
W-10(5/89)			
W-11(1/89)	.00500	.00250	.00500
W-11(5/89)			
W-7(5/89)			.00500
W-7(1/89)	.00500	.00500	.00500

000337

data file: G:\project\539-15\bg\sw\SWADDT.CSS
[9 cases with 7 variables]

0 CASE NAME	4 VANADIUM
SW-05-01	.00710
SW-08-02	.00200
ASIT-3	.00500
W-10(1/89)	.01770
W-10(5/89)	
W-11(1/89)	.01360
W-11(5/89)	.00500
W-7(5/89)	.00500
W-7(1/89)	.01270

data file: G:\project\539-15\bg\sw\SWADDT.CSS
[9 cases with 7 variables]

VARIABLE LIST and missing data values:

4 VANADIUM (-9999.)

SD = SQRT (SUM (d**2)/(n-1))

css/3: basic stats	Descriptive Statistics N. of Cases = 8 [from 9] (MD pairwise deleted)					
	N	Min	Max	Mean	St. Err.	St. Dev.
VANADIUM	8	.002000	.017700	.008513	.001933	.005467

ss/3: basic stats	Descriptive Statistics N. of Cases = 8 [from 9] (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
VANADIUM	.013247	.003778

000339

data file: G:\project\539-15\bg\sw\SWADDT.CSS
[9 cases with 7 variables]

VARIABLE LIST and missing data values:

1 BERYLLIU (-9999.)	2 CHROMIUM (-9999.)	3 COPPER (-9999.)
4 VANADIUM (-9999.)	5 COBALT (-9999.)	6 METH_CHL (-9999.)
7 ACETONE (-9999.)		

SD = SQRT (SUM (d**2)/(n-1))

css/3: basic stats	Descriptive Statistics N. of Cases = 9 (MD pairwise deleted)					
	N	Min	Max	Mean	St. Err.	St. Dev.
BERYLLIU	5	.000500	.005000	.001660	.000848	.001896
CHROMIUM	9	.002500	.020000	.009700	.002335	.007004
COPPER	9	.002000	.014700	.006289	.001254	.003761
VANADIUM	8	.002000	.017700	.008513	.001933	.005467
COBALT	5	.001500	.005000	.003800	.000752	.001681
METH_CHL	5	.000700	.005000	.002340	.000762	.001704
ACETONE	6	.002500	.005000	.004583	.000417	.001021

css/3: basic stats	Descriptive Statistics N. of Cases = 9 (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
BERYLLIU	.004363	-.001043
CHROMIUM	.015205	.004195
COPPER	.009245	.003333
VANADIUM	.013247	.003778
COBALT	.006196	.001404
METH_CHL	.004769	-.000089
ACETONE	.005738	.003429

data file: G:\project\539-15\bg\sw\SWMISC.CSS
[5 cases with 5 variables]

0 CASE NAME	1 ACRYLONI	2 DCA_12	3 CHLOROME	4 BIS_2ETH
SW-05-01	.01250	.00250	.00500	.00200
SW-08-02	.01250	.00100	.00100	.00050
W-10(1/89)		.00250	.00500	.00500
W-11(1/89)		.00250	.00500	.00500
W-7(1/89)		.00250	.00500	.00500

000341

data file: G:\project\539-15\bg\sw\SWMISC.CSS
[5 cases with 5 variables]

0 CASE NAME	5 TOXAPHEN
SW-05-01	.00005
SW-08-02	.00005
W-10(1/89)	.00050
W-11(1/89)	.00050
W-7(1/89)	.00050

data file: G:\project\539-15\bg\sw\SWMISC.CSS
[5 cases with 5 variables]

VARIABLE LIST and missing data values:

1 ACRYLONI (-9999.)	2 DCA_12 (-9999.)	3 CHLOROME (-9999.)
4 BIS_2ETH (-9999.)	5 TOXAPHEN (-9999.)	

SD = SQRT (SUM (d**2)/(n-1))

css/3: basic stats	Descriptive Statistics N. of Cases = 5 (MD pairwise deleted)					
	N	Min	Max	Mean	St. Err.	St. Dev.
ACRYLONI	2	.012500	.012500	.012500	0.000000	0.000000
DCA_12	5	.001000	.002500	.002200	.000300	.000671
CHLOROME	5	.001000	.005000	.004200	.000800	.001789
BIS_2ETH	5	.000500	.005000	.003500	.000949	.002121
TOXAPHEN	5	.000050	.000500	.000320	.000110	.000246

css/3: basic stats	Descriptive Statistics N. of Cases = 5 (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
ACRYLONI	--	--
DCA_12	.003156	.001244
CHLOROME	.006750	.001650
BIS_2ETH	.006524	.000476
TOXAPHEN	.000671	-.000031

000343

data file: G:\project\539-15\bg\sw\SWGEN.CSS
[10 cases with 8 variables]

0 CASE NAME	1 AMMONIA	2 CHLORIDE	3 DIS_PHOS	4 SULFATE
SW-05-01	2.20000	23.00000		71.00000
SW-08-02	.05000	29.00000	.10000	47.00000
ASIT-3(3/89)				
ASIT-3(5/89)	.12600	34.00000		51.30000
W-10(1/89)	.10000	14.50000		39.50000
W-10(5/89)	.40900	12.00000		52.20000
W-11(1/89)	.45000	16.50000		37.00000
W-11(5/89)	.05000	19.99000		57.36000
W-7(1/89)	.16000	16.00000		39.20000
W-7(5/89)	.05000	18.19000		57.36000

data file: G:\project\539-15\bg\sw\SWGEN.CSS
[10 cases with 8 variables]

0 CASE NAME	5 TOT_PHOS	6 URANIUM	7 LOG10AMM	8 LO10CHL
SW-05-01	.04000	3.80000	.3424227	1.3617278
SW-08-02	.20000	16.00000	-1.3010300	1.4623980
ASIT-3(3/89)		7.00000		
ASIT-3(5/89)	.16000	2.00000	-.8996295	1.5314789
W-10(1/89)	.26000		-1.0000000	1.1613680
W-10(5/89)	.48000	5.00000	-.3882767	1.0791812
W-11(1/89)	.54000		-.3467875	1.2174839
W-11(5/89)	.01000	9.00000	-1.3010300	1.3008128
W-7(1/89)	.39000		-.7958800	1.2041200
W-7(5/89)	.03000	15.00000	-1.3010300	1.2598327

000345

data file: G:\project\539-15\bg\sw\SWGEN.CSS
[10 cases with 8 variables]

VARIABLE LIST and missing data values:

var. 1:	AMMONIA		MD:	-9999.
var. 2:	CHLORIDE		MD:	-9999.
var. 3:	DIS_PHOS		MD:	-9999.
var. 4:	SULFATE		MD:	-9999.
var. 5:	TOT_PHOS		MD:	-9999.
var. 6:	URANIUM		MD:	-9999.
var. 7:	LOG10AMM	=log10(v1)	MD:	-9999.
var. 8:	LO10CHL	=log10(v2)	MD:	-9999.

SD = SQRT (SUM (d**2)/(n-1))

css/3: basic stats	Descriptive Statistics N. of Cases = 10 (MD pairwise deleted)					
	N	Min	Max	Mean	St. Err.	St. Dev.
AMMONIA	9	.05000	2.20000	.39944	.230722	.69217
CHLORIDE	9	12.00000	34.00000	20.35333	2.388202	7.16461
DIS_PHOS	1	.10000	.10000	.10000	0.000000	0.00000
SULFATE	9	37.00000	71.00000	50.21333	3.652148	10.95645
TOT_PHOS	9	.01000	.54000	.23444	.066167	.19850
URANIUM	7	2.00000	16.00000	8.25714	2.053900	5.43411
LOG10AMM	9	-1.30103	.34242	-.77680	.185526	.55658
LO10CHL	9	1.07918	1.53148	1.28649	.048264	.14479

css/3: basic stats	Descriptive Statistics N. of Cases = 10 (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
AMMONIA	.94349	-.14460
CHLORIDE	25.98474	14.72193
DIS_PHOS	--	--
SULFATE	58.82514	41.60153
TOT_PHOS	.39047	.07842
URANIUM	13.54453	2.96976
LOG10AMM	-.33933	-1.21428
LO10CHL	1.40030	1.17268

000347

APPENDIX D

SEDIMENT RESULTS SUMMARY

data file: G:\project\539-15\bg\sED\SEDMETAL.CSS
[8 cases with 27 variables]

0 CASE NAME	1 ARSENIC	2 BERYLLI	3 CHROMIUM
SD05	1.60000	.12000	3.70000
SD08	7.30000	.10500	5.90000
ASIT007			
ASIT010			
W10	6.50000	.50000	18.40000
W11	2.70000	.50000	17.40000
W5	7.00000	.50000	18.30000
W7	2.60000	.50000	16.90000

data file: G:\project\539-15\bg\sED\SEDMETAL.CSS
[8 cases with 27 variables]

0 CASE NAME	4 COPPER	5 LEAD	6 MERCURY
SD05	8.30000	3.80000	.05500
SD08	6.80000	18.20000	.05500
ASIT007		12.00000	
ASIT010		18.40000	
W10	14.50000		.05000
W11	11.70000		.05000
W5	10.80000		.05000
W7	11.50000		.05000

data file: G:\project\539-15\bg\sED\SEDMETAL.CSS
[8 cases with 27 variables]

0 CASE NAME	7 NICKEL	8 SELENIUM	9 ZINC
SD05	11.30000	1.20000	21.00000
SD08	7.30000	.31500	33.80000
ASIT007		.15000	
ASIT010			
W10	19.50000	.25000	24.40000
W11	16.40000	.25000	13.40000
W5	13.70000	.20000	13.50000
W7	17.90000	.25000	15.30000

data file: G:\project\539-15\bg\sED\SEDMETAL.CSS
[8 cases with 27 variables]

0 CASE NAME	10 BARIUM	11 IRON	12 MANGANES
SD05	15.60000	7250.00000	314.00000
SD08	28.20000	8210.00000	338.00000
ASIT007			
ASIT010			
W10	31.20000	8830.00000	415.00000
W11	21.00000	5940.00000	362.00000
W5	21.00000	6700.00000	411.00000
W7	21.20000	5600.00000	273.00000

000352

data file: G:\project\539-15\bg\sED\SEDMETAL.CSS
[8 cases with 27 variables]

0 CASE NAME	13 VANADIUM	14 ALUMINUM	15 COBALT
SD05	2.10000	1960.00000	1.30000
SD08	11.30000	4710.00000	3.80000
ASIT007			
ASIT010			
W10	14.00000	3920.00000	6.50000
W11	13.70000	2080.00000	4.70000
W5	12.40000	1970.00000	4.90000
W7	15.40000	2480.00000	5.20000

data file: G:\project\539-15\bg\sED\SEDMETAL.CSS
[8 cases with 27 variables]

0 CASE NAME	16 MAGNESIU	17 CALCIUM	18 SODIUM
SD05	22700.00000	91400.00000	626.00000
SD08	17000.00000	87100.00000	222.00000
ASIT007			
ASIT010			
W10	18300.00000	78700.00000	180.00000
W11	26600.00000	110000.00000	188.00000
W5	18700.00000	25900.00000	197.00000
W7	35900.00000	103000.00000	188.00000

000354

data file: G:\project\539-15\bg\sED\SEDMETAL.CSS
[8 cases with 27 variables]

0 CASE NAME	19 POTASSIU	20 L10BERYL	21 L10LEAD
SD05	1160.00000	-.9208188	.5797836
SD08	749.00000	-.9788107	1.2600714
ASIT007	871.00000		1.0791812
ASIT010	659.00000		1.2648178
W10	655.00000	-.3010300	
W11	366.00000	-.3010300	
W5	307.00000	-.3010300	
W7	421.00000	-.3010300	

data file: G:\project\539-15\bg\sED\SEDMETAL.CSS
[8 cases with 27 variables]

0 CASE NAME	22 L10MERC	23 L10SELEN	24 L10BARI
SD05	-1.2596373	.0791812	1.1931246
SD08	-1.2596373	-.5016894	1.4502491
ASIT007		-.8239087	
ASIT010			
W10	-1.3010300	-.6020600	1.4941546
W11	-1.3010300	-.6020600	1.3222193
W5	-1.3010300	-.6989700	1.3222193
W7	-1.3010300	-.6020600	1.3263359

000356

data file: G:\project\539-15\bg\sED\SEDMETAL.CSS
[8 cases with 27 variables]

0 CASE NAME	25 L10IRON	26 L10ALUM	27 L10SODIU
SD05	3.8603380	3.2922561	2.7965743
SD08	3.9143432	3.6730209	2.3463530
ASIT007			
ASIT010			
W10	3.9459607	3.5932861	2.2552725
W11	3.7737864	3.3180633	2.2741578
W5	3.8260748	3.2944662	2.2944662
W7	3.7481880	3.3944517	2.2741578

css/3: basic stats	Descriptive Statistics N. of Cases = 8 (MD pairwise deleted)					
	N	Min	Max	Mean	St. Err.	St. Dev.
ARSENIC	6	1.60	7.3	4.62	1.05	2.58
BERYLLI	6	.11	.5	.37	.08	.20
CHROMIUM	6	3.70	18.4	13.43	2.75	6.75
COPPER	6	6.80	14.5	10.60	1.11	2.72
LEAD	4	3.80	18.4	13.10	3.44	6.88
MERCURY	6	.05	.1	.05	.00	.00
NICKEL	6	7.30	19.5	14.35	1.85	4.53
SELENIUM	7	.15	1.2	.37	.14	.37
ZINC	6	13.40	33.8	20.23	3.26	7.98
BARIUM	6	15.60	31.2	23.03	2.31	5.66
IRON	6	5600.00	8830.0	7088.33	516.47	1265.09
MANGANES	6	273.00	415.0	352.17	22.68	55.55
VANADIUM	6	2.10	15.4	11.48	1.96	4.81
ALUMINUM	6	1960.00	4710.0	2853.33	479.61	1174.80
COBALT	6	1.30	6.5	4.40	.72	1.75
MAGNESIU	6	17000.00	35900.0	23200.00	2920.05	7152.62
CALCIUM	6	25900.00	110000.0	82683.33	12240.19	29982.22
SODIUM	6	180.00	626.0	266.83	72.08	176.55
POTASSIU	8	307.00	1160.0	648.50	100.85	285.25
L10BERYL	6	-.98	-.3	-.52	.14	.34
L10LEAD	4	.58	1.3	1.05	.16	.32
L10MERC	6	-1.30	-1.3	-1.29	.01	.02
L10SELEN	7	-.82	.1	-.54	.11	.29
L10BARI	6	1.19	1.5	1.35	.04	.11
L10IRON	6	3.75	3.9	3.84	.03	.08
L10ALUM	6	3.29	3.7	3.43	.07	.17
L10SODIU	6	2.26	2.8	2.37	.09	.21

000358

css/3: basic stats	Descriptive Statistics N. of Cases = 8 (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
ARSENIC	7.5	1.70
BERYLLI	.6	.14
CHROMIUM	21.1	5.80
COPPER	13.7	7.52
LEAD	27.9	-1.66
MERCURY	.1	.05
NICKEL	19.5	9.22
SELENIUM	.7	.02
ZINC	29.3	11.21
BARIUM	29.4	16.63
IRON	8519.4	5657.26
MANGANES	415.0	289.32
VANADIUM	16.9	6.05
ALUMINUM	4182.3	1524.41
COBALT	6.4	2.42
MAGNESIU	31291.0	15108.97
CALCIUM	116599.2	48767.49
SODIUM	466.6	67.12
POTASSIU	895.5	401.50
L10BERYL	-.1	-.90
L10LEAD	1.7	.35
L10MERC	-1.3	-1.31
L10SELEN	-.3	-.82
L10BARI	1.5	1.23
L10IRON	3.9	3.76
L10ALUM	3.6	3.24
L10SODIU	2.6	2.14

data file: G:\project\539-15\bg\sED\ADDMISC.CSS
[8 cases with 14 variables]

C

0 CASE	1 METHCHLO	2 ACETONE	3 DINBUTYL	4 FLOURANT
SD05	.03300	.01200	.05200	.52000
SD08	.00300	.00650	.21000	.11000
ASIT07	.01600	.05500	.20000	.20000
ASIT-10	.01900	.09400	.24500	.24500
W10	.01300	.01500	.05100	.24000
W11	.01500	.00800	.05500	.20000
W5	.00700	.01800	.03900	.19500
W7	.00600	.01400	.03900	.19500

000360

data file: G:\project\539-15\bg\sED\ADDMISC.CSS
[8 cases with 14 variables]

C

0 CASE	5 IDENO	6 ANTIM	7 CADMI	8 LOG10_MC
SD05	.12000	10.30000	.60000	-1.4814861
SD08	.21000	2.30000	.42000	-2.5228787
ASIT07	.20000	.05000	.10000	-1.7958800
ASIT-10	.24500	.05000	.10000	-1.7212464
W10	.24000		3.90000	-1.8860566
W11	.20000		4.50000	-1.8239087
W5	.19500		3.70000	-2.1549020
W7	.19500		5.50000	-2.2218487

data file: G:\project\539-15\bg\sED\ADDMISC.CSS
[8 cases with 14 variables]

C

0 CASE	9 LOG10_AC	10 LOG10_DI	11 LOG10_FL	12 LOG10ID
SD05	-1.9208188	-1.2839967	-.2839967	-.9208188
SD08	-2.1870866	-.6777807	-.9586073	-.6777807
ASIT07	-1.2596373	-.6989700	-.6989700	-.6989700
ASIT-10	-1.0268721	-.6108339	-.6108339	-.6108339
W10	-1.8239087	-1.2924298	-.6197888	-.6197888
W11	-2.0969100	-1.2596373	-.6989700	-.6989700
W5	-1.7447275	-1.4089354	-.7099654	-.7099654
W7	-1.8538720	-1.4089354	-.7099654	-.7099654

000362

data file: G:\project\539-15\bg\sED\ADDMISC.CSS
[8 cases with 14 variables]

C

0 CASE	13 LOG10_AN	14 LOG10_CD
SD05	1.0128372	-.2218487
SD08	.3617278	-.3767507
ASIT07	-1.3010300	-1.0000000
ASIT-10	-1.3010300	-1.0000000
W10		.5910646
W11		.6532125
W5		.5682017
W7		.7403627

data file: G:\project\539-15\bg\sED\ADDMISC.CSS
[8 cases with 14 variables]

C

VARIABLE LIST and missing data values:

var. 1:	METHCHLO		MD:	-9999.
var. 2:	ACETONE		MD:	-9999.
var. 3:	DINBUTYL		MD:	-9999.
var. 4:	FLOURANT		MD:	-9999.
var. 5:	IDENO		MD:	-9999.
var. 6:	ANTIM		MD:	-9999.
var. 7:	CADMI		MD:	-9999.
var. 8:	LOG10_MC	=log10(v1)	MD:	-9999.
var. 9:	LOG10_AC	=log10(v2)	MD:	-9999.
var. 10:	LOG10_DI	=log10(v3)	MD:	-9999.
var. 11:	LOG10_FL	=log10(v4)	MD:	-9999.
var. 12:	LOG10ID	=log10(v5)	MD:	-9999.
var. 13:	LOG10_AN	=log10(v6)	MD:	-9999.
var. 14:	LOG10_CD	=log10(v7)	MD:	-9999.

SD = SQRT (SUM (d**2)/(n-1))

css/3: basic stats	Descriptive Statistics N. of Cases = 8 (MD pairwise deleted)					
	N	Min	Max	Mean	St. Err.	St. Dev.
METHCHLO	8	.00300	.03300	.01400	.003343	.009457
ACETONE	8	.00650	.09400	.02781	.010912	.030864
DINBUTYL	8	.03900	.24500	.11138	.031697	.089652
FLOURANT	8	.11000	.52000	.23813	.042792	.121035
IDENO	8	.12000	.24500	.20063	.013477	.038120
ANTIM	4	.05000	10.30000	3.17500	2.433490	4.866980
CADMI	8	.10000	5.50000	2.35250	.798239	2.257760
LOG10_MC	8	-2.52288	-1.48149	-1.95103	.116469	.329424
LOG10_AC	8	-2.18709	-1.02687	-1.73923	.141377	.399873
LOG10_DI	8	-1.40894	-.61083	-1.08019	.124103	.351017
LOG10_FL	8	-.95861	-.28400	-.66139	.065818	.186162
LOG10ID	8	-.92082	-.61083	-.70589	.033690	.095291
LOG10_AN	4	-1.30103	1.01284	-.30687	.589163	1.178326
LOG10_CD	8	-1.00000	.74036	-.00572	.261791	.740456

000364

css/3: basic stats	Descriptive Statistics N. of Cases = 8 (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
METHCHLO	.02219	.00581
ACETONE	.05454	.00109
DINBUTYL	.18901	.03374
FLOURANT	.34293	.13332
IDENO	.23363	.16762
ANTIM	13.62592	-7.27592
CADMI	4.30754	.39746
LOG10_MC	-1.66577	-2.23628
LOG10_AC	-1.39297	-2.08549
LOG10_DI	-.77624	-1.38414
LOG10_FL	-.50019	-.82259
LOG10ID	-.62337	-.78840
LOG10_AN	2.22336	-2.83711
LOG10_CD	.63546	-.64690

data file: G:\project\539-15\bg\sED\SEDSEMI.CSS
[8 cases with 21 variables]

0 CASE	1 ACENAPHT	2 ACENAPHT	3 ANTHRACE	4 B_A_ANTH	5 B_A_PYR	6 B_B_FLOU	7 BEN_GHI
SD-05-01	205.00	205.00	51.00	220.00	250.00	180.00	140.00
SD-08-02	210.00	210.00	210.00	59.00	51.00	92.00	210.00
ASIT-7	200.00	200.00	200.00	200.00	200.00	200.00	200.00
ASIT-10	245.00	245.00	245.00	245.00	245.00	245.00	245.00
W-10	240.00	240.00	240.00	240.00	240.00	240.00	240.00
W-11	200.00	200.00	200.00	200.00	200.00	200.00	200.00
W-5	195.00	195.00	195.00	195.00	195.00	195.00	195.00
W-7	195.00	195.00	195.00	195.00	195.00	195.00	195.00

000366

007359

data file: G:\project\539-15\bg\sED\SEDSEMI.CSS
[8 cases with 21 variables]

0 CASE	8 B_K_FLOU	9 BIS2ETHY	10 CHRYSENE	11 DIB_AH_A	12 FLUORENE	13 NAPHTHAL	14 PHENANTH
SD-05-01	400.00	205.00	240.00	205.00	205.00	205.00	290.00
SD-08-02	92.00	55.00	47.00	210.00	210.00	210.00	56.00
ASIT-7	200.00	200.00	200.00	200.00	200.00	200.00	200.00
ASIT-10	245.00	245.00	245.00	245.00	245.00	245.00	245.00
W-10	240.00	590.00	240.00	240.00	240.00	240.00	240.00
W-11	200.00	500.00	200.00	200.00	200.00	200.00	200.00
W-5	195.00	460.00	195.00	195.00	195.00	195.00	195.00
W-7	195.00	400.00	195.00	195.00	195.00	195.00	195.00

000367

data file: G:\project\539-15\bg\sED\SEDSEMI.CSS
[8 cases with 21 variables]

0 CASE	15 PYRENE	16 DIBENZOF	17 METHYNAP	18 METHYPHE	19 BENZOIC	20 LOG10SEM	21 LOG10BEN
SD-05-01	530.00	205.00	205.00	205.00	1000.00	2.31	3.00
SD-08-02	90.00	210.00	210.00	55.00	1050.00	2.32	3.02
ASIT-7	200.00	200.00	200.00	200.00	1000.00	2.30	3.00
ASIT-10	245.00	245.00	245.00	245.00	1250.00	2.39	3.10
W-10	240.00	240.00	240.00	240.00	1150.00	2.38	3.06
W-11	200.00	200.00	200.00	200.00	1000.00	2.30	3.00
W-5	195.00	195.00	195.00	195.00	950.00	2.29	2.98
W-7	195.00	195.00	195.00	195.00	950.00	2.29	2.98

000268

css/3: basic stats	Descriptive Statistics N. of Cases = 8 (MD pairwise deleted)					
	N	Min	Max	Mean	St. Err.	St. Dev.
ACENAPHT	8	195.0000	245.000	211.250	7.05527	19.9553
ACENAPHT	8	195.0000	245.000	211.250	7.05527	19.9553
ANTHRACE	8	51.0000	245.000	192.000	21.32403	60.3135
B_A_ANTH	8	59.0000	245.000	194.250	20.56848	58.1765
B_A_PYR	8	51.0000	250.000	197.000	22.48174	63.5880
B_B_FLOU	8	92.0000	245.000	193.375	16.57659	46.8857
BEN_GHI	8	140.0000	245.000	203.125	11.41496	32.2864
B_K_FLOU	8	92.0000	400.000	220.875	30.42933	86.0671
BIS2ETHY	8	55.0000	590.000	331.875	64.59308	182.6968
CHRYSENE	8	47.0000	245.000	195.250	22.56083	63.8117
DIB_AH_A	8	195.0000	245.000	211.250	7.05527	19.9553
FLUORENE	8	195.0000	245.000	211.250	7.05527	19.9553
NAPHTHAL	8	195.0000	245.000	211.250	7.05527	19.9553
PHENANTH	8	56.0000	290.000	202.625	24.07424	68.0922
PYRENE	8	90.0000	530.000	236.875	45.07868	127.5017
DIBENZOF	8	195.0000	245.000	211.250	7.05527	19.9553
METHYNAP	8	195.0000	245.000	211.250	7.05527	19.9553
METHYPHE	8	55.0000	245.000	191.875	20.78670	58.7937
BENZOIC	8	950.0000	1250.000	1043.750	37.12611	105.0085
LOG10SEM	8	2.2900	2.389	2.323	.01396	.0395
LOG10BEN	8	2.9777	3.097	3.017	.01480	.0419

css/3: basic stats	Descriptive Statistics N. of Cases = 8 (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
ACENAPHT	228.530	193.9703
ACENAPHT	228.530	193.9703
ANTHRACE	244.227	139.7732
B_A_ANTH	244.626	143.8737
B_A_PYR	252.062	141.9378
B_B_FLOU	233.974	152.7756
BEN_GHI	231.082	175.1675
B_K_FLOU	295.402	146.3476
BIS2ETHY	490.076	173.6738
CHRYSENE	250.506	139.9941
DIB_AH_A	228.530	193.9703
FLUORENE	228.530	193.9703
NAPHTHAL	228.530	193.9703
PHENANTH	261.588	143.6624
PYRENE	347.282	126.4684
DIBENZOF	228.530	193.9703
METHYNAP	228.530	193.9703
METHYPHE	242.786	140.9643
BENZOIC	1134.679	952.8208
LOG10SEM	2.357	2.2890
LOG10BEN	3.053	2.9805

000370

data file: G:\project\539-15\bg\sED\GEN-RAD.CSS
[8 cases with 12 variables]

0 CASE	1 CYANIDE	2 AMMONIA	3 TOC	4 CHLORIDE
SD-05-01	.31000	46.25000		125.00000
SD-08-02		6.42000	4358.97000	14.10000
ASIT-7	.45000	50.40000		230.00000
ASIT-10	.45000	93.60000		40.00000
W-10	1.35000			
W-11	1.20000			
W-5	1.10000			
W-7	1.15000			

data file: G:\project\539-15\bg\sED\GEN-RAD.CSS
[8 cases with 12 variables]

0 CASE	5 NITRATE	6 PH	7 SULFATE	8 PHOSPHOR
SD-05-01		7.20000	187.50000	775.00000
SD-08-02		7.50000	339.74000	141.83000
ASIT-7	2.76000		697.00000	37.40000
ASIT-10	2.62000		418.00000	38.90000
W-10				
W-11				
W-5				
W-7				

000372

data file: G:\project\539-15\bg\sED\GEN-RAD.CSS
[8 cases with 12 variables]

0 CASE	9 GROSS_AL	10 GROSS_BE	11 URANIUM	12 LOG10UR
SD-05-01	1.50000	8	.30000	-.5228787
SD-08-02	7.40000	16	.70000	-.1549020
ASIT-7			4.53000	.6532125
ASIT-10			30.30000	1.4814426
W-10			1.00000	0.0000000
W-11			.50000	-.3010300
W-5			1.00000	0.0000000
W-7			1.00000	0.0000000

data file: G:\project\539-15\bg\sED\GEN-RAD.CSS
[8 cases with 12 variables]

VARIABLE LIST and missing data values:

var. 1:	CYANIDE	MD:	-9999.
var. 2:	AMMONIA	MD:	-9999.
var. 3:	TOC	MD:	-9999.
var. 4:	CHLORIDE	MD:	-9999.
var. 5:	NITRATE	MD:	-9999.
var. 6:	PH	MD:	-9999.
var. 7:	SULFATE	MD:	-9999.
var. 8:	PHOSPHOR	MD:	-9999.
var. 9:	GROSS_AL	MD:	-9999.
var. 10:	GROSS_BE	MD:	-9999.
var. 11:	URANIUM	MD:	-9999.
var. 12:	LOG10UR =log10(v11)	MD:	-9999.

SD = SQRT (SUM (d**2)/(n-1))

CSS/3: basic stats

Descriptive Statistics
N. of Cases = 8
(MD pairwise deleted)

	N	Min	Max	Mean	St. Err.	St. Dev.
CYANIDE	7	.310	1.350	.859	.1645	.4351
AMMONIA	4	6.420	93.600	49.168	17.8223	35.6447
TOC	1	4358.970	4358.970	4358.970	0.0000	0.0000
CHLORIDE	4	14.100	230.000	102.275	48.7195	97.4391
NITRATE	2	2.620	2.760	2.690	.0700	.0990
PH	2	7.200	7.500	7.350	.1500	.2121
SULFATE	4	187.500	697.000	410.560	106.7998	213.5997
PHOSPHOR	4	37.400	775.000	248.283	177.2653	354.5306
GROSS_AL	2	1.500	7.400	4.450	2.9500	4.1719
GROSS_BE	2	8.000	16.000	12.000	4.0000	5.6569
URANIUM	8	.300	30.300	4.916	3.6574	10.3447
LOG10UR	8	-.523	1.481	.144	.2253	.6372

000374

css/3: basic stats	Descriptive Statistics N. of Cases = 8 (MD pairwise deleted)	
	p=.9500 Up.limit	p=.9500 Dn.limit
CYANIDE	1.282	.435
AMMONIA	125.708	-27.373
TOC	--	--
CHLORIDE	311.507	-106.957
NITRATE	--	--
PH	--	--
SULFATE	869.225	-48.105
PHOSPHOR	1009.570	-513.005
GROSS_AL	--	--
GROSS_BE	--	--
URANIUM	13.874	-4.041
LOG10UR	.696	-.407

007359

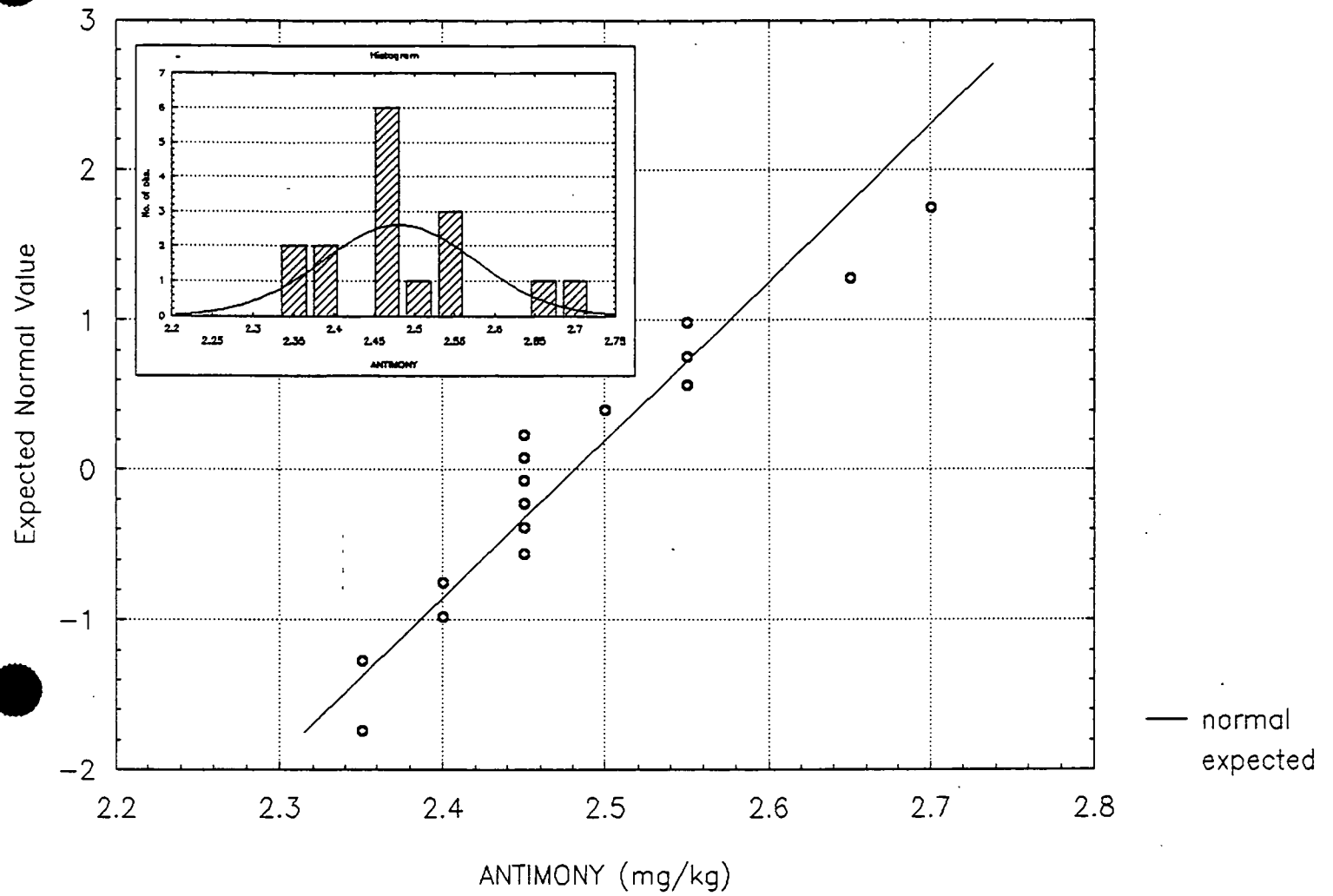
APPENDIX E

STATISTICAL EVALUATION SUMMARY - SURFACE SOIL

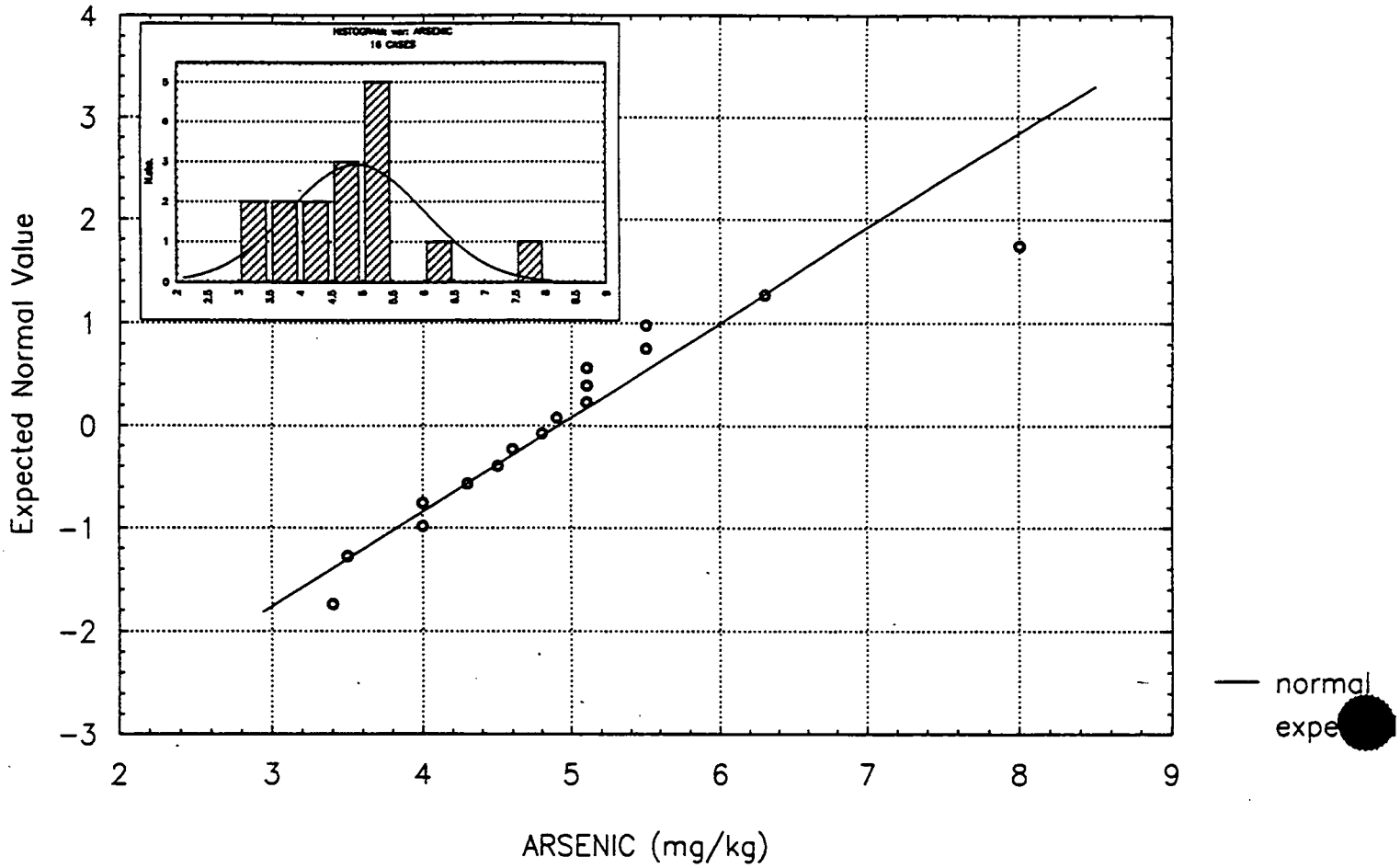
000376

TOTAL METALS

Normal Probablility Plot for Antimony
in Background Surface Soils

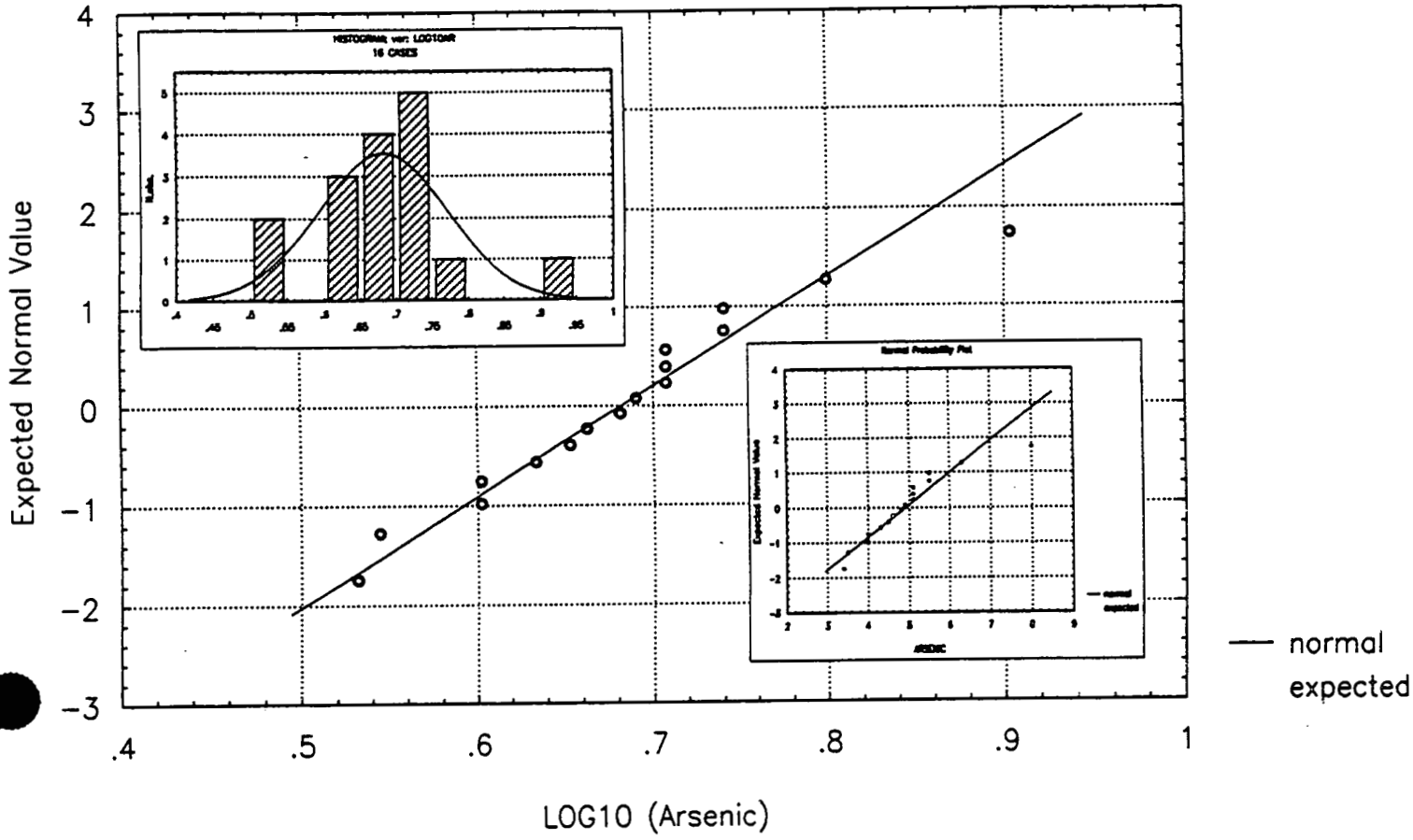


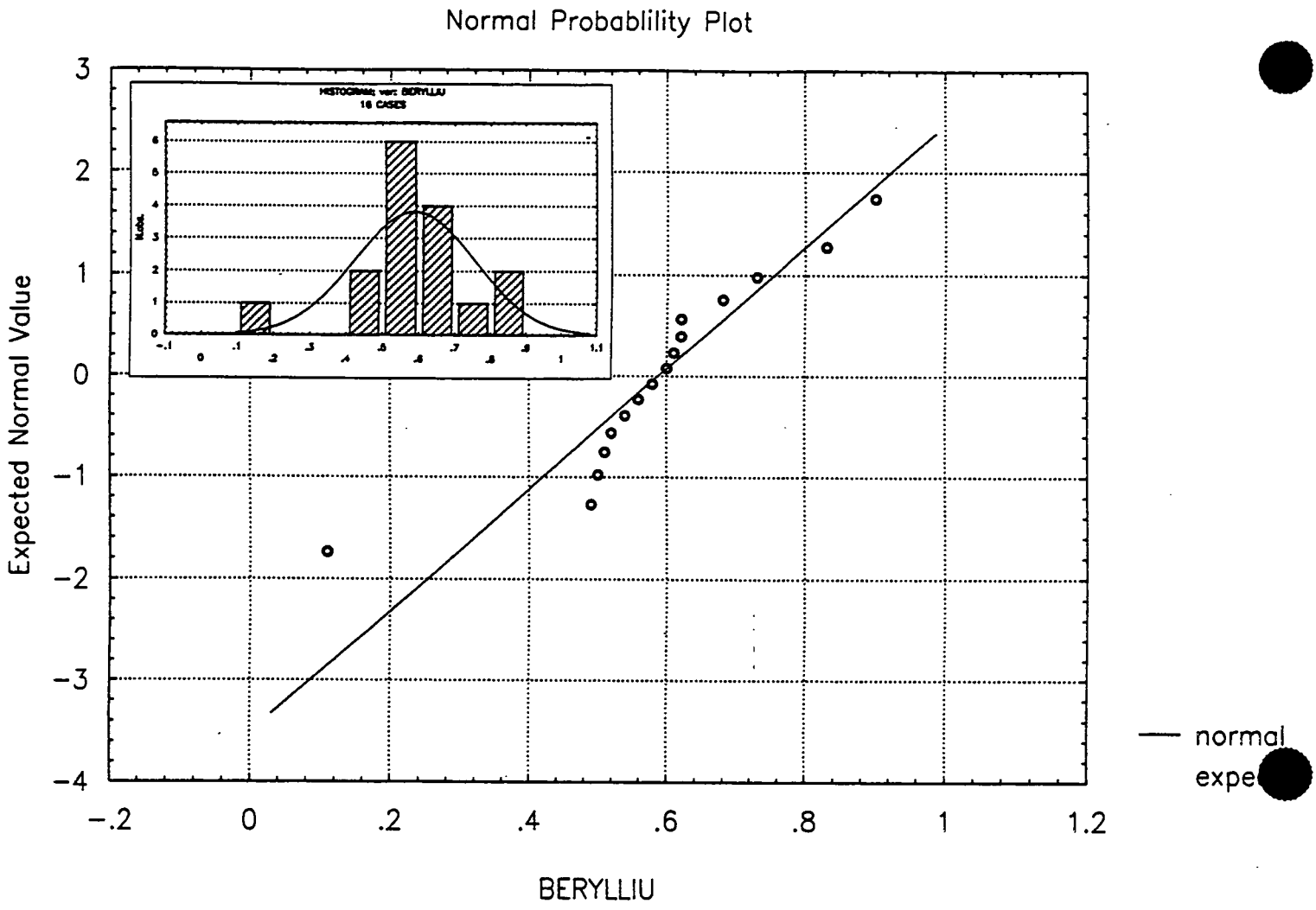
Normal Probablility Plot
for Asenic in Surface Soils



000379

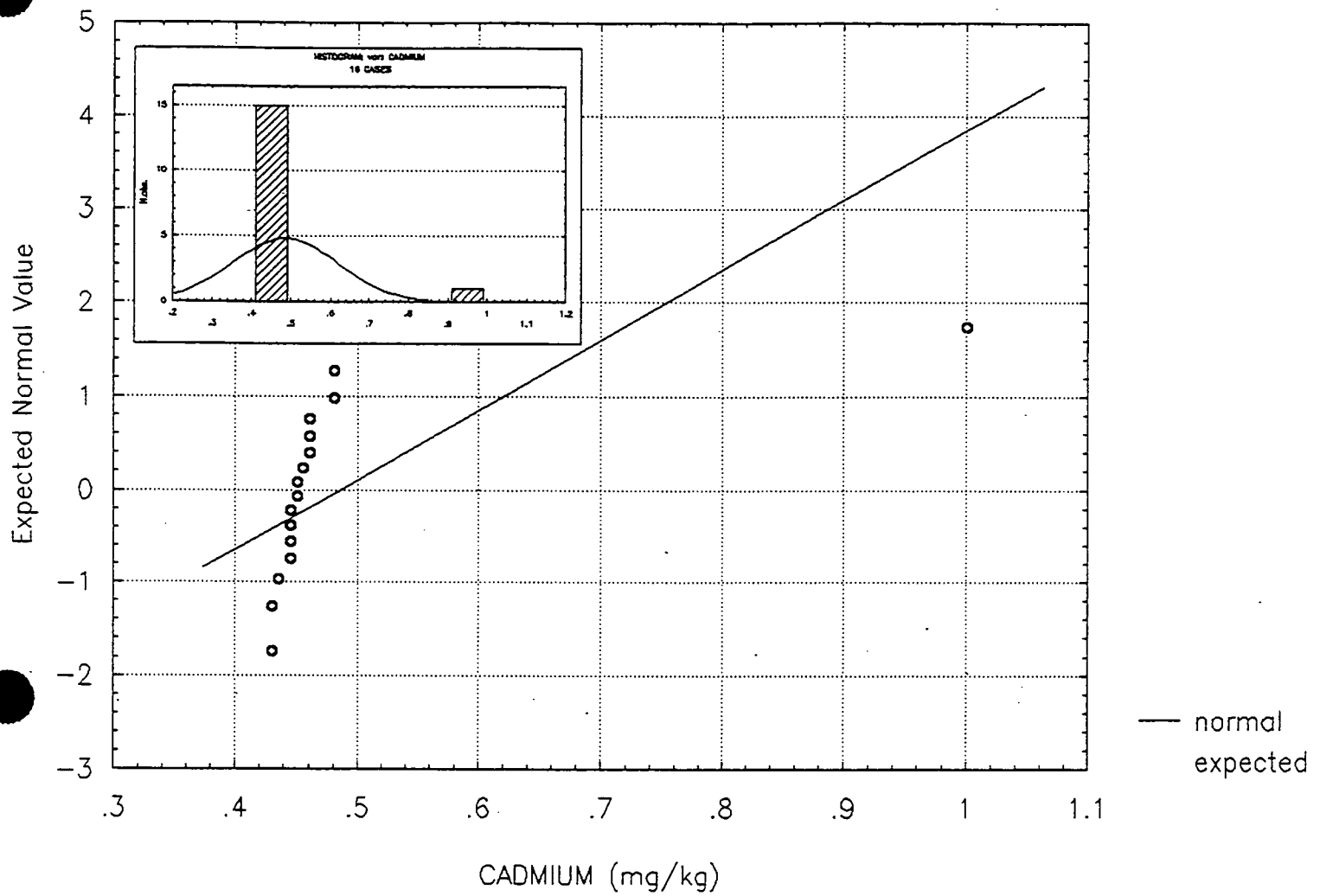
Normal Probablility Plot
for Arsenic in Surface Soils
(Log Base 10 Transform)



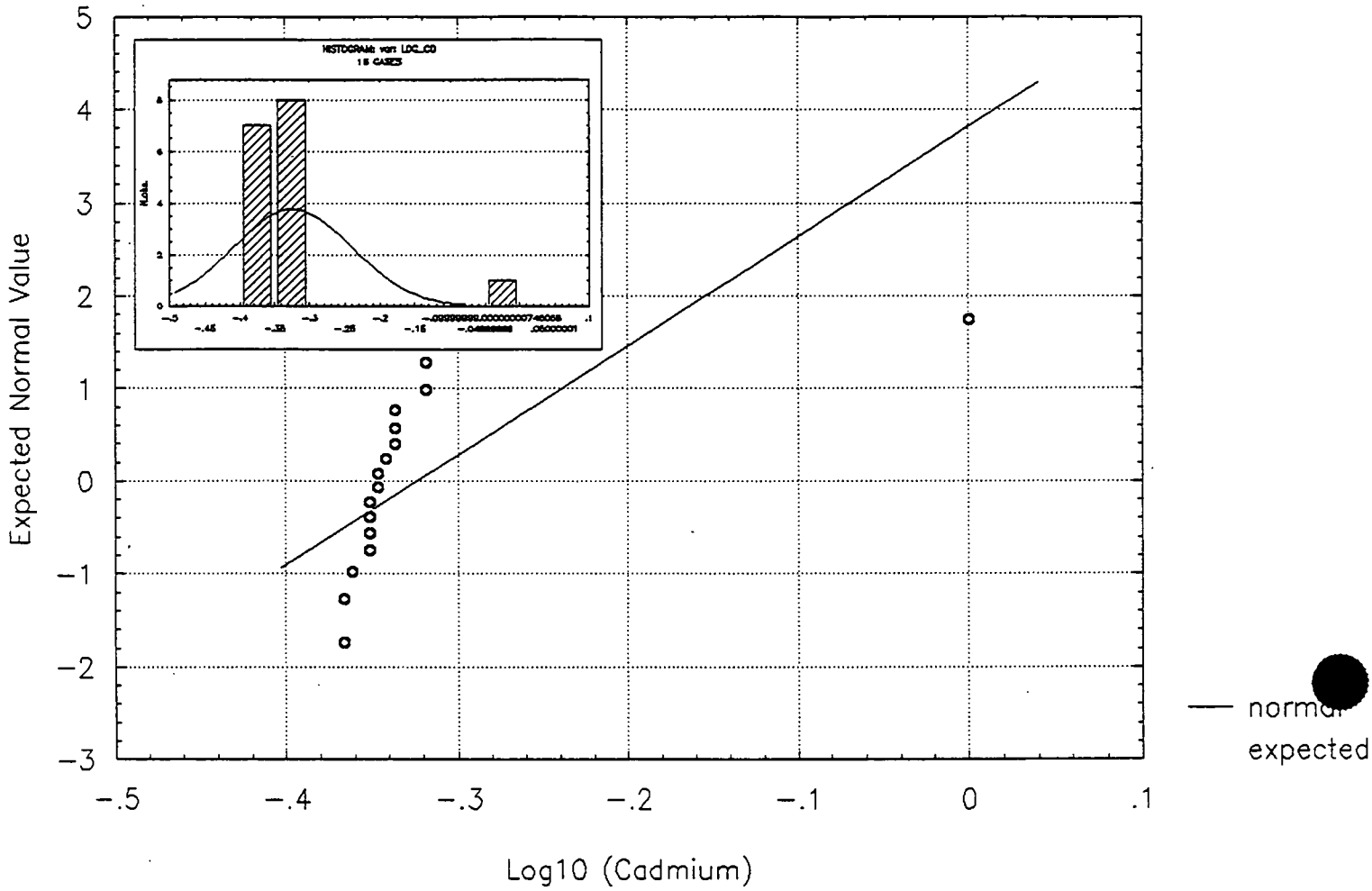

Normal Probablility Plot
Expected Normal Value
BERYLLIU
normal
expe
3
2
1
0
−1
−2
−3
−4
−.2
0
.2
.4
.6
.8
1
1.2

000381

Normal Probablility Plot for Cadmium
in Background Surface Soils

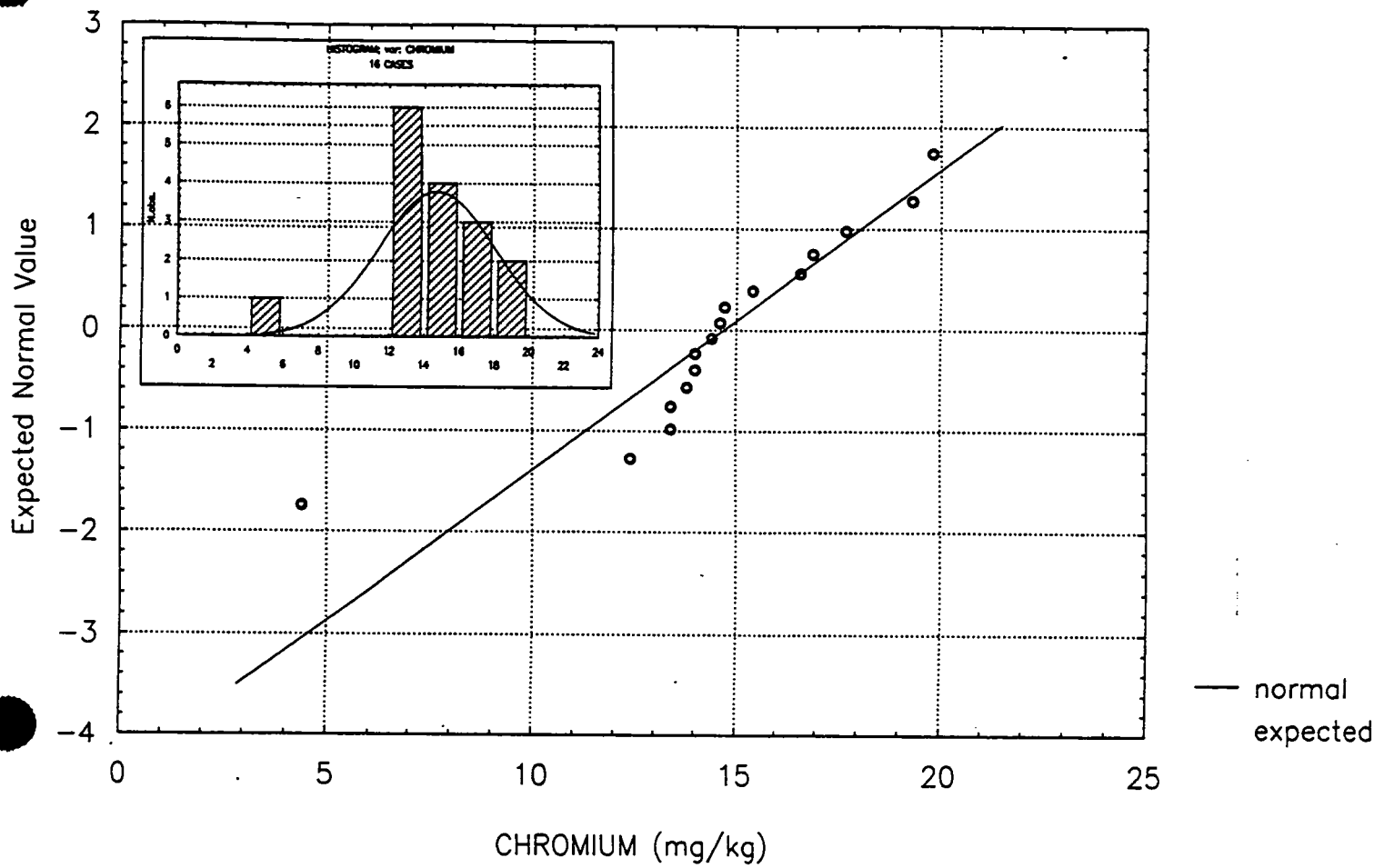


Normal Probablility Plot for the
Log Base 10 of Cadmium in Background
Surface Soils

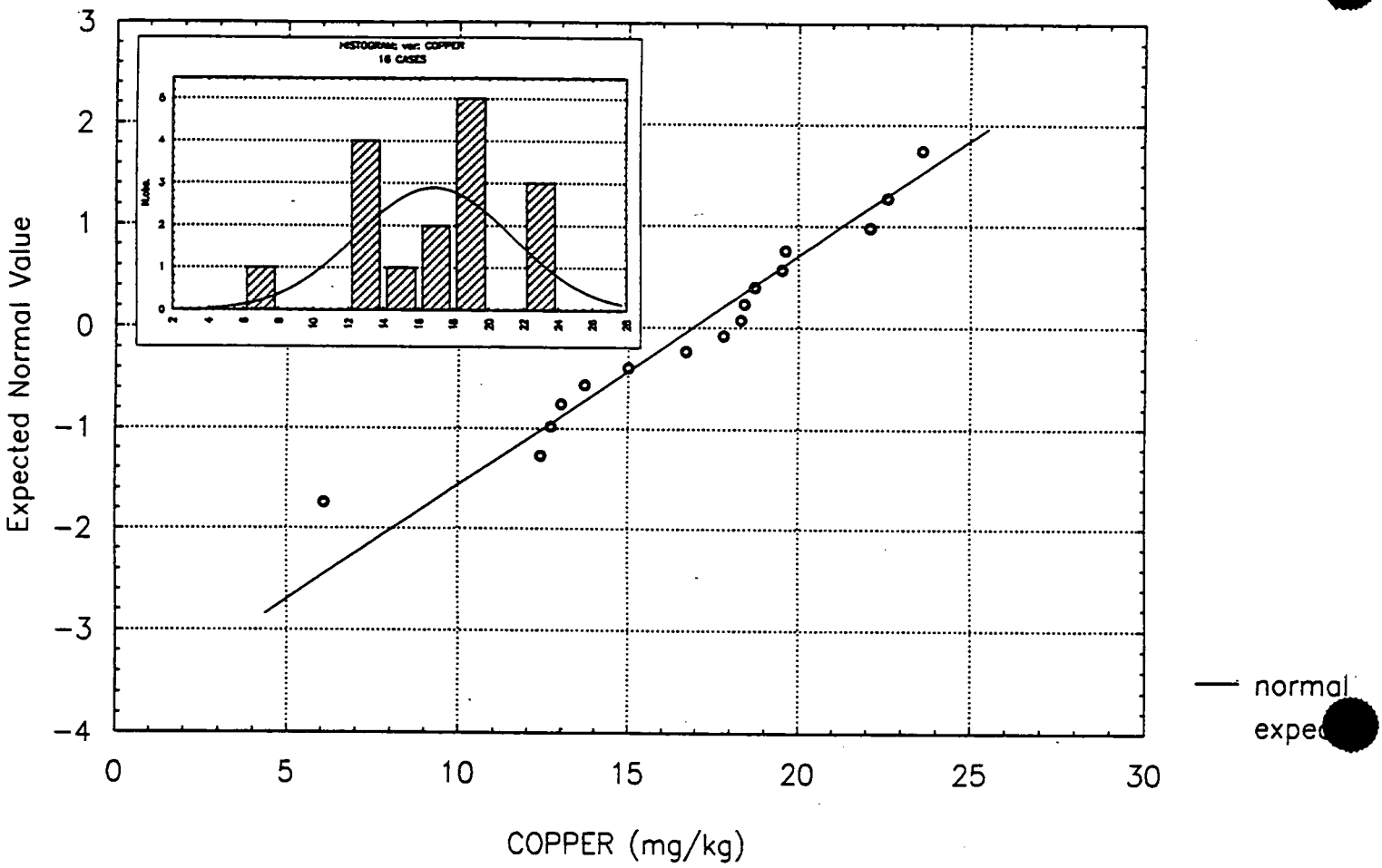


000383

Normal Probablility Plot
for Chromium in Surface Soils

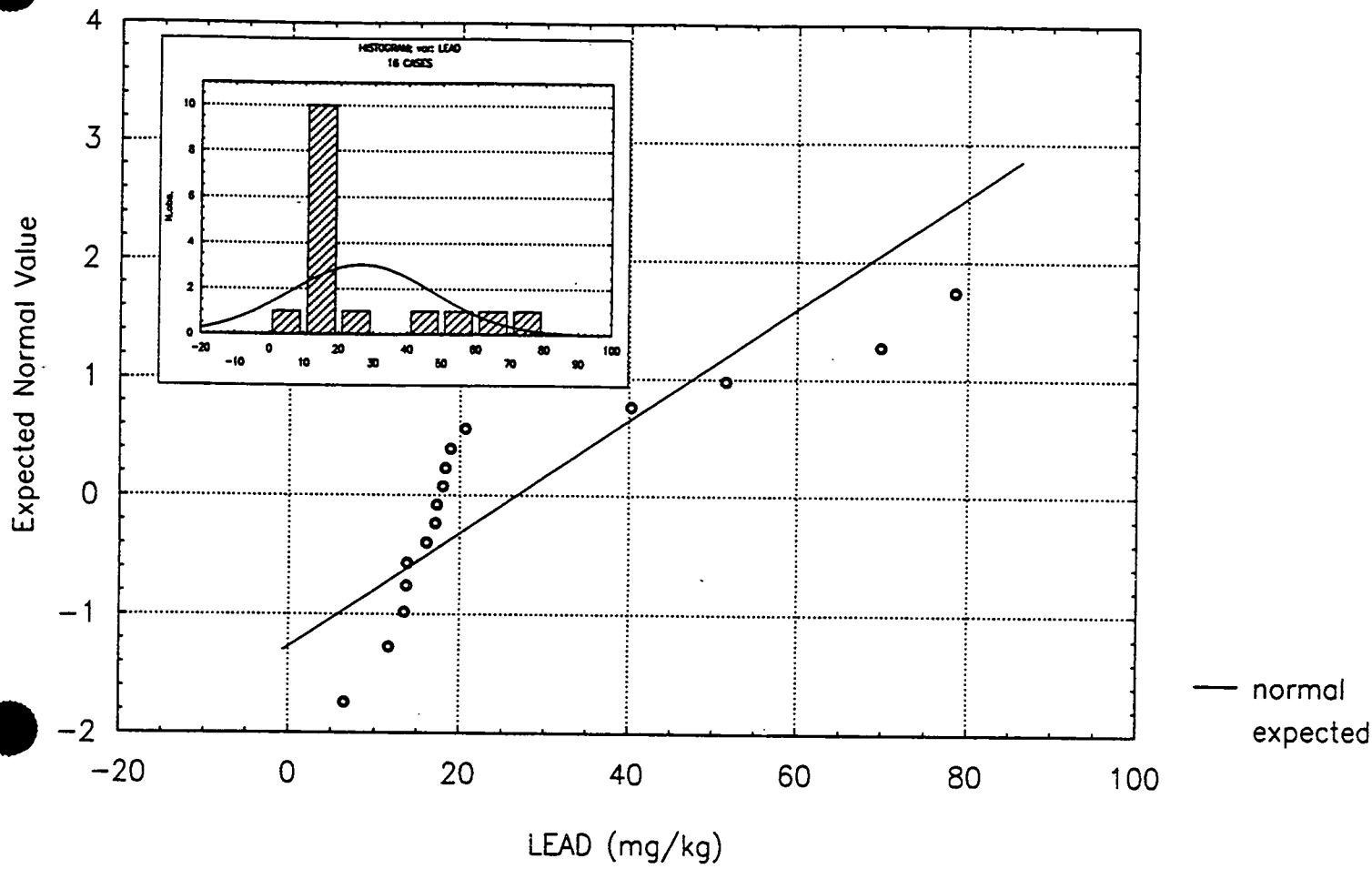


Normal Probablility Plot
for Copper in Surface Soils

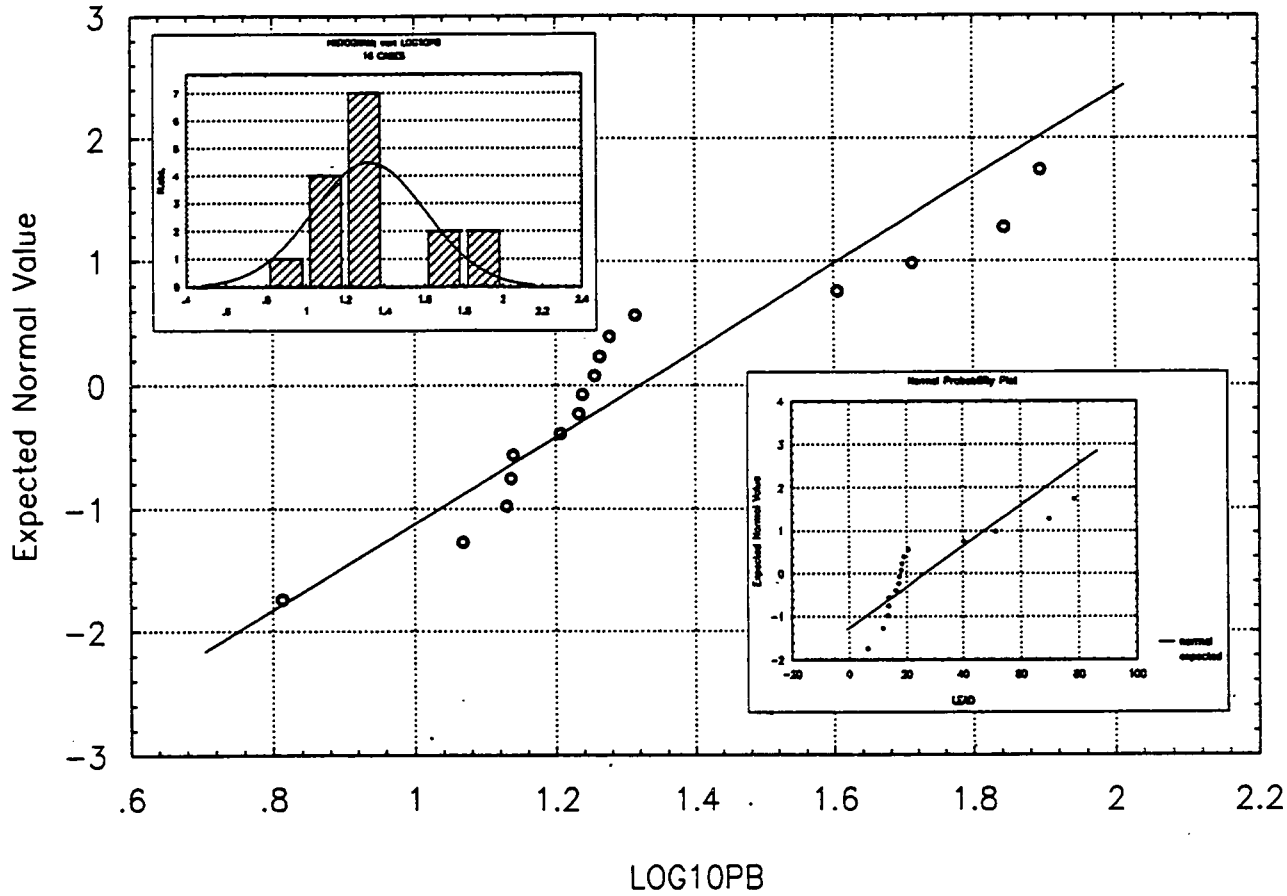


000385

Normal Probablility Plot
for Lead in Surface Soils



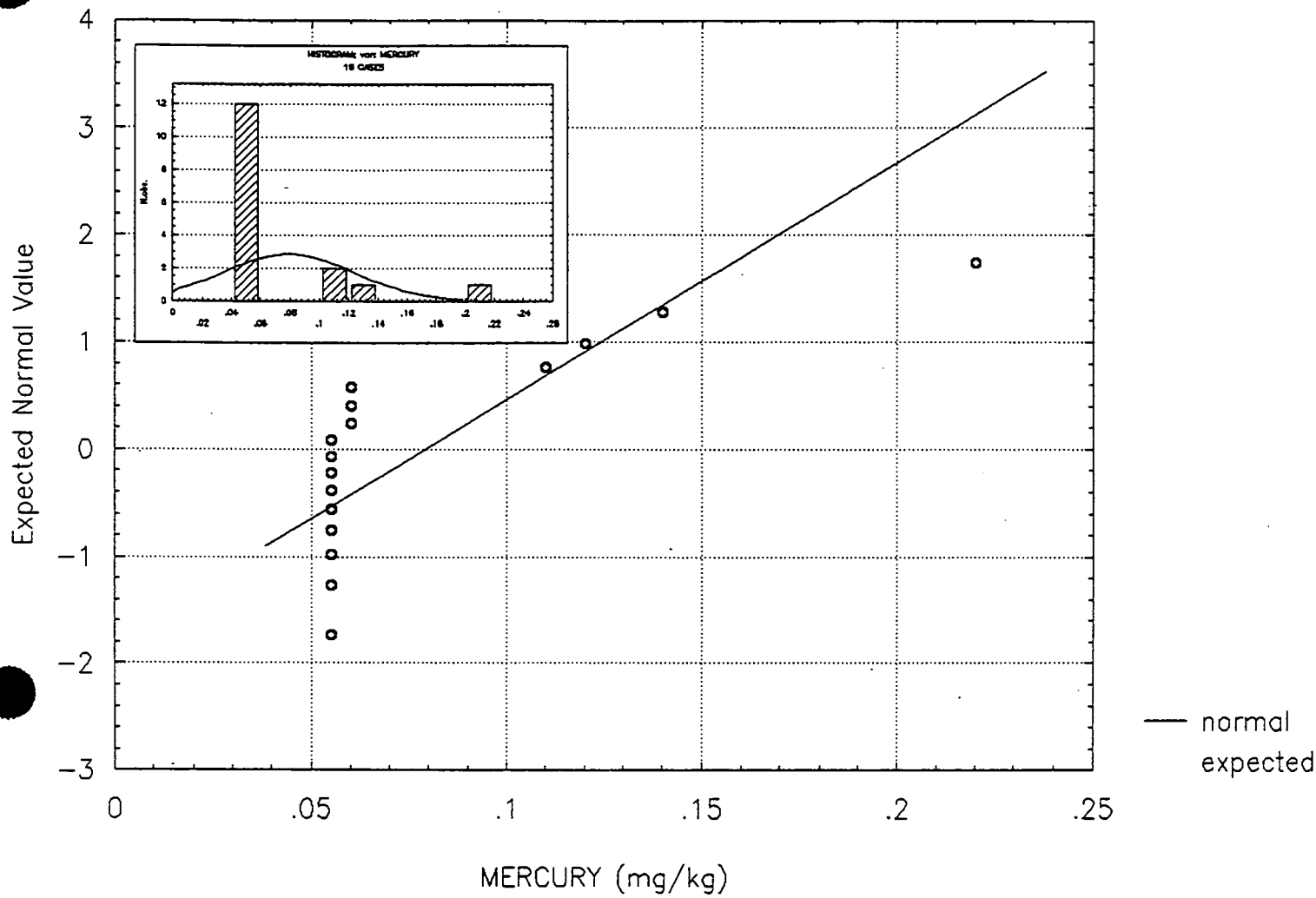
Normal Probablility Plot
for Lead in Surface Soils
(Log Base 10 Transform)



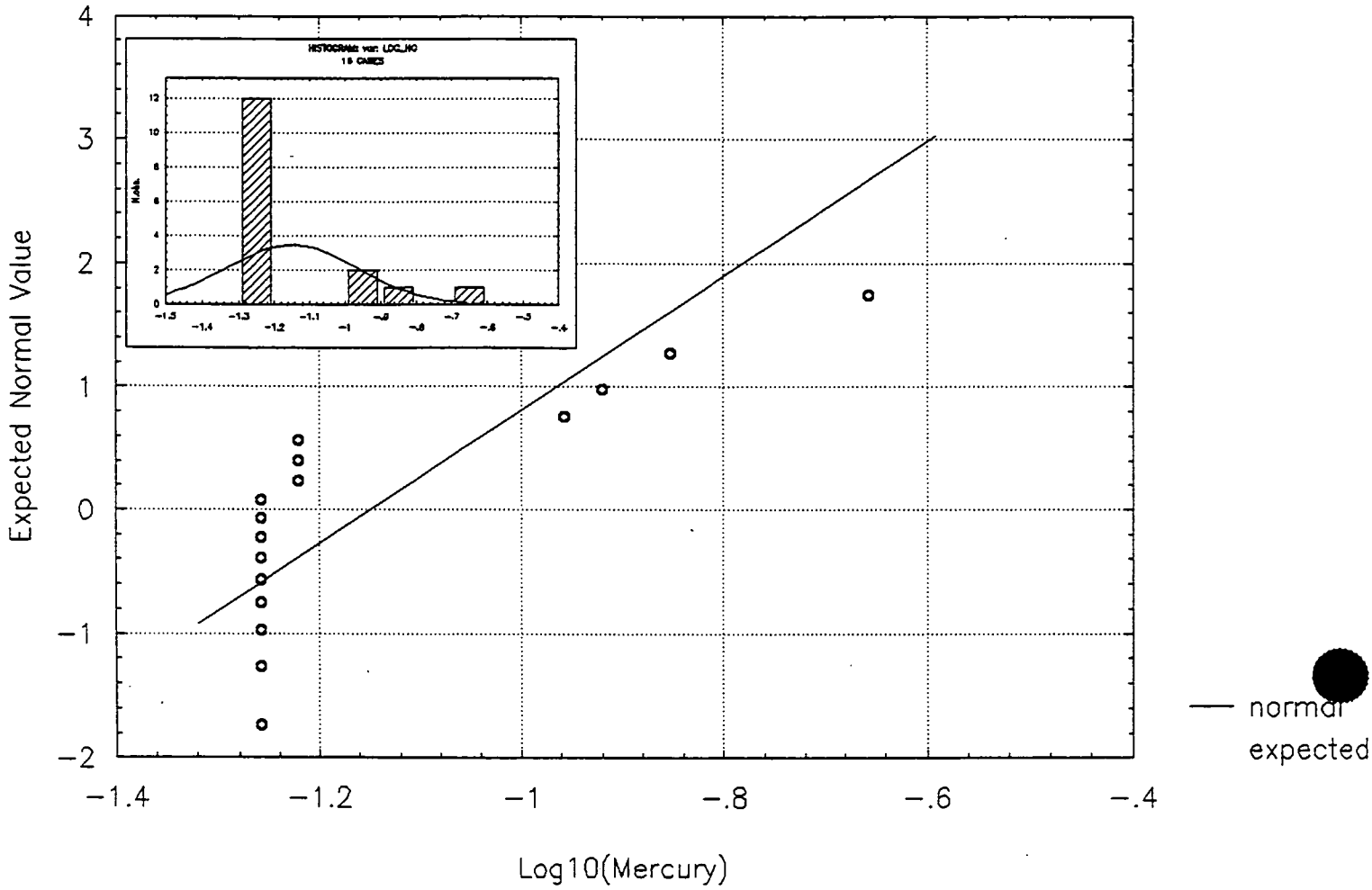
— normal
expec

000387

Normal Probablility Plot for Mercury
in Background Surface Soils

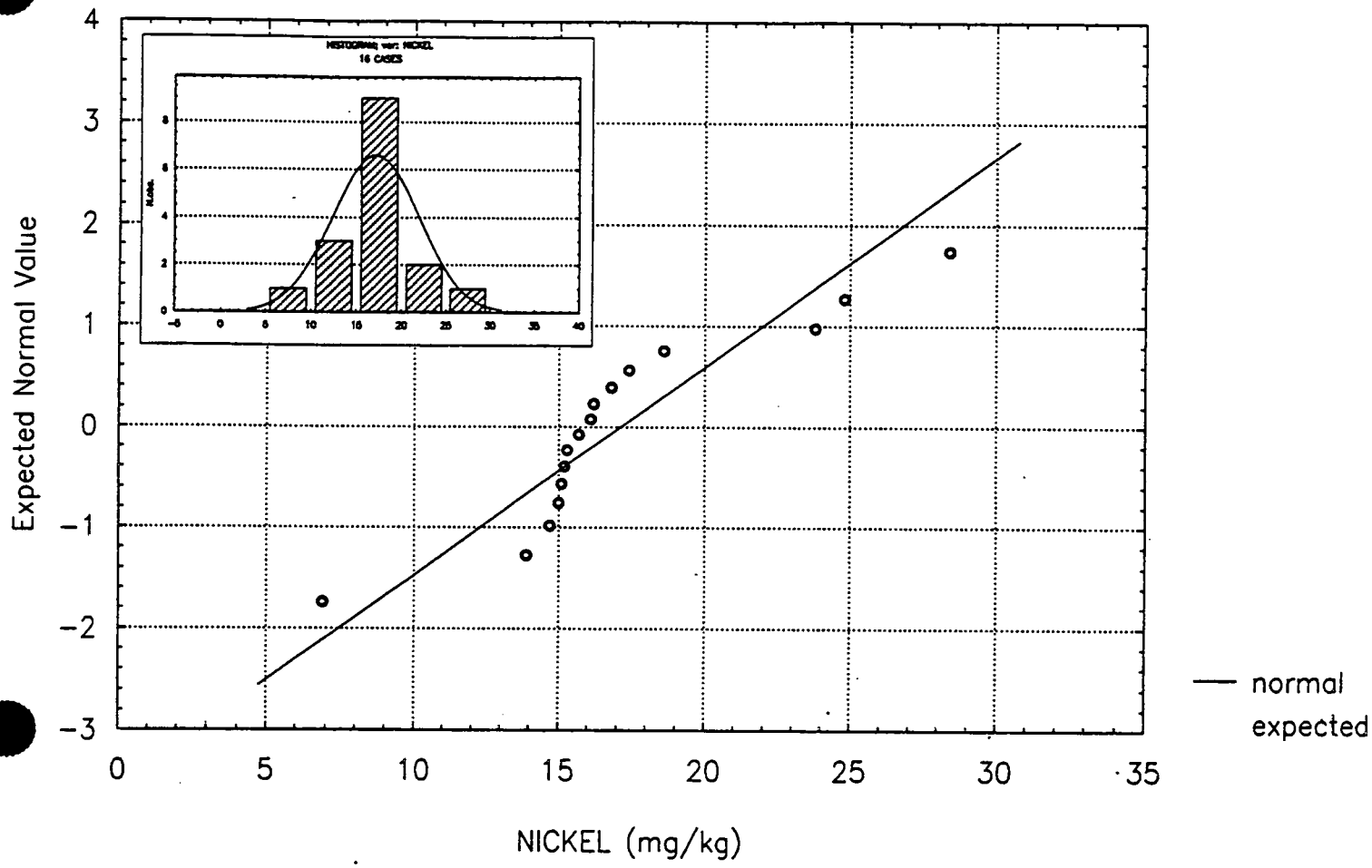


Normal Probablility Plot for the Log Base 10 of Mercury in Background Surface Soils

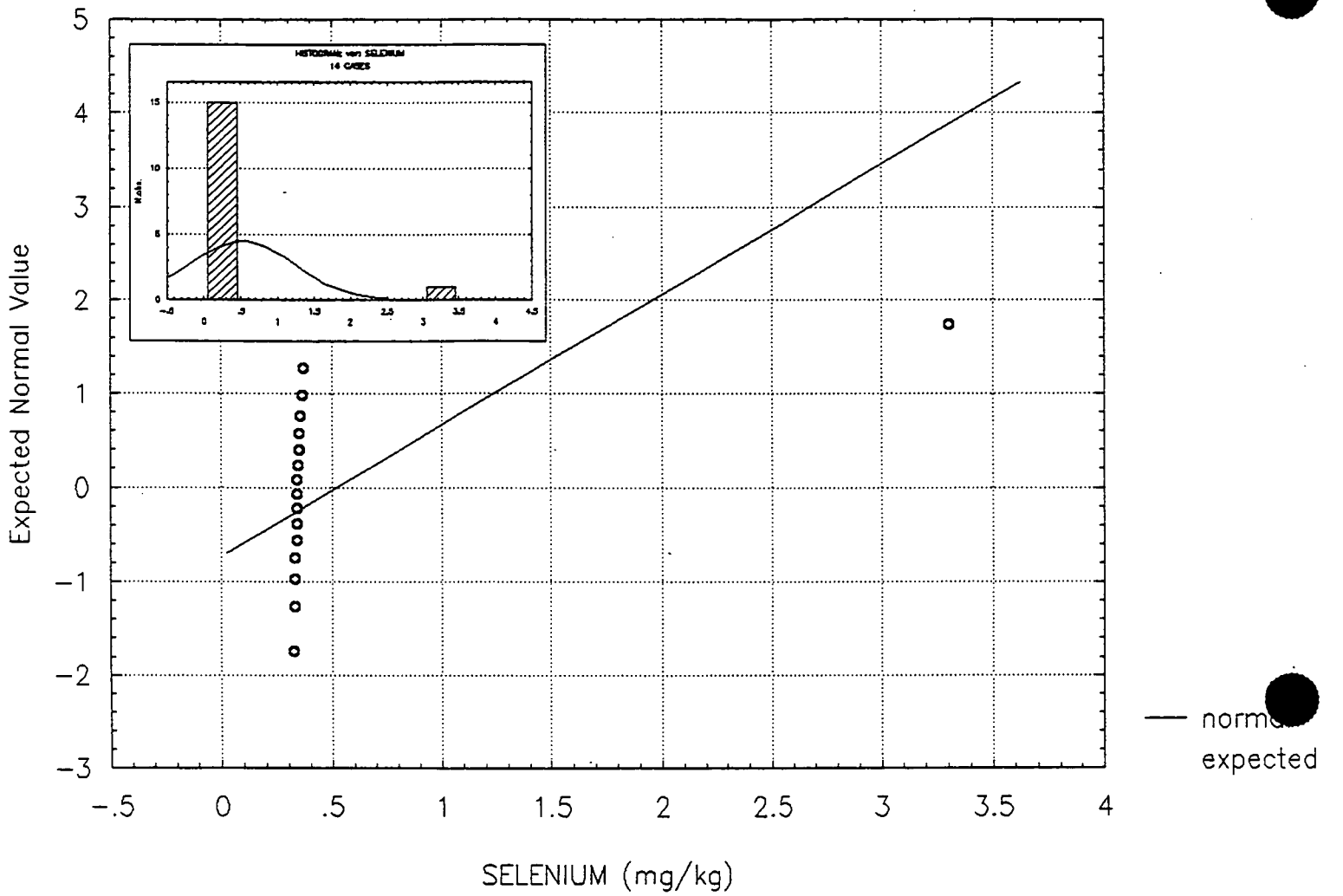


000389

Normal Probablility Plot
for Nickel in Surface Soils

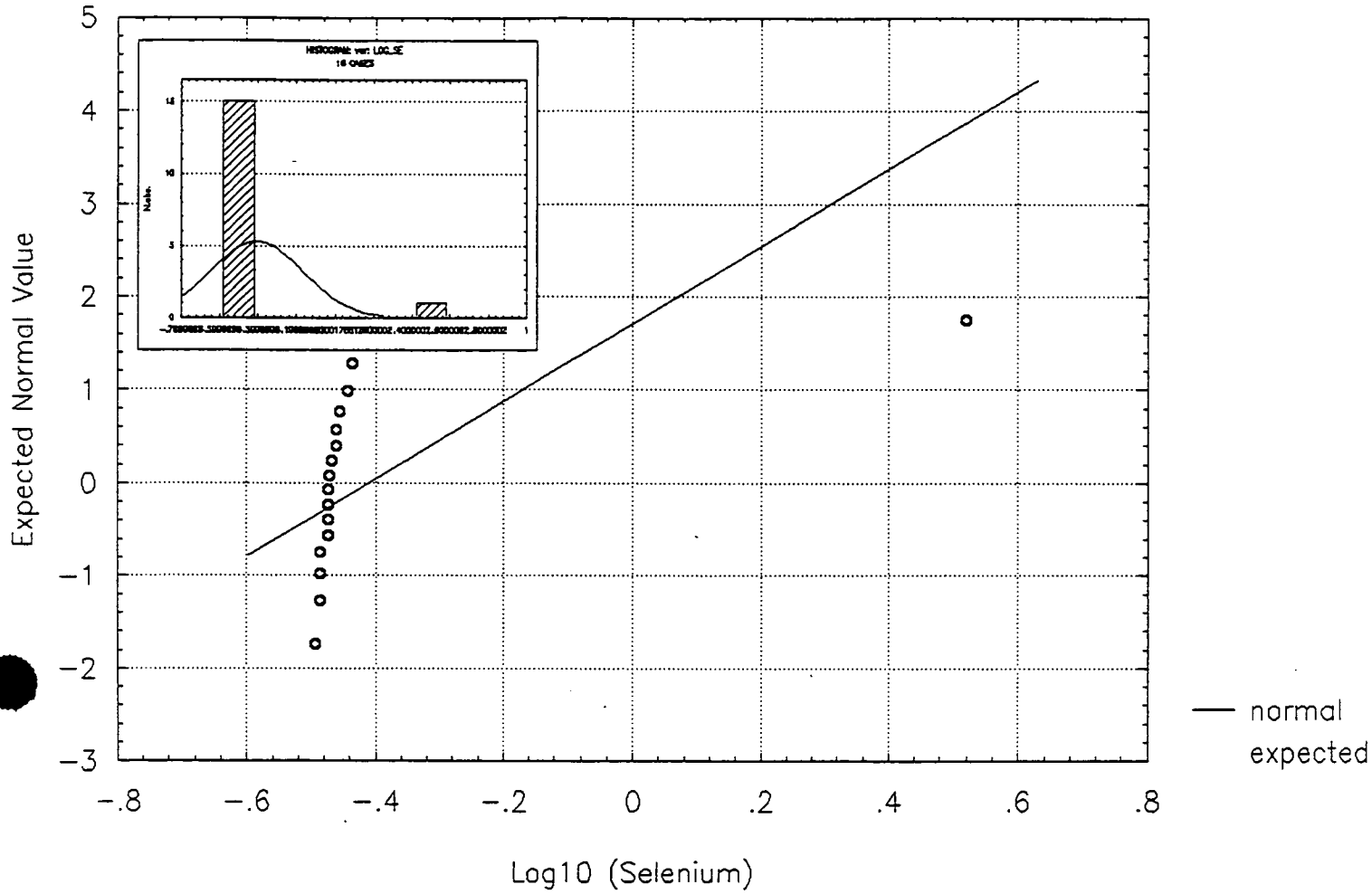


Normal Probablility Plot for Selenium
in Background Surface Soils

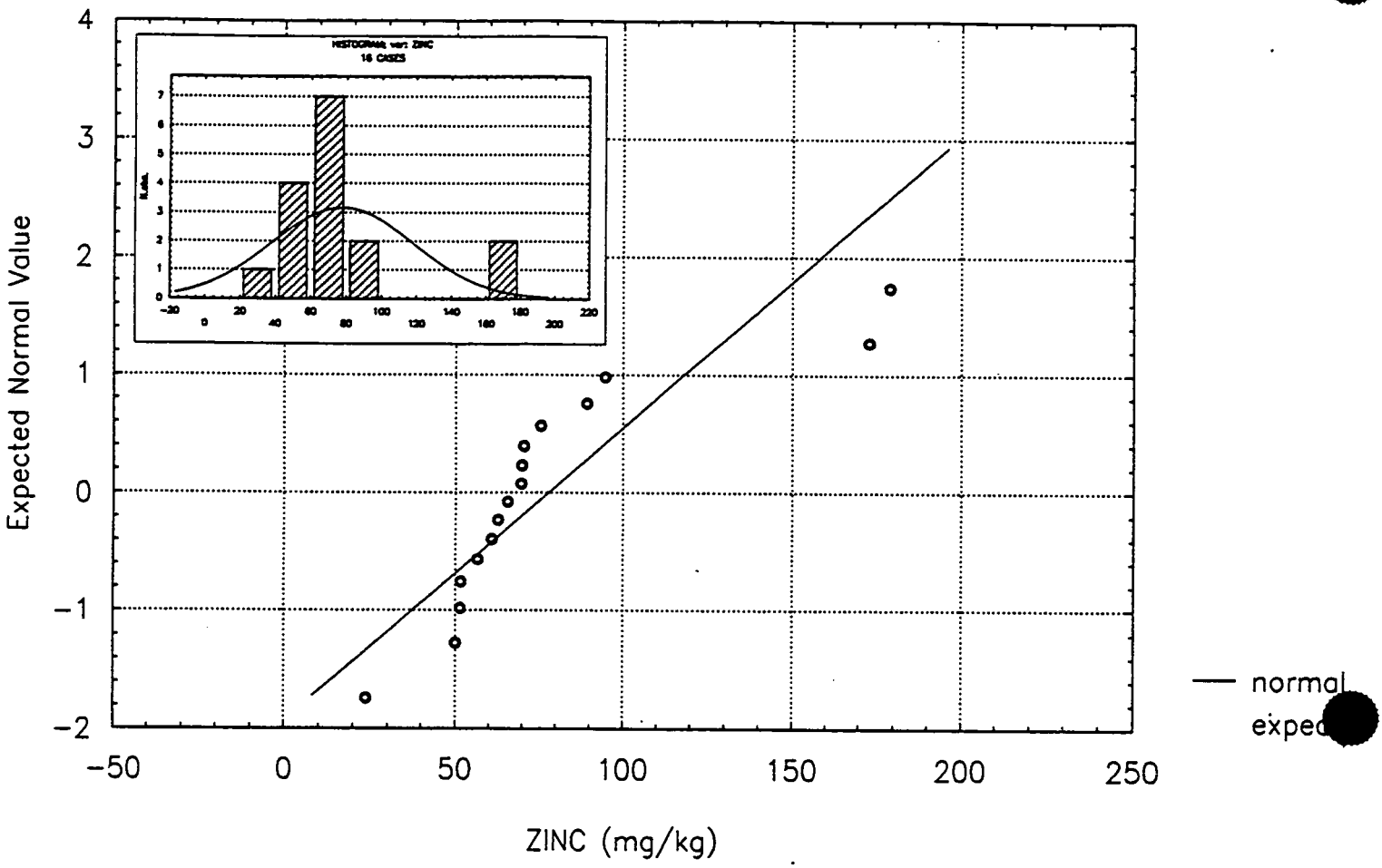


000391

Normal Probablility Plot for the Log Base 10 of Selenium in Background Surface Soils

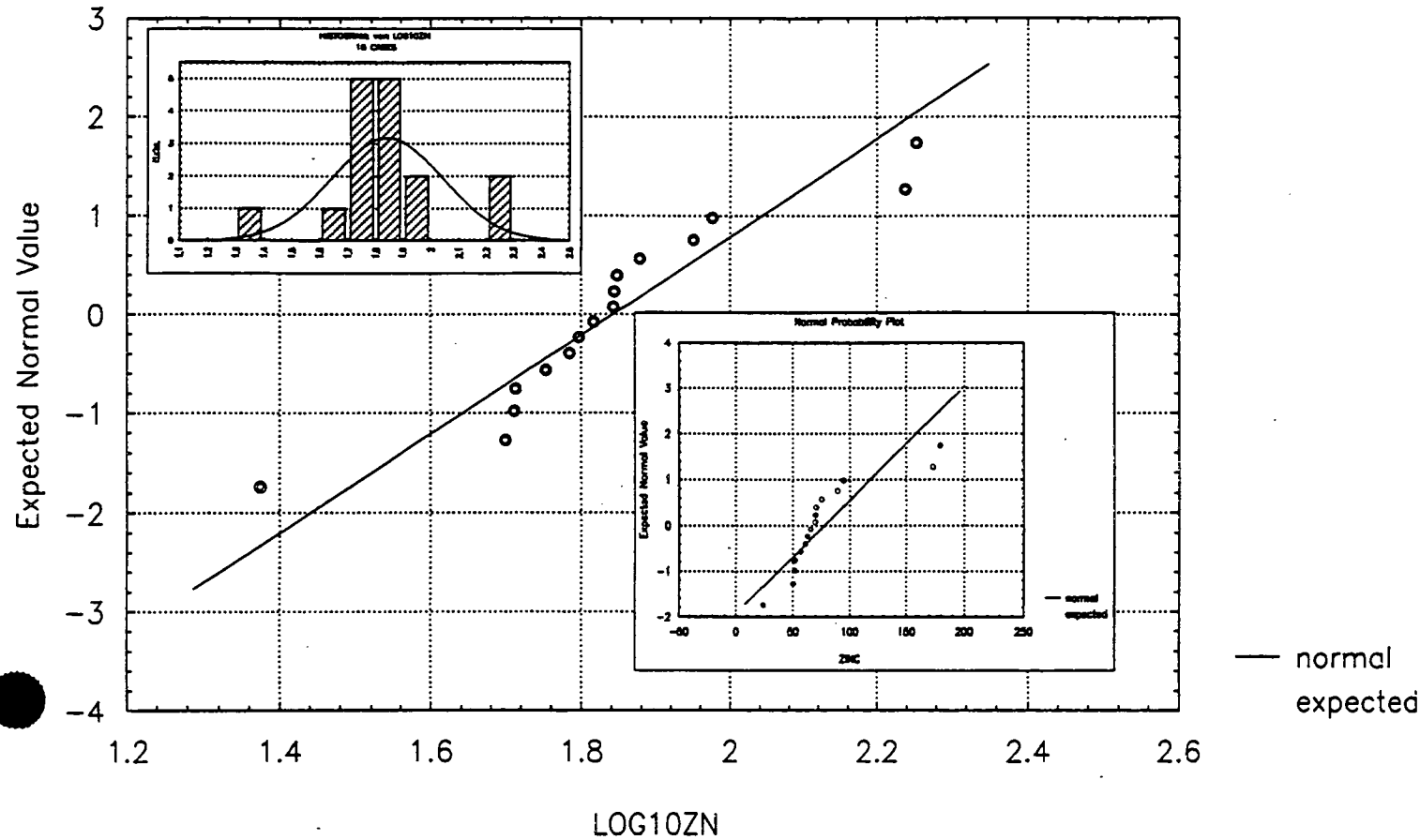


Normal Probablility Plot
for Zinc in Surface Soils

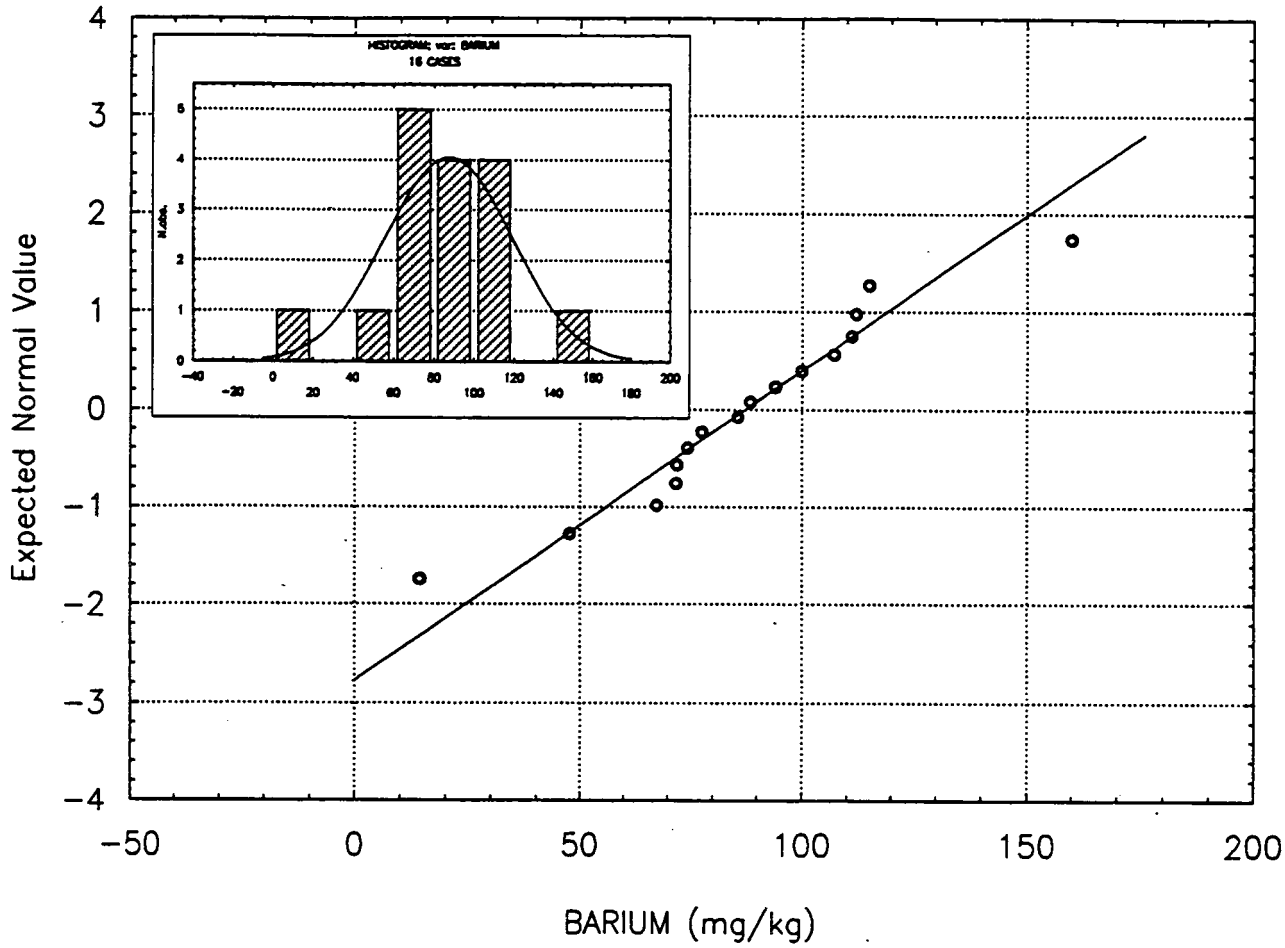


000393

Normal Probablility Plot
for Zinc in Surface Soils
(Log Base 10 Transform)

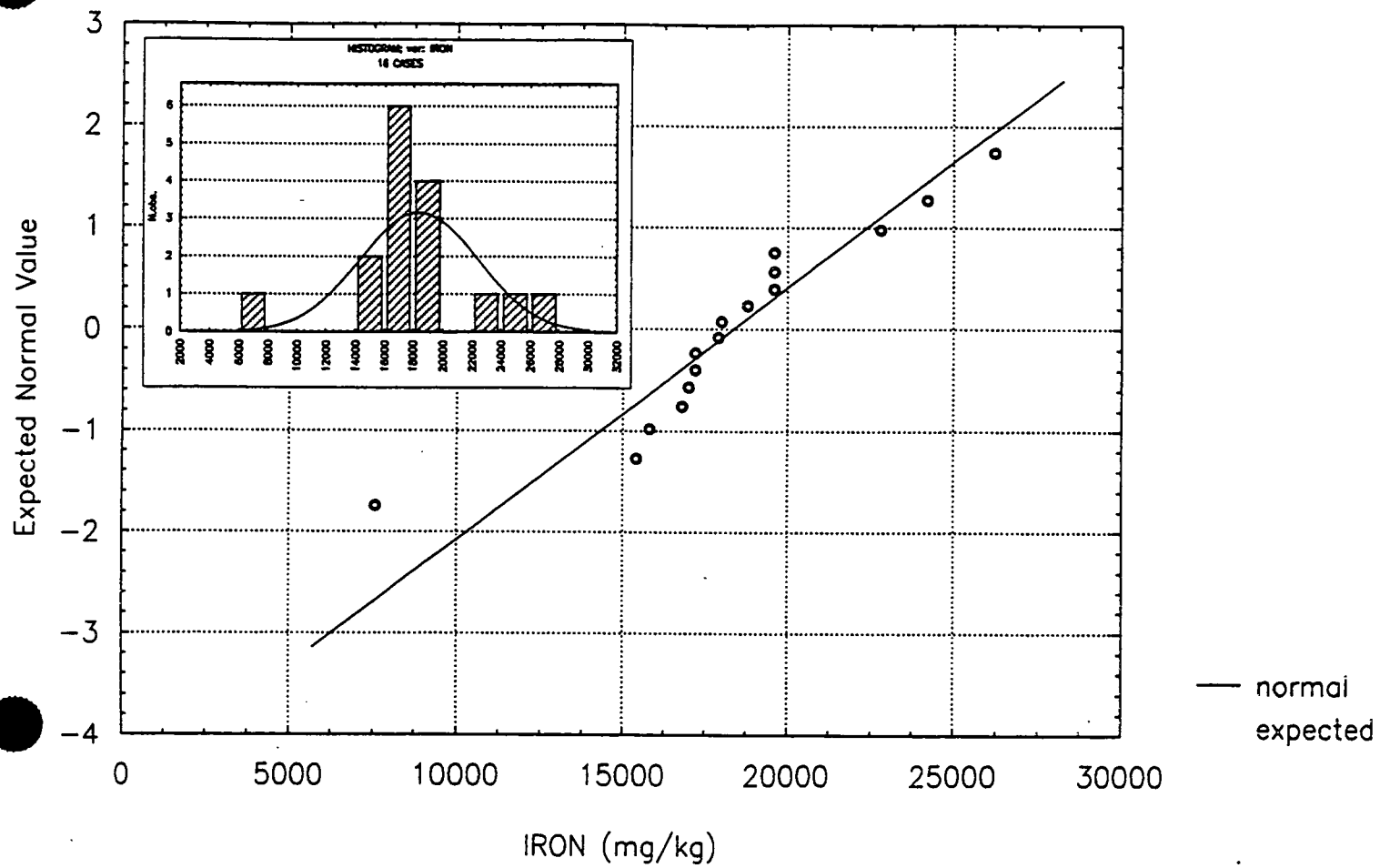


Normal Probablility Plot
for Barium in Surface Soils

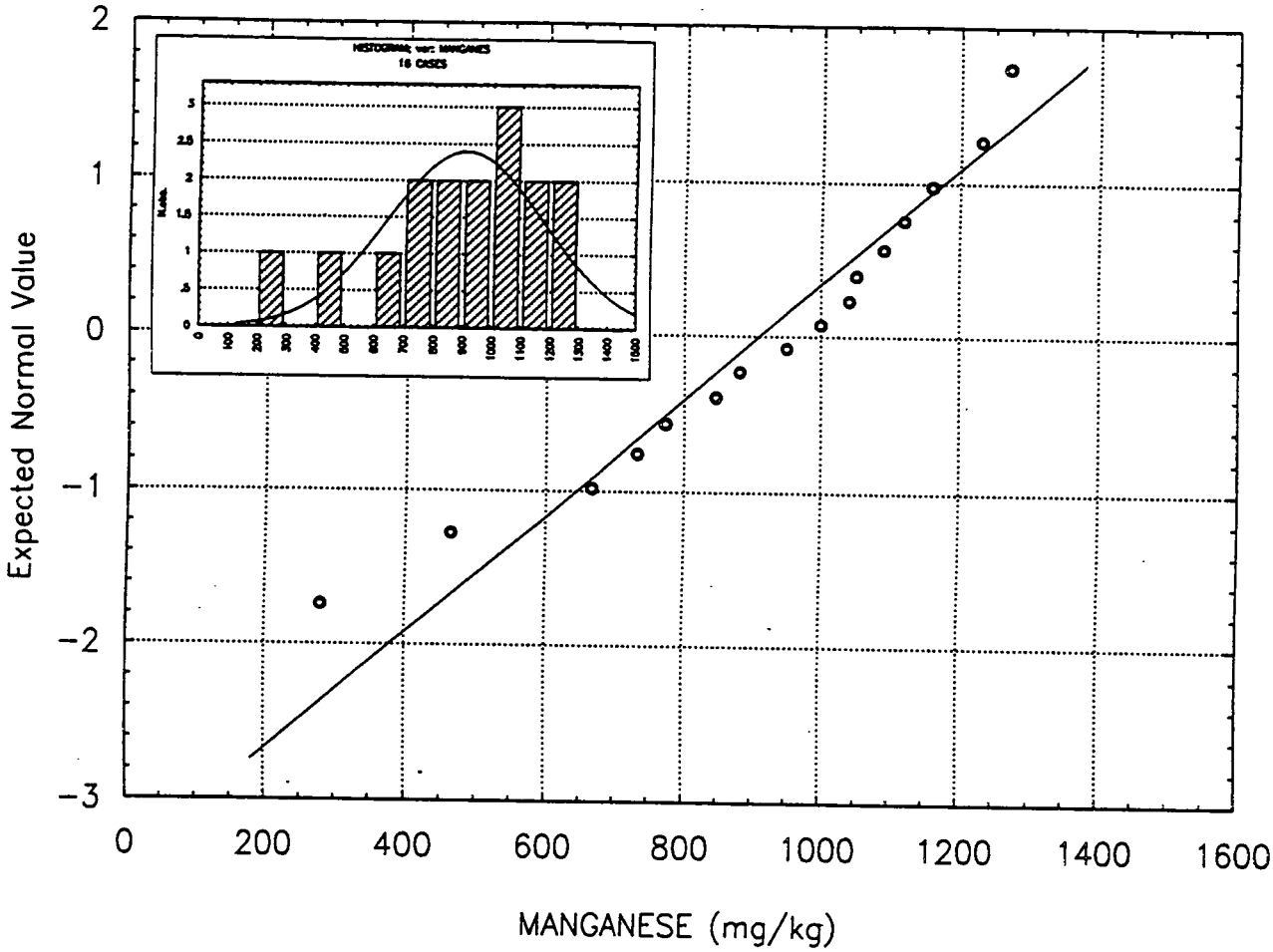


000395

Normal Probablility Plot
for Iron in Surface Soils

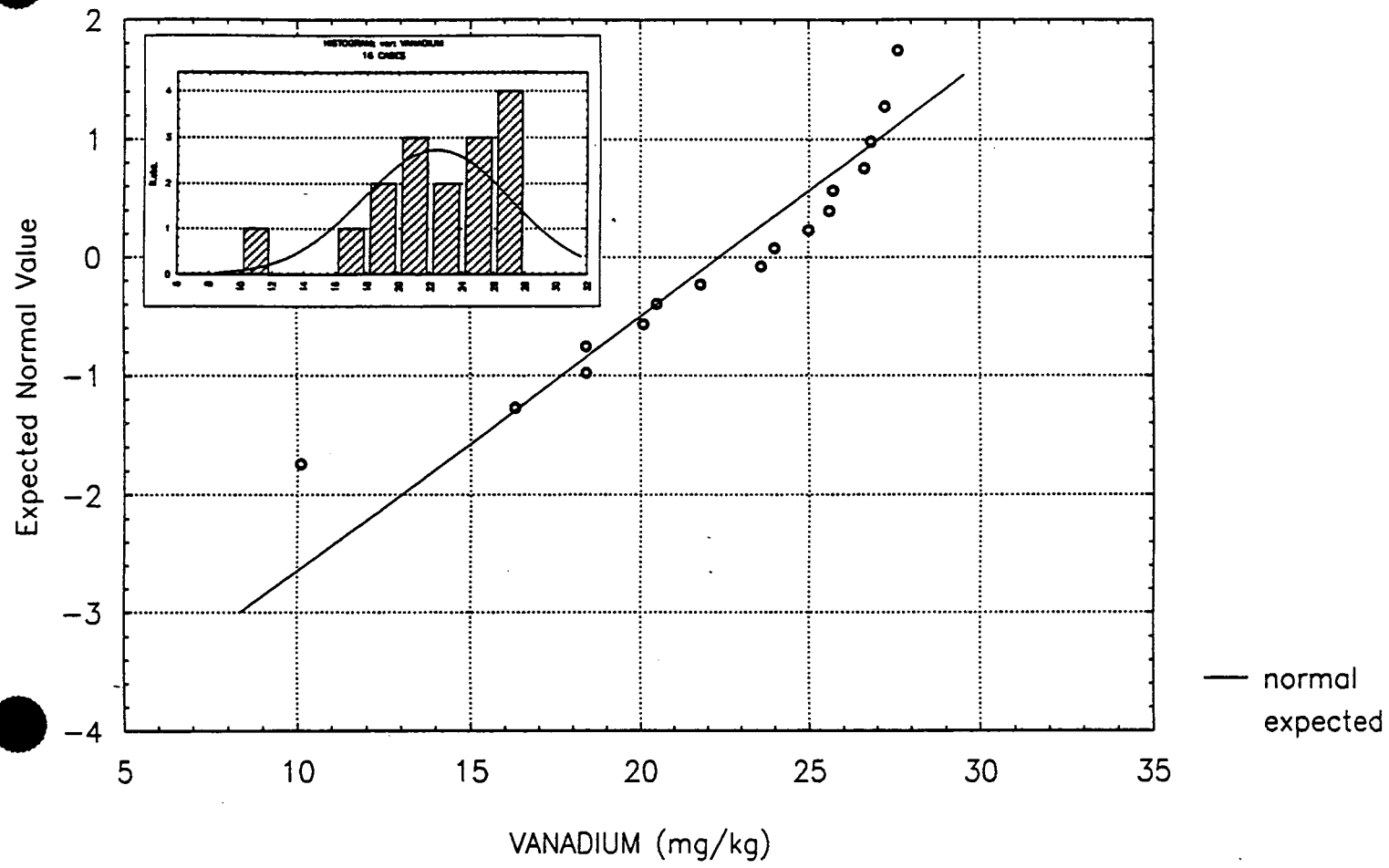


Normal Probablility Plot
for Manganese in Surface Soils

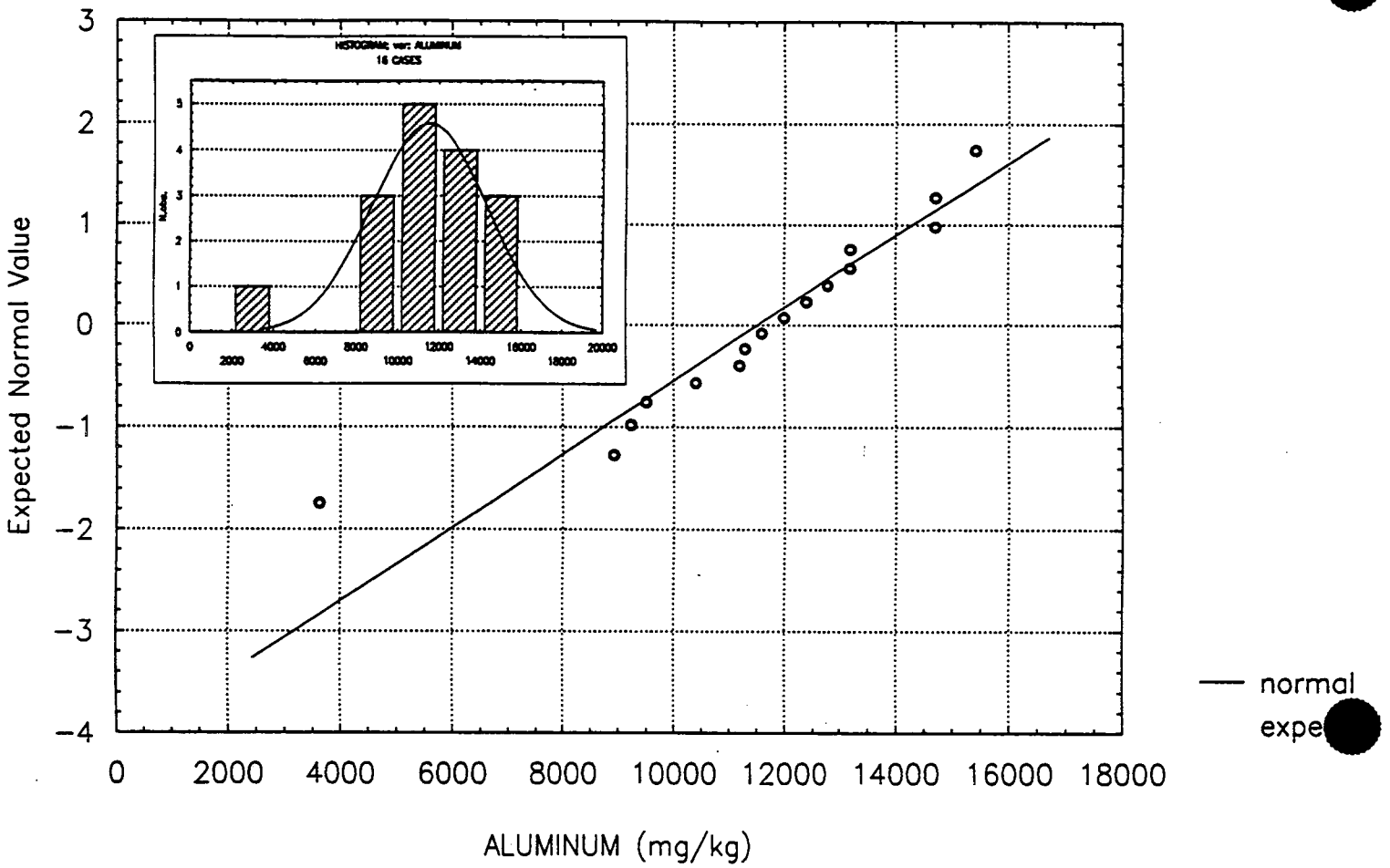


000397

Normal Probablility Plot
for Vanadium in Surface Soils

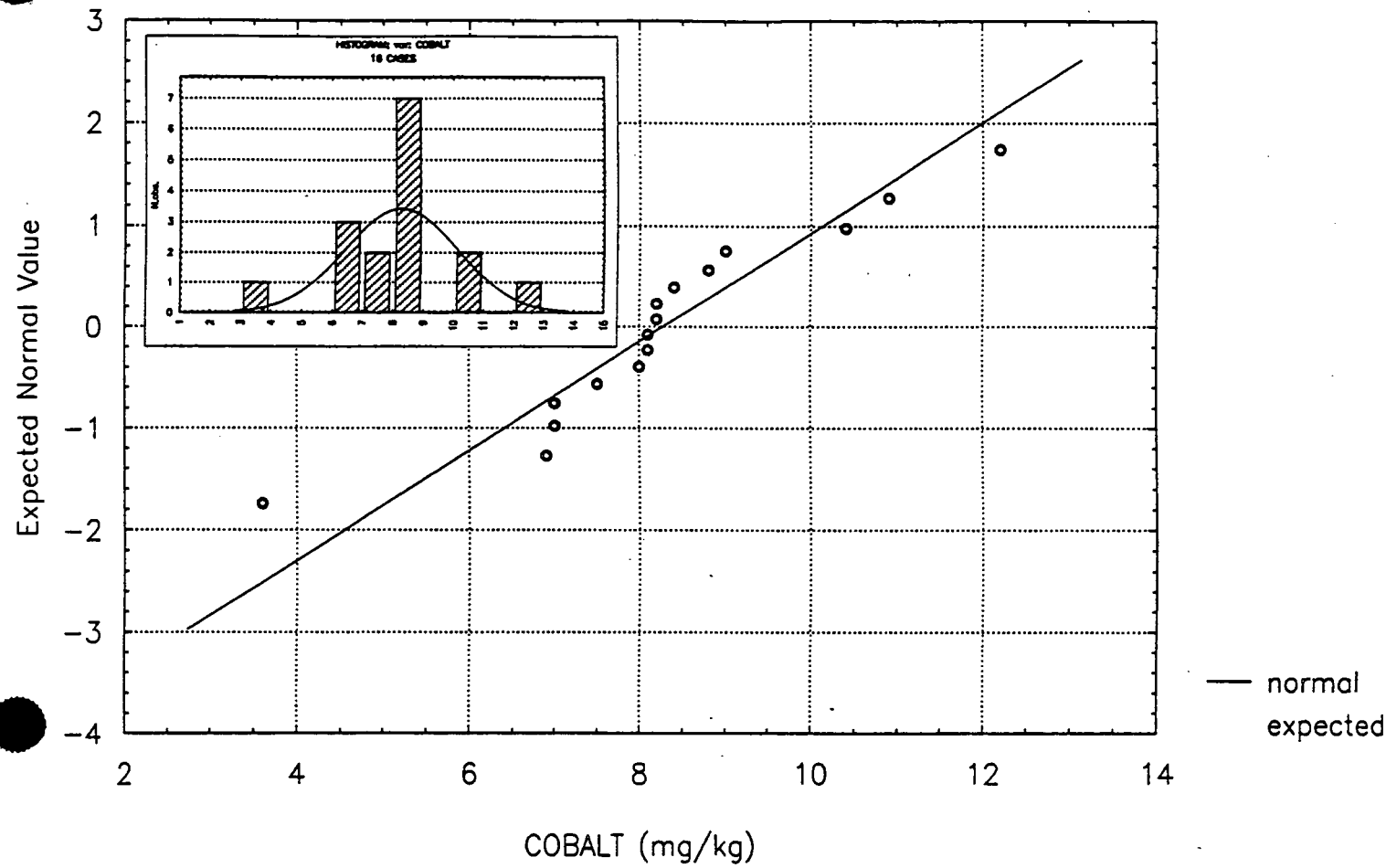


Normal Probablility Plot
for Aluminum in Surface Soils

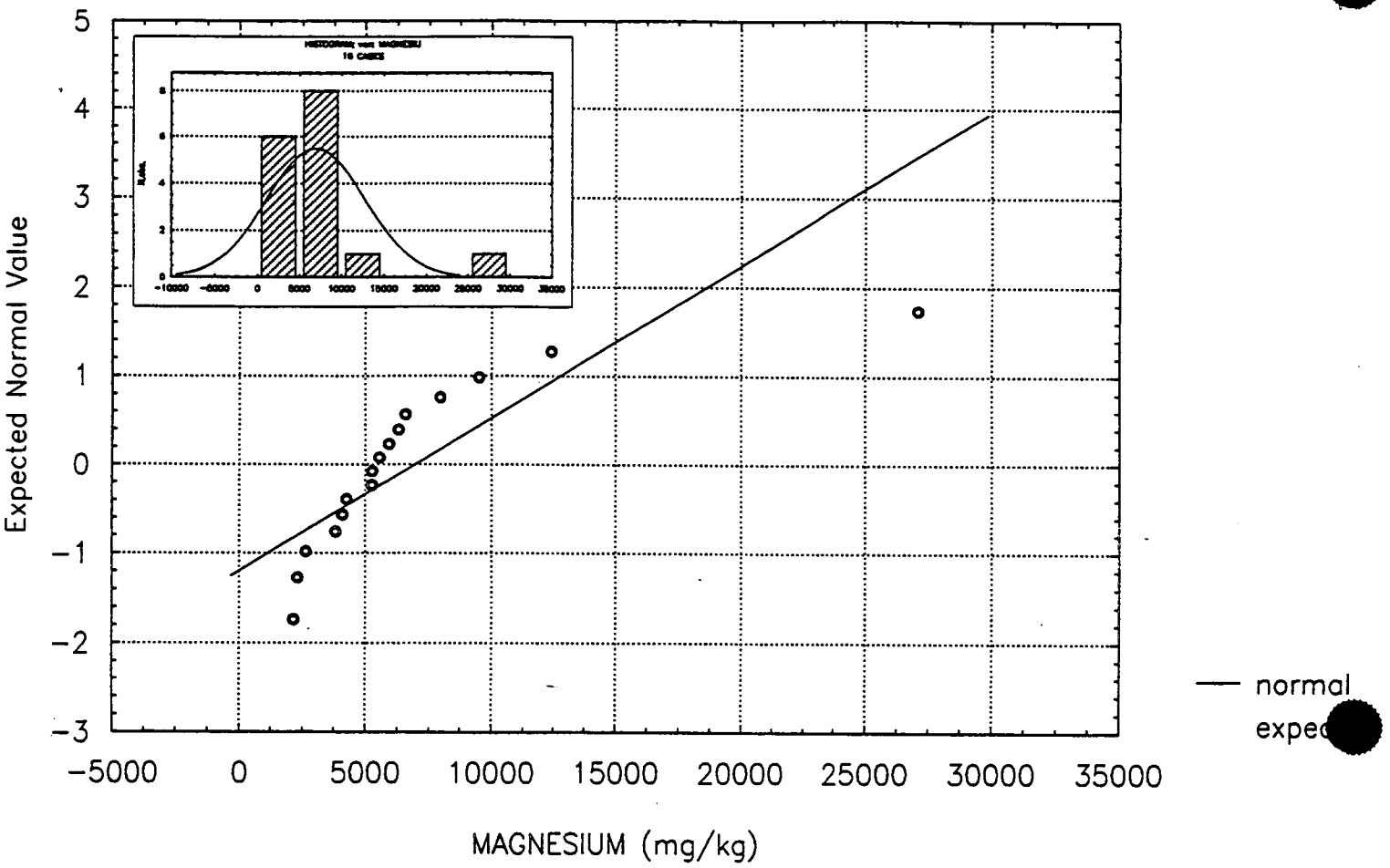


000399

Normal Probablility Plot
for Cobalt in Surface Soils

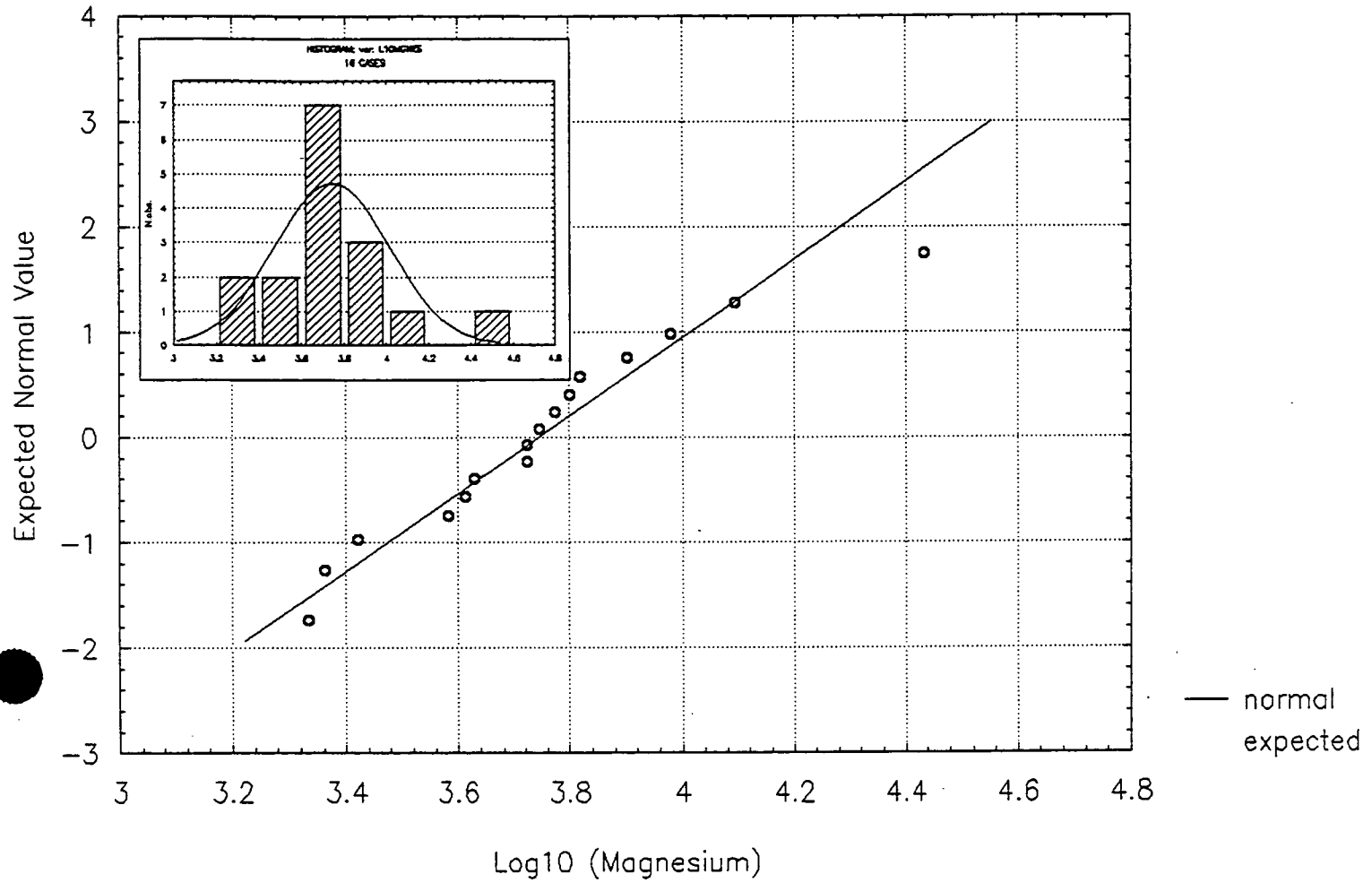


Normal Probablility Plot
for Magnesium in Surface Soils

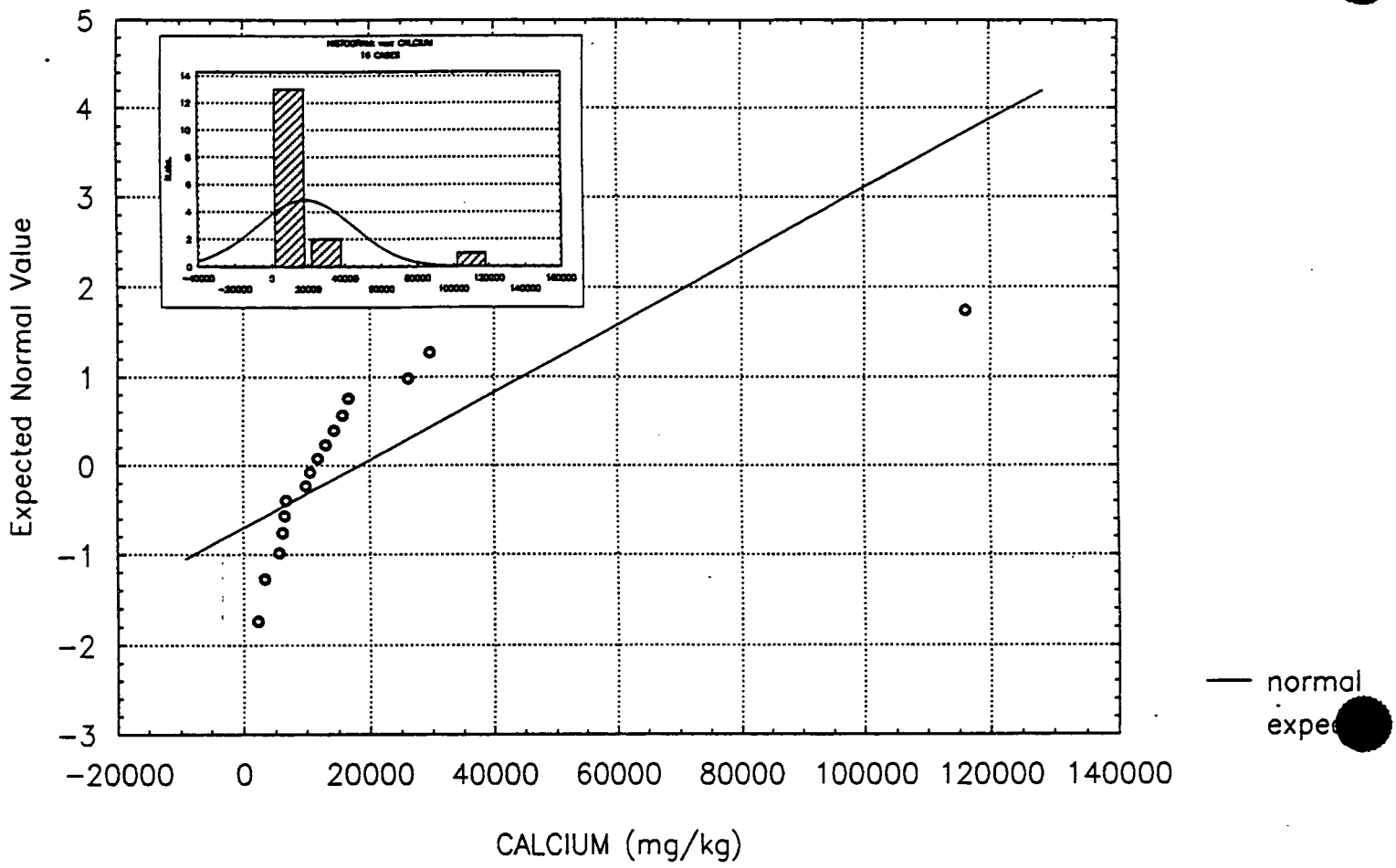


000401

Normal Probablility Plot for the Log Base 10 Transform of Magnesium in Background Surface Soils

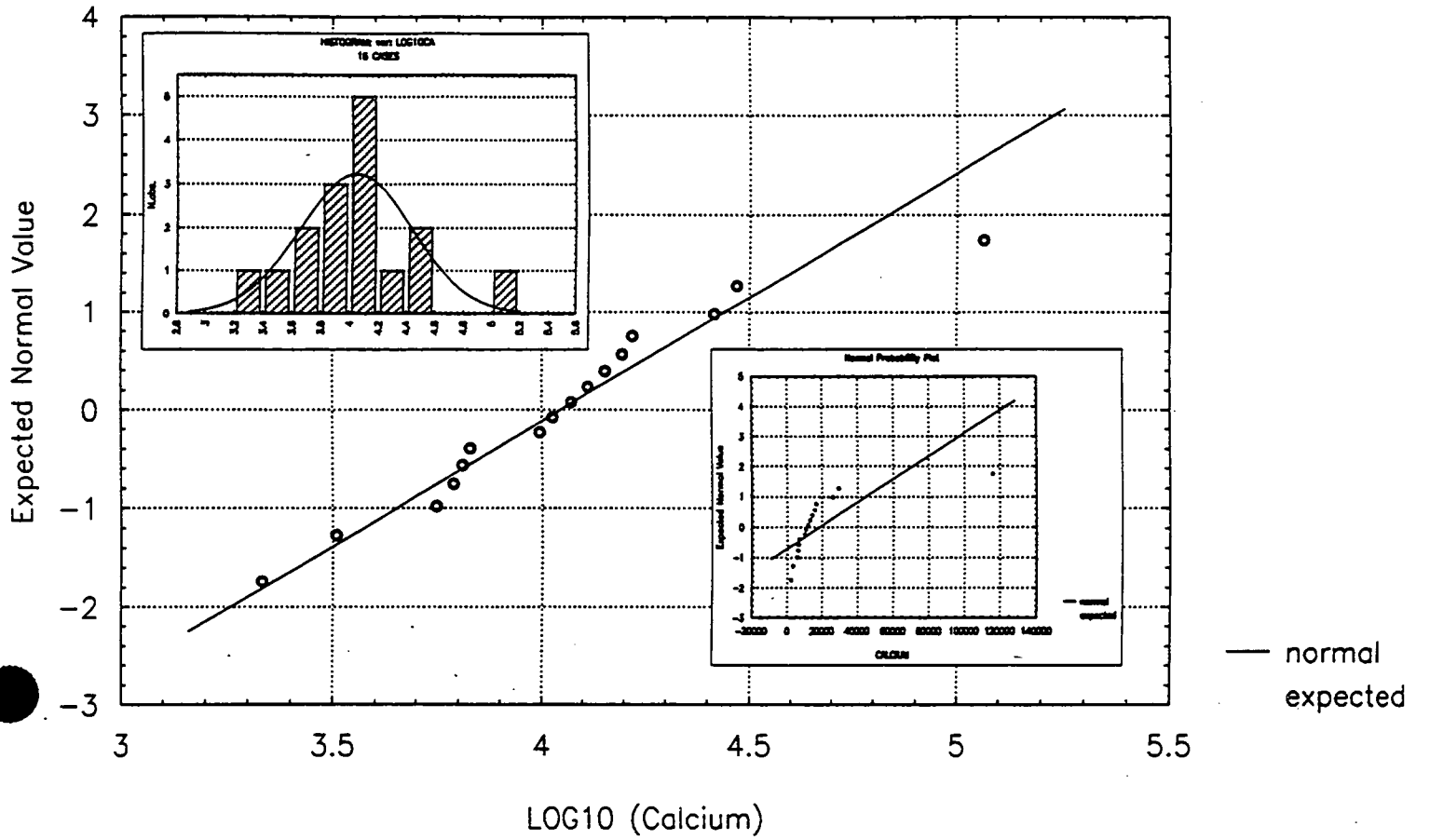


Normal Probablility Plot
for Calcium in Surface Soils

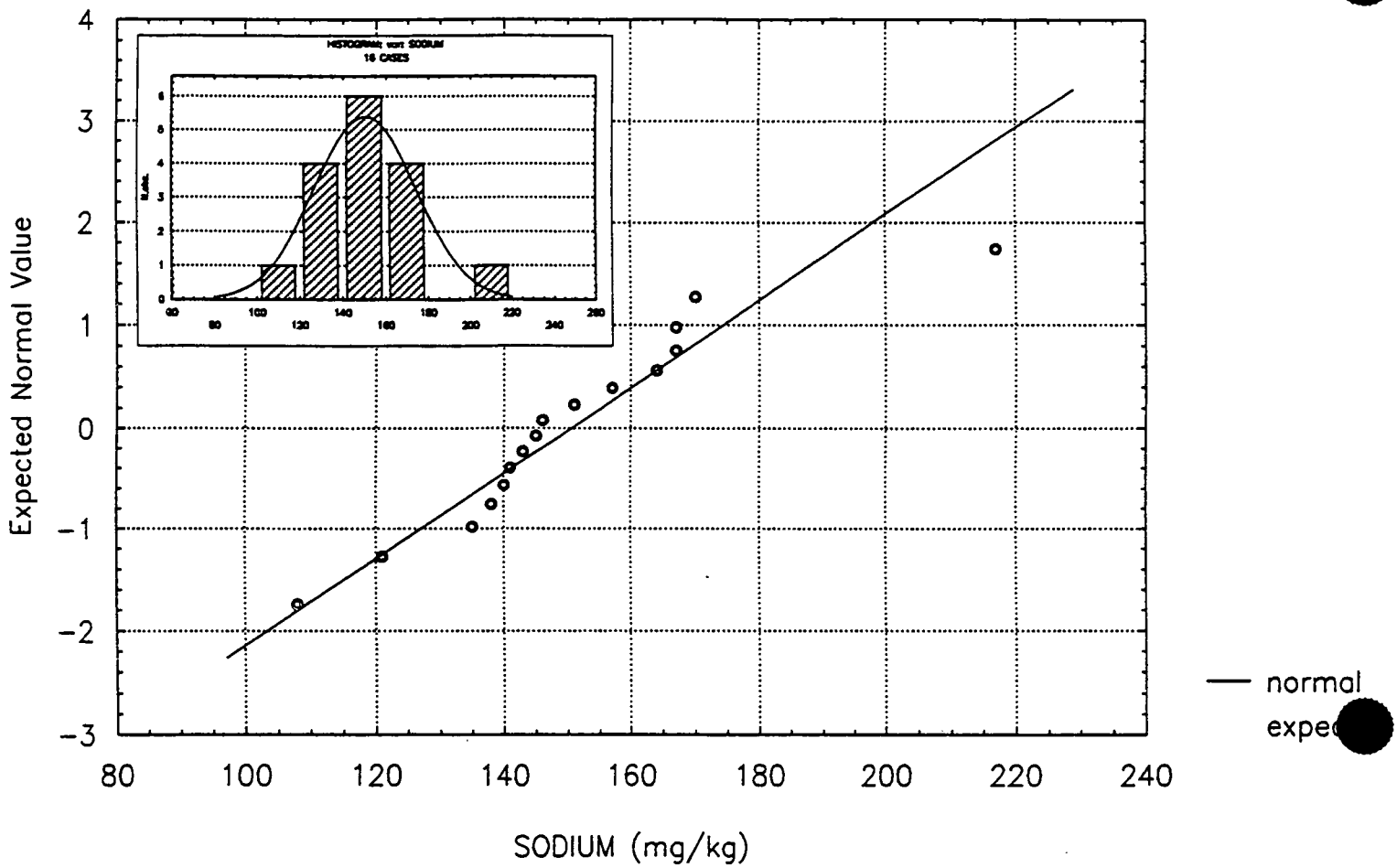


000403

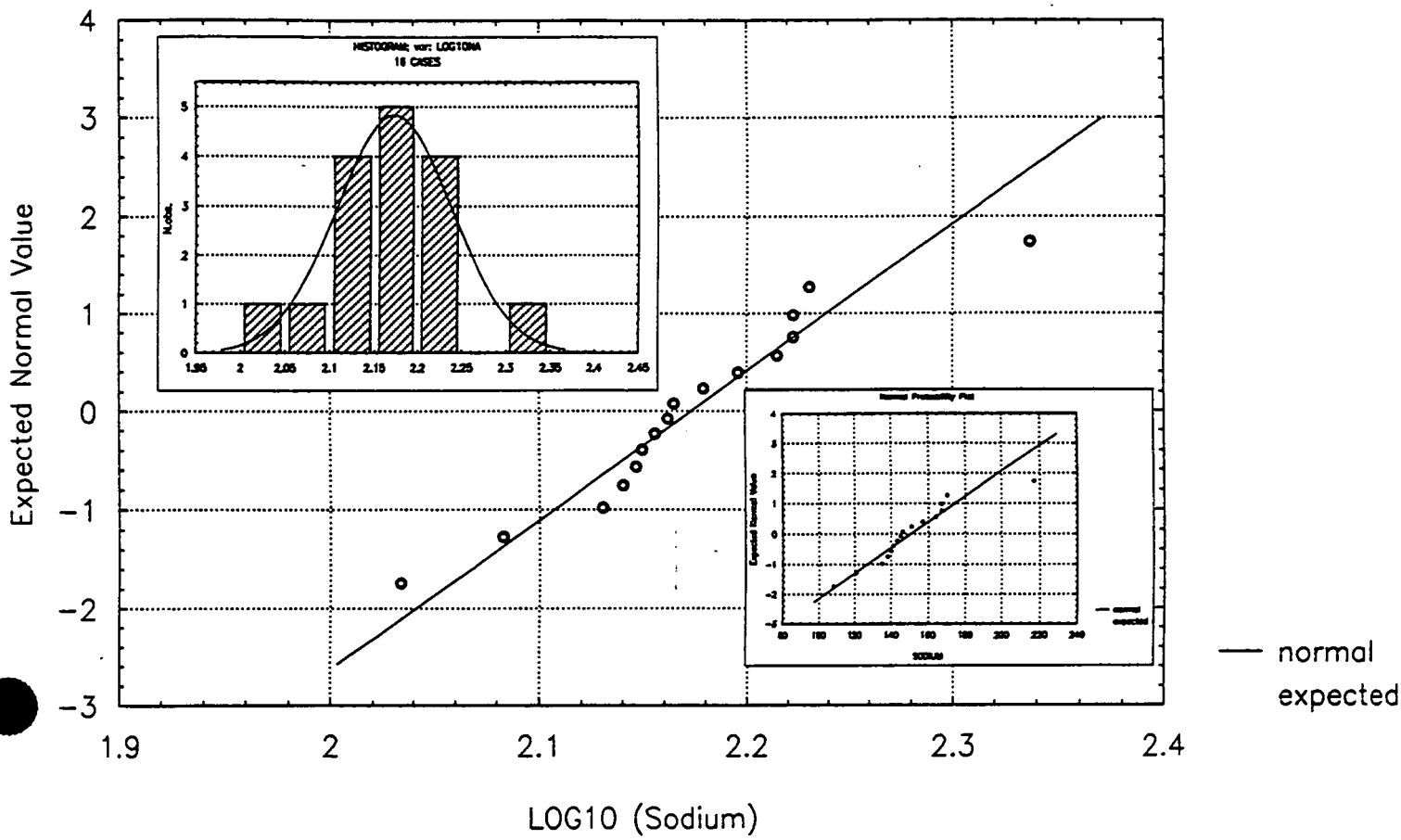
Normal Probablility Plot
for Calcium in Surface Soils
(Log Base10 Transform)



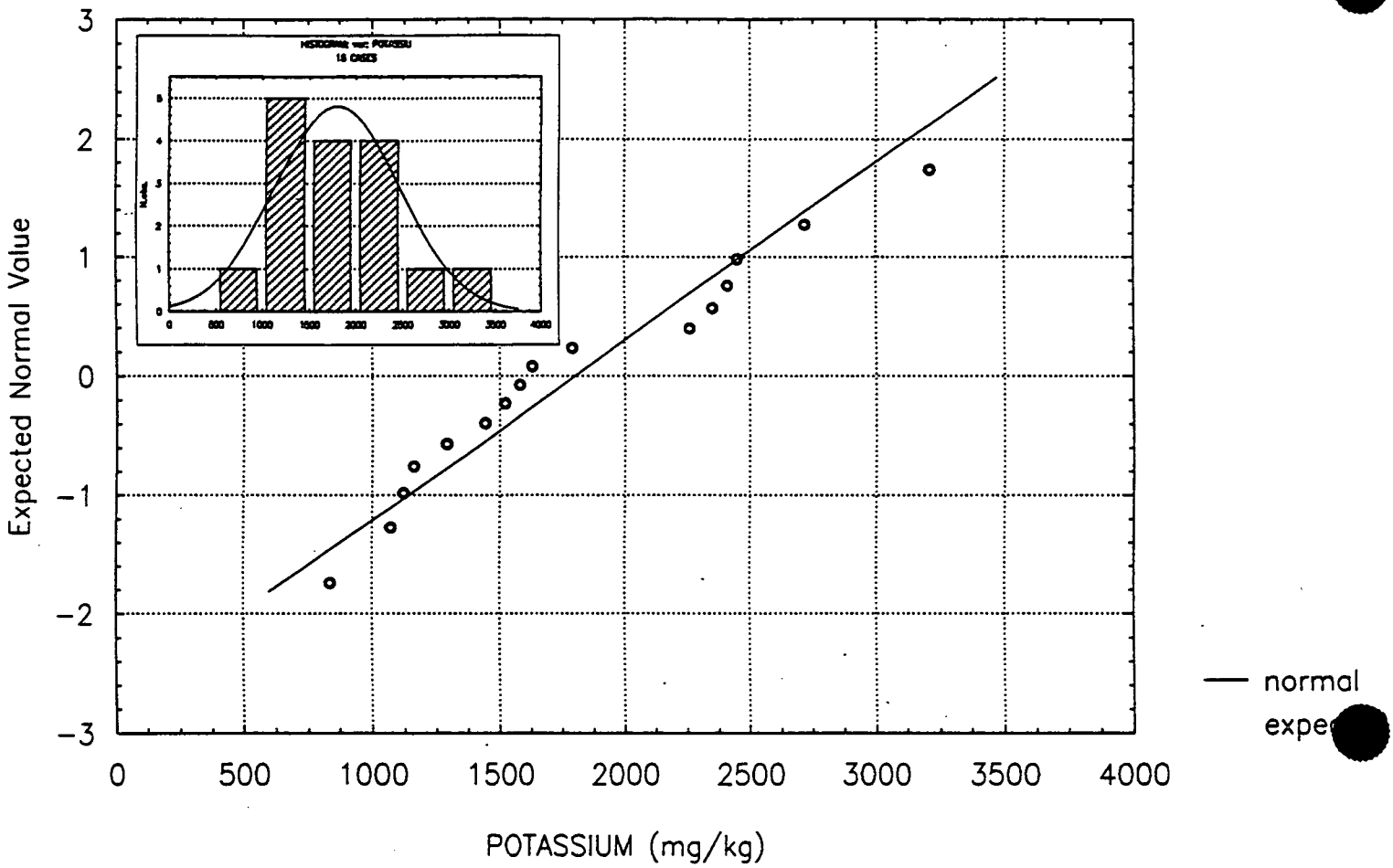
Normal Probablility Plot
for Sodium in Surface Soils



Normal Probablility Plot
for Sodium in Surface Soils
(Base Log 10 Transform)



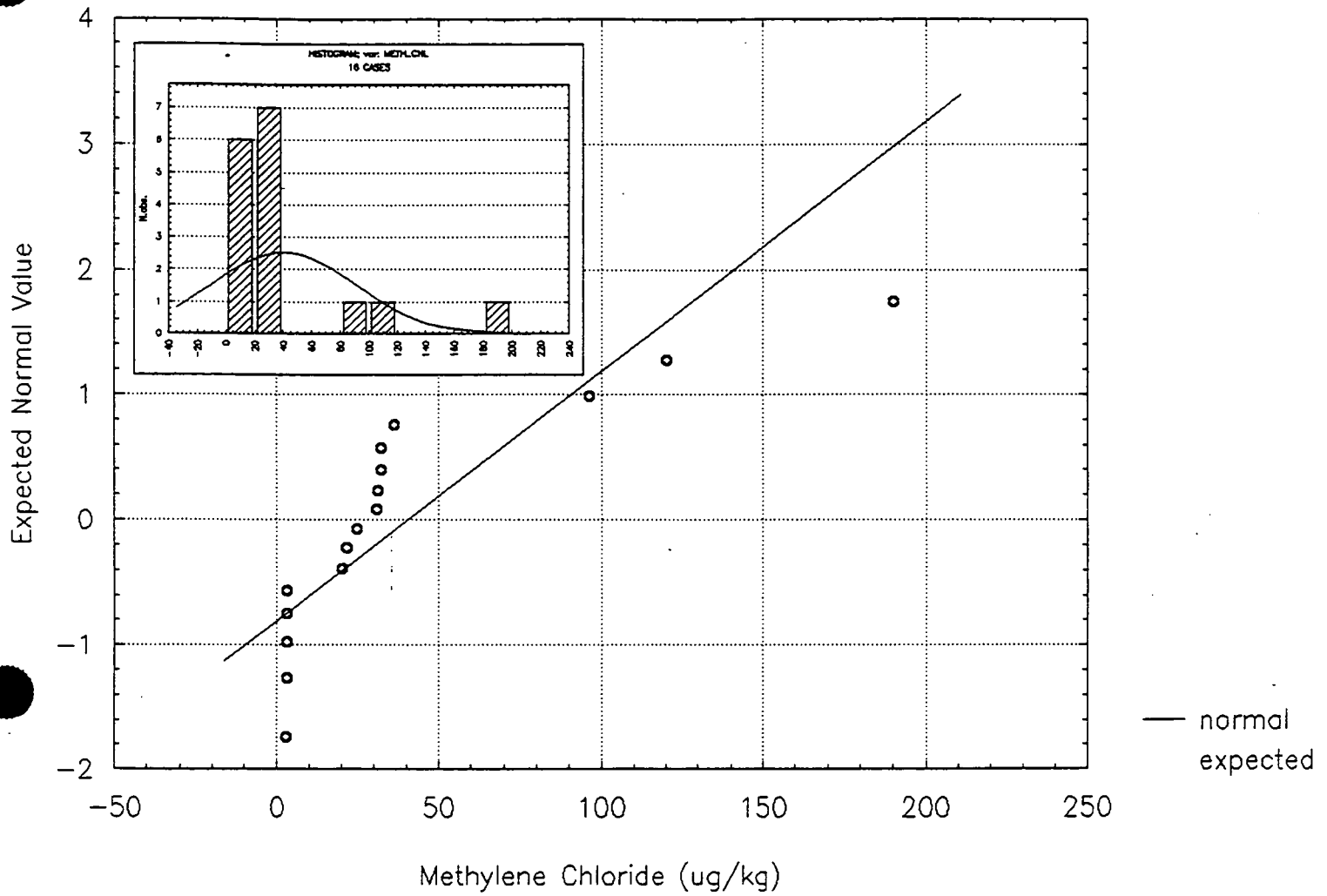
Normal Probablility Plot
for Potassium in Surface Soils



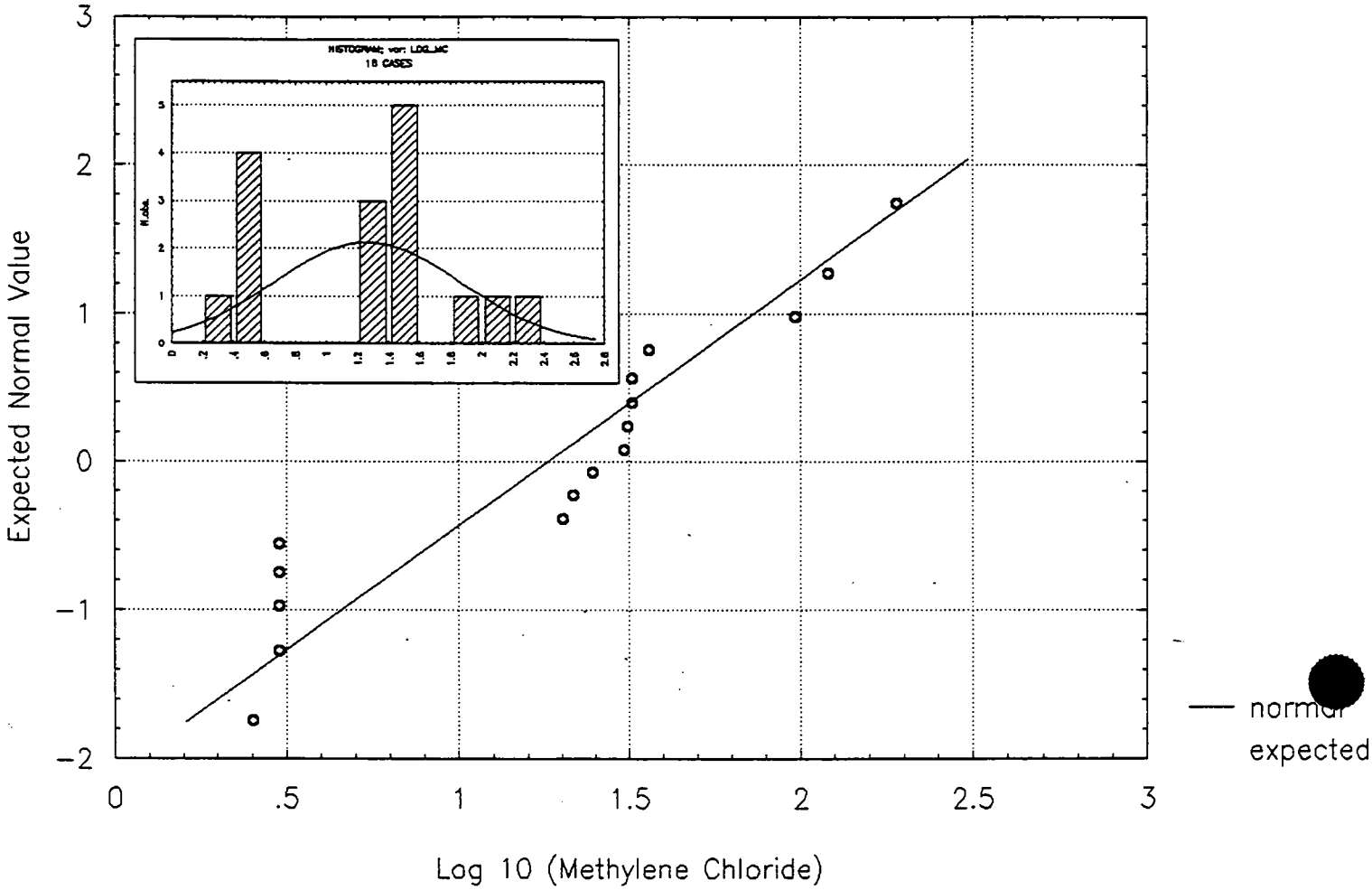
000407

VOLATILE ORGANIC COMPOUNDS

Normal Probablility Plot for Methylene Chloride in Background Surface Soils

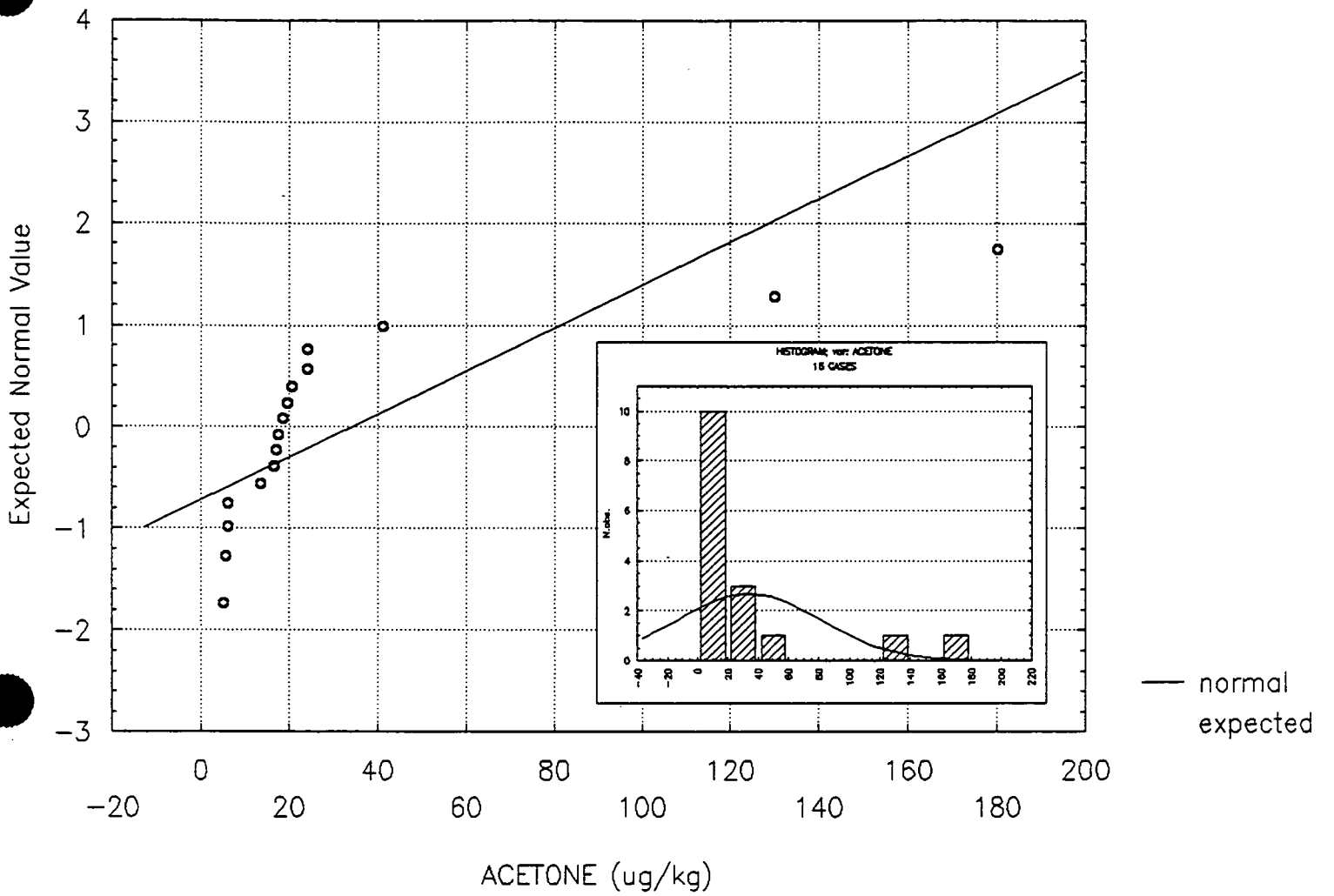


Normal Probablility Plot for the Log
Base 10 Transform of Methylene Chloride
in Background Surface Soil

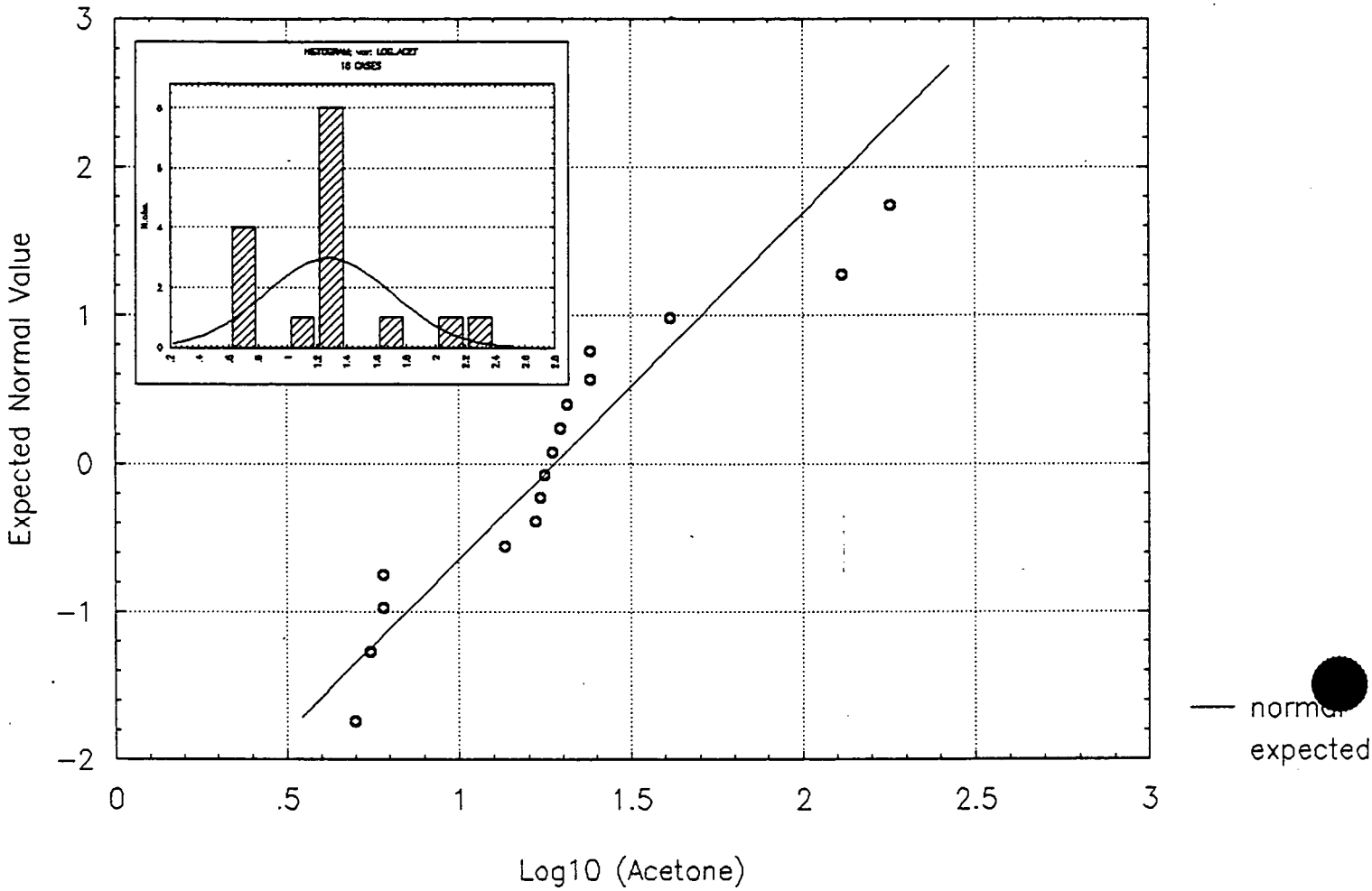


000410

Normal Probablility Plot for Acetone
in Background Surface Soil Samples



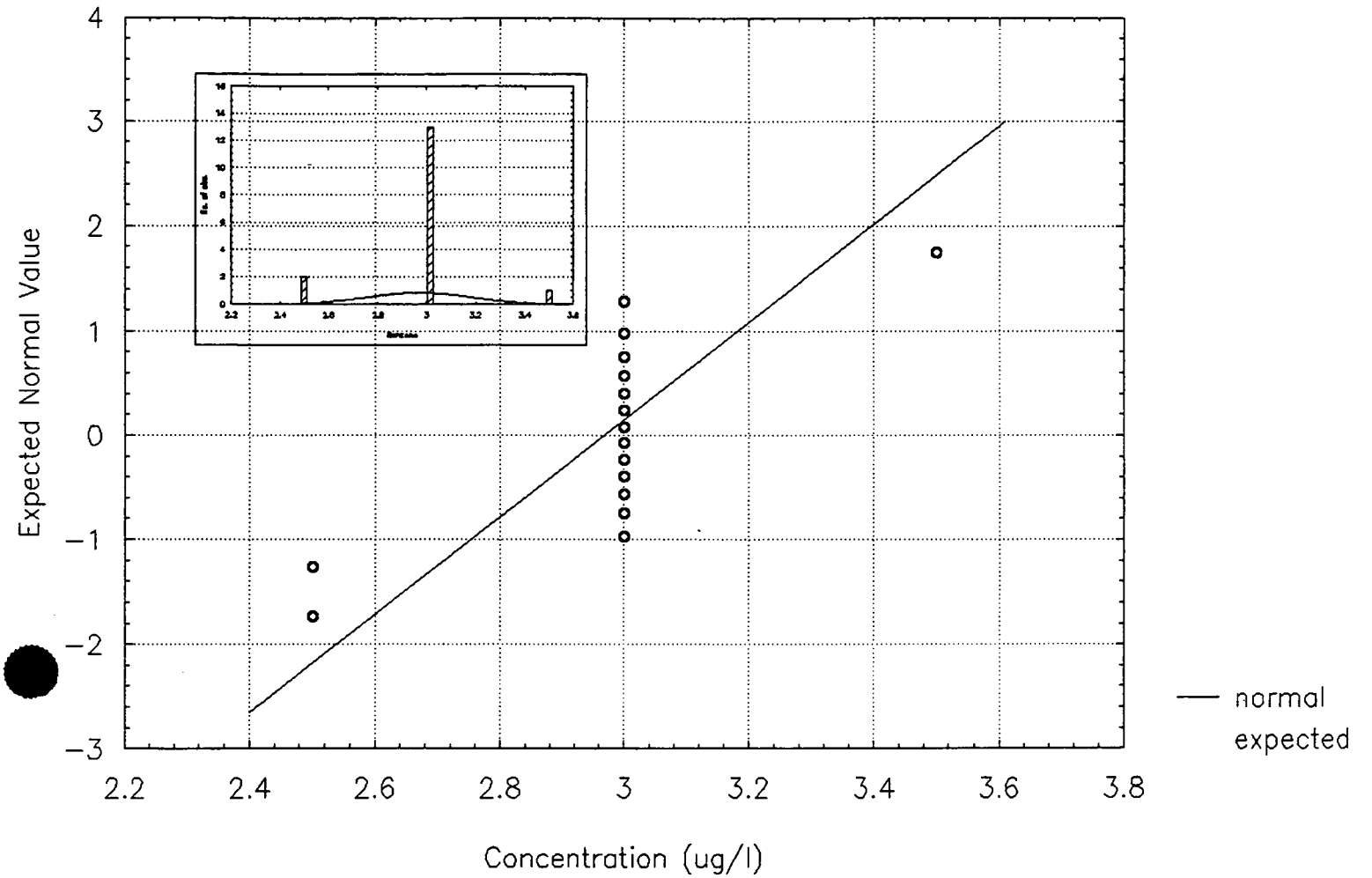
Normal Probablility Plot for the Log
Base 10 Transform of Acetone in
Background Surface Soils



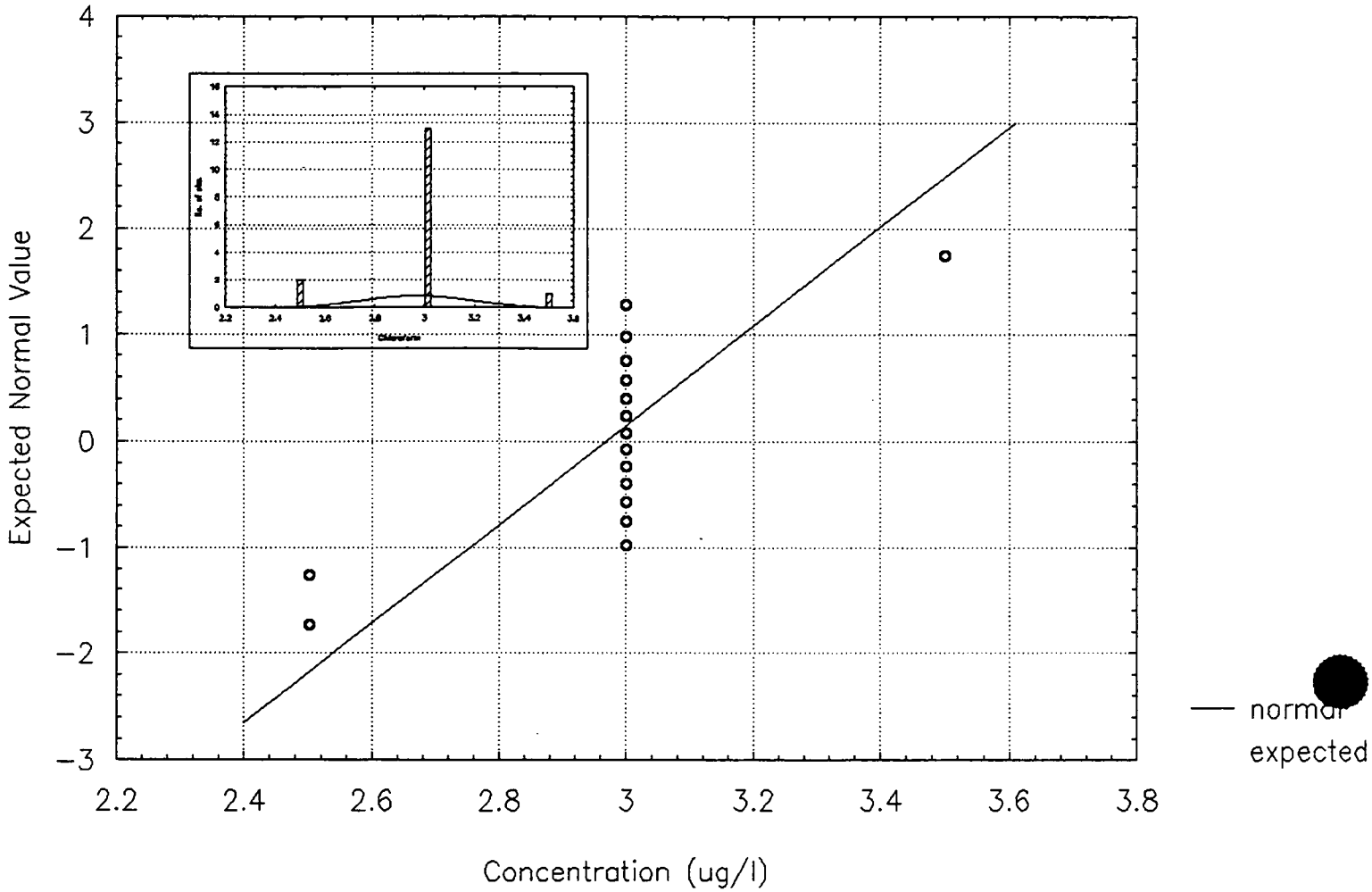
000412

SEMIVOLATILE ORGANICS

Normal Probability Plot For
Benzene
In The Background Surface Soils

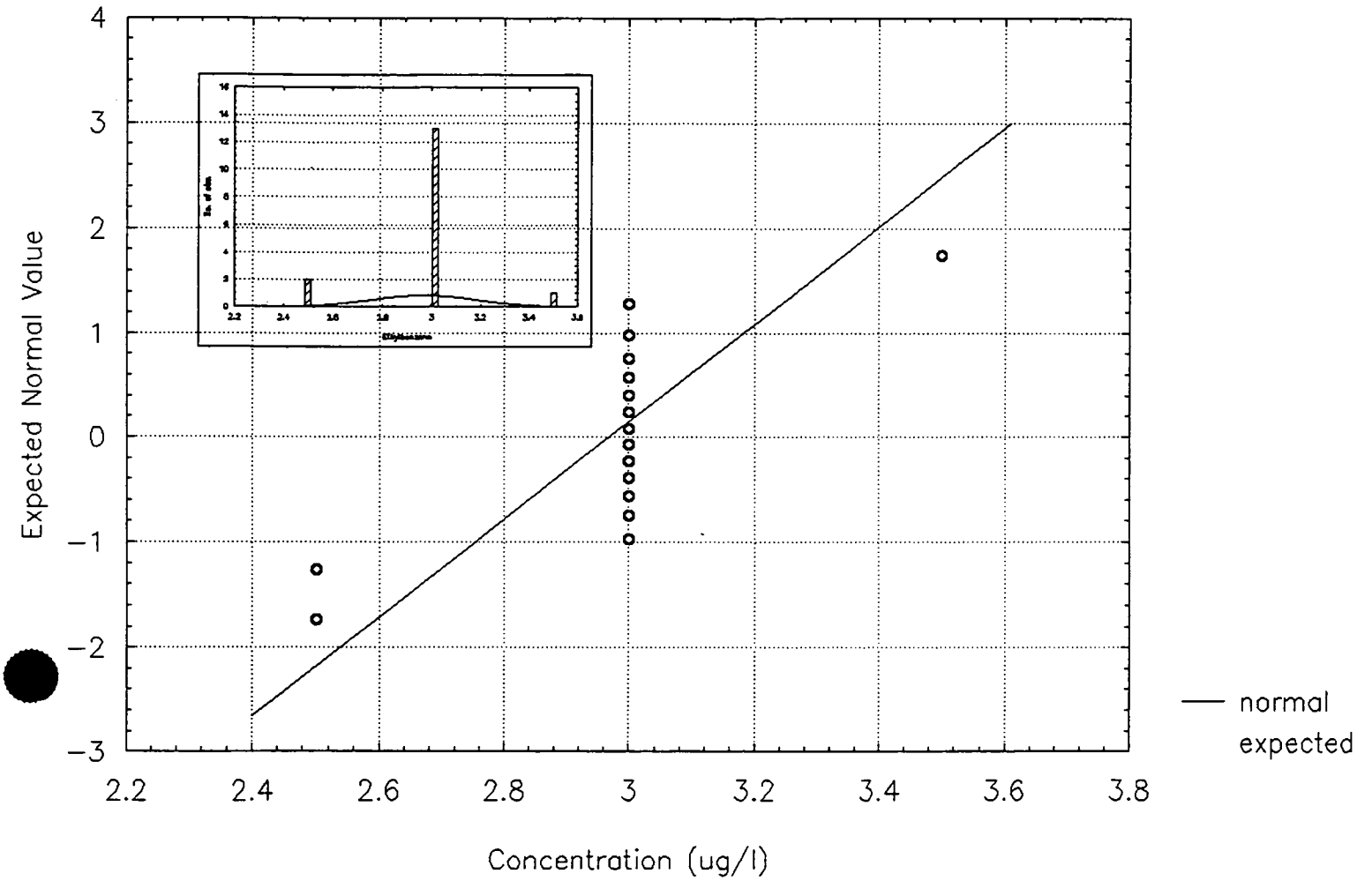


Normal Probability Plot For
Chloroform
In The Background Surface Soils

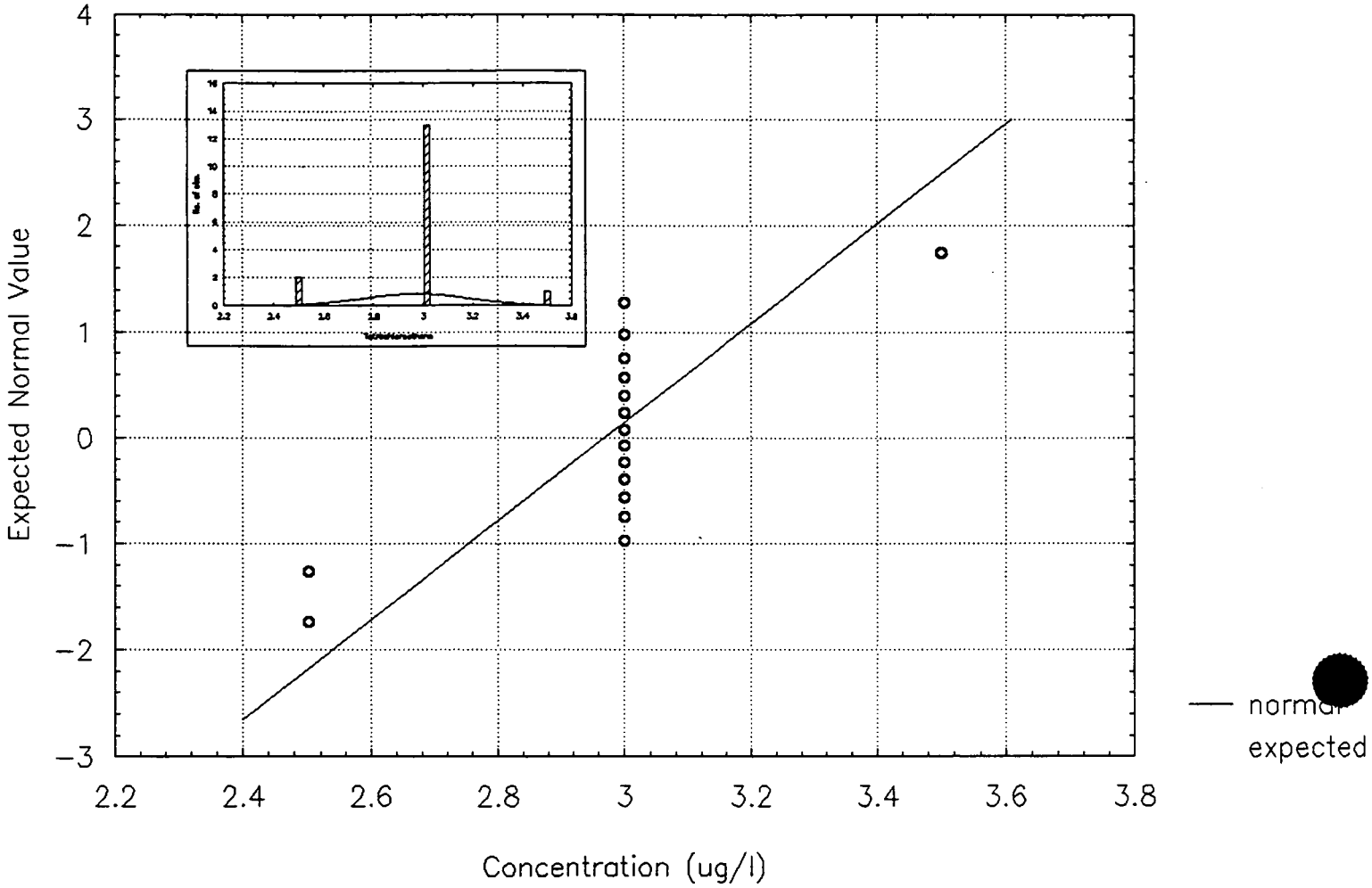


000415

Normal Probability Plot For
Ethylbenzene
In The Background Surface Soils

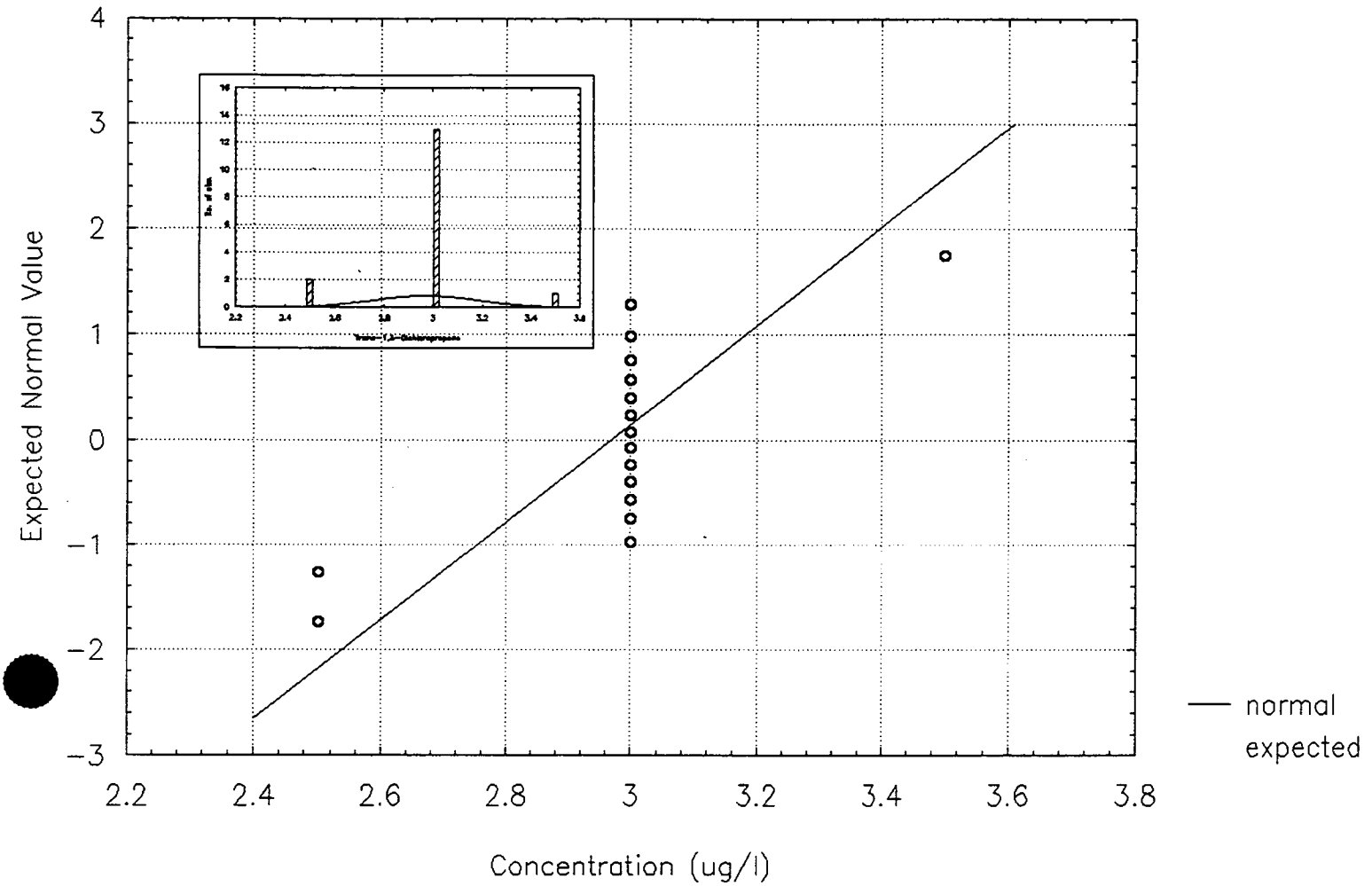


Normal Probability Plot For
Tetrachloroethene
In The Background Surface Soils

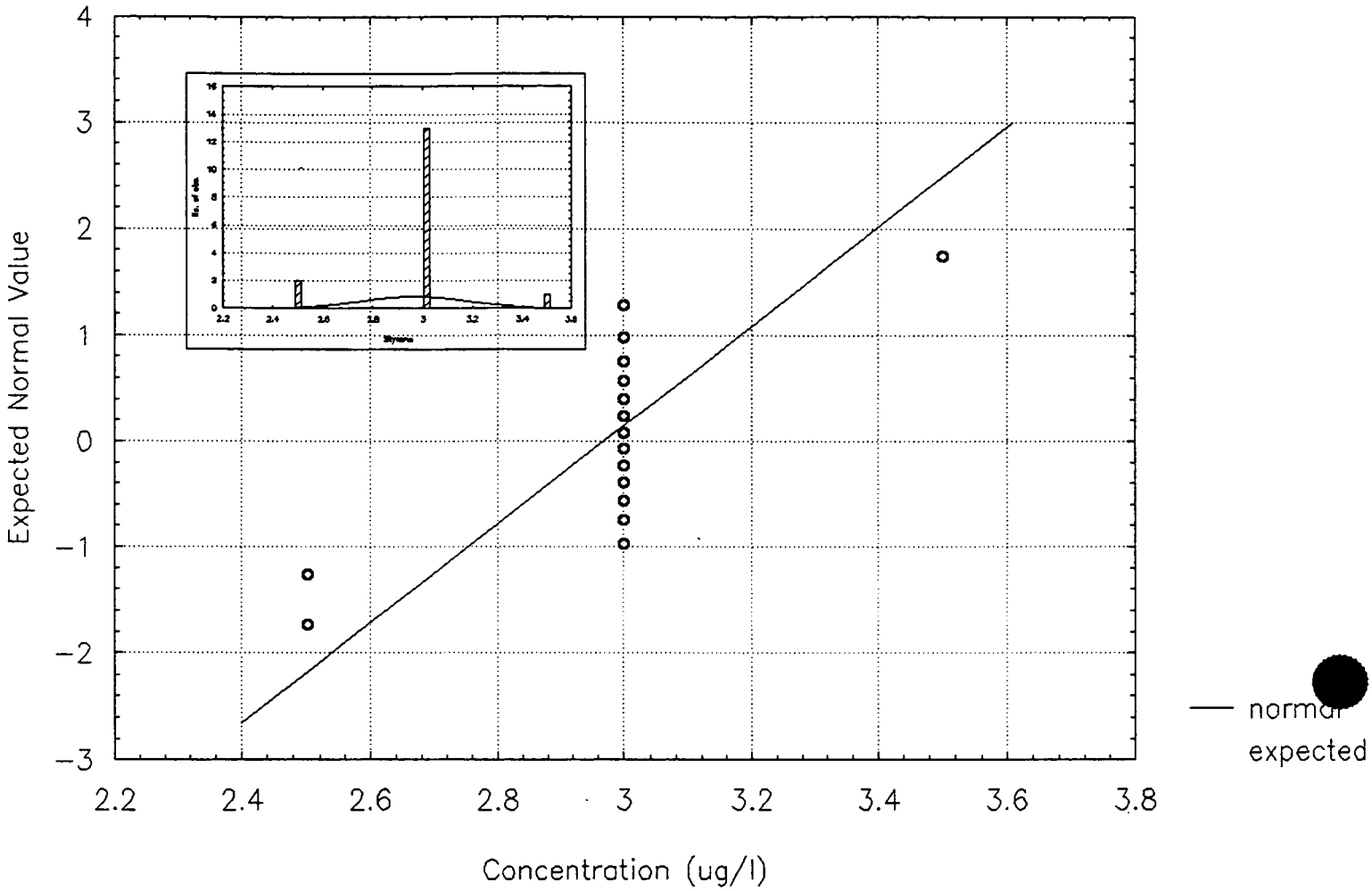


000417

Normal Probability Plot For
Trans-1,3-Dichloropropene
In The Background Surface Soils

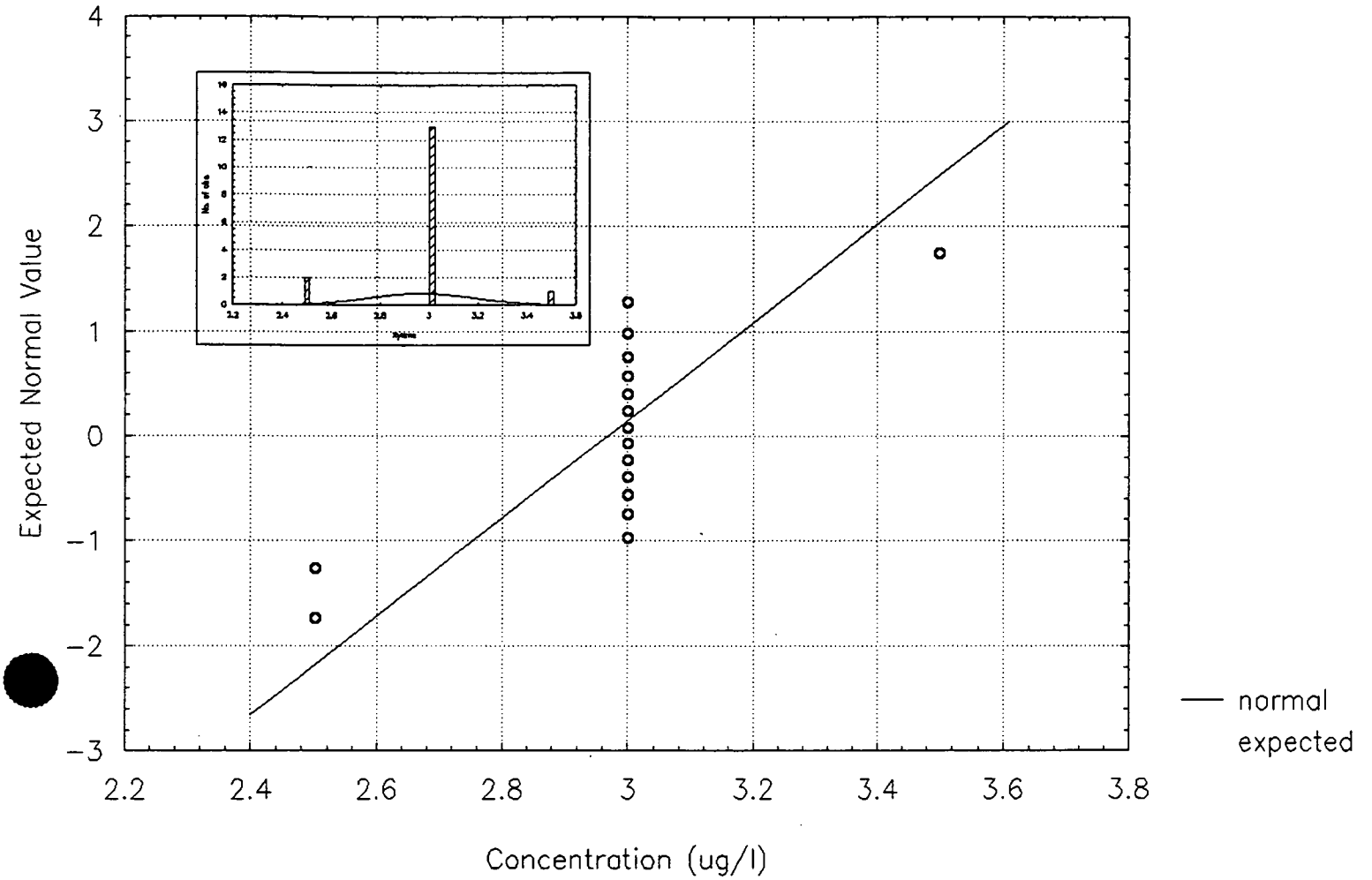


Normal Probability Plot For
Styrene
In The Background Surface Soils

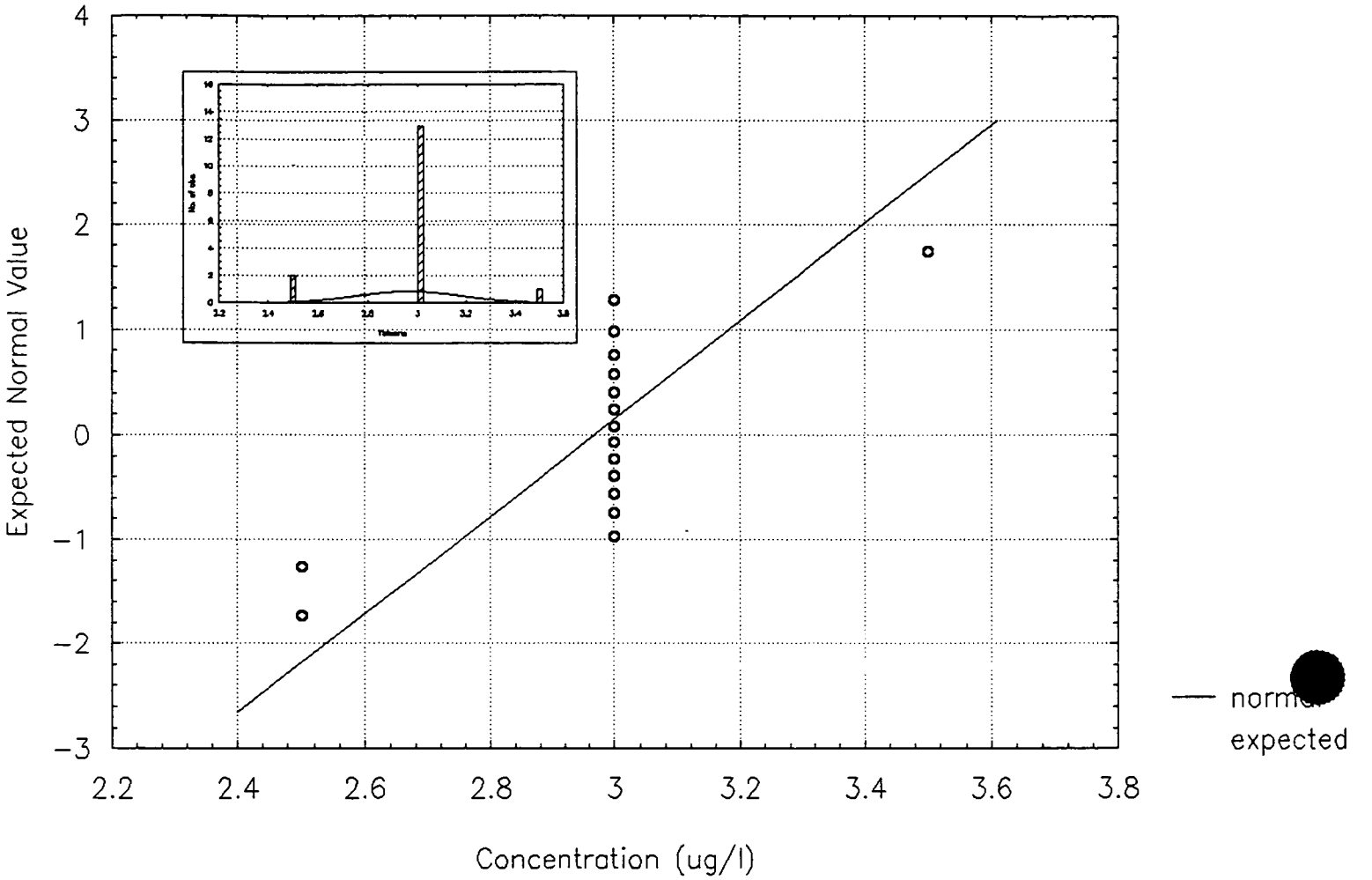


000419

Normal Probability Plot For
Xylene
In The Background Surface Soils

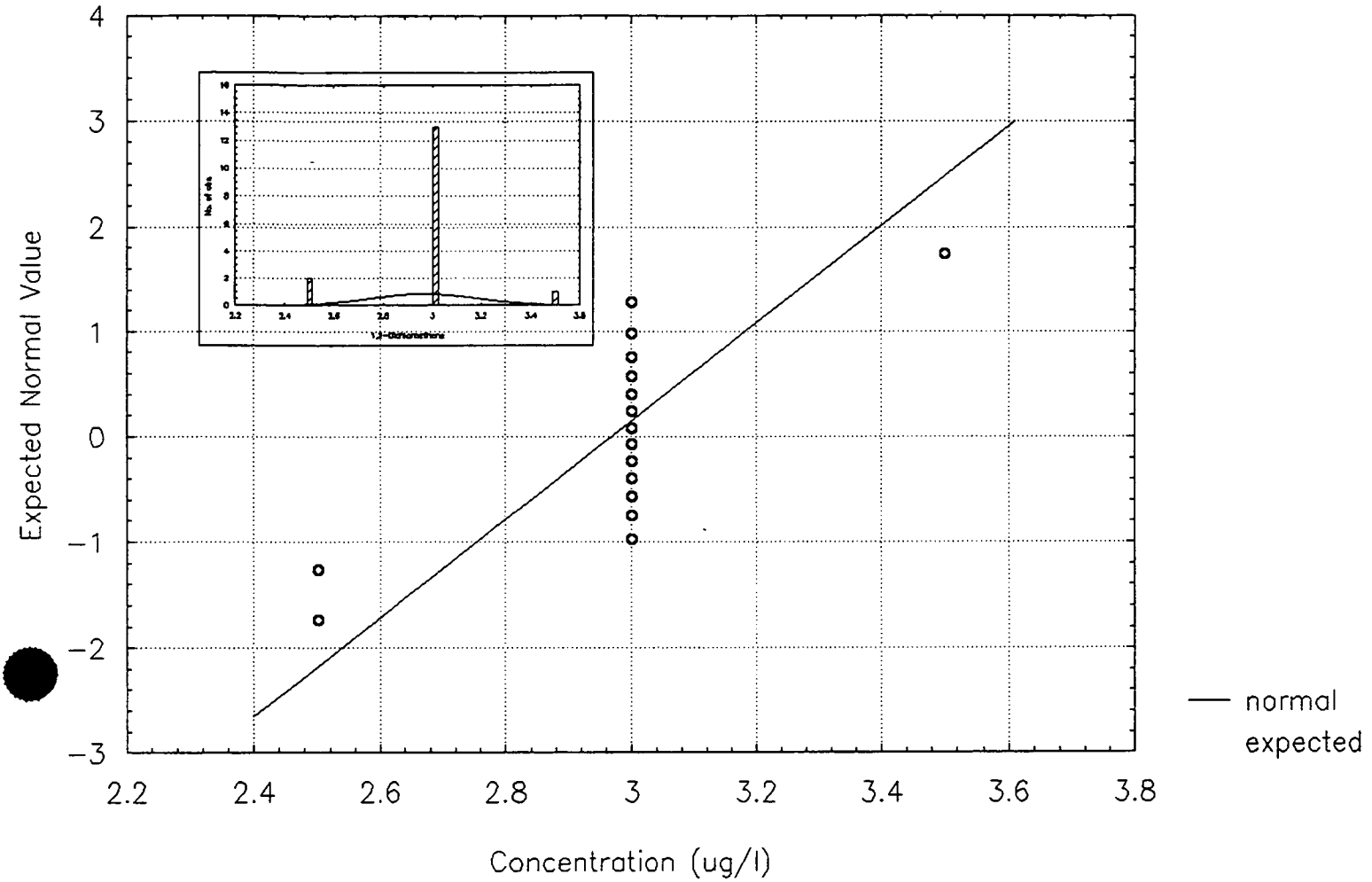


Normal Probability Plot For
Toluene
In The Background Surface Soils

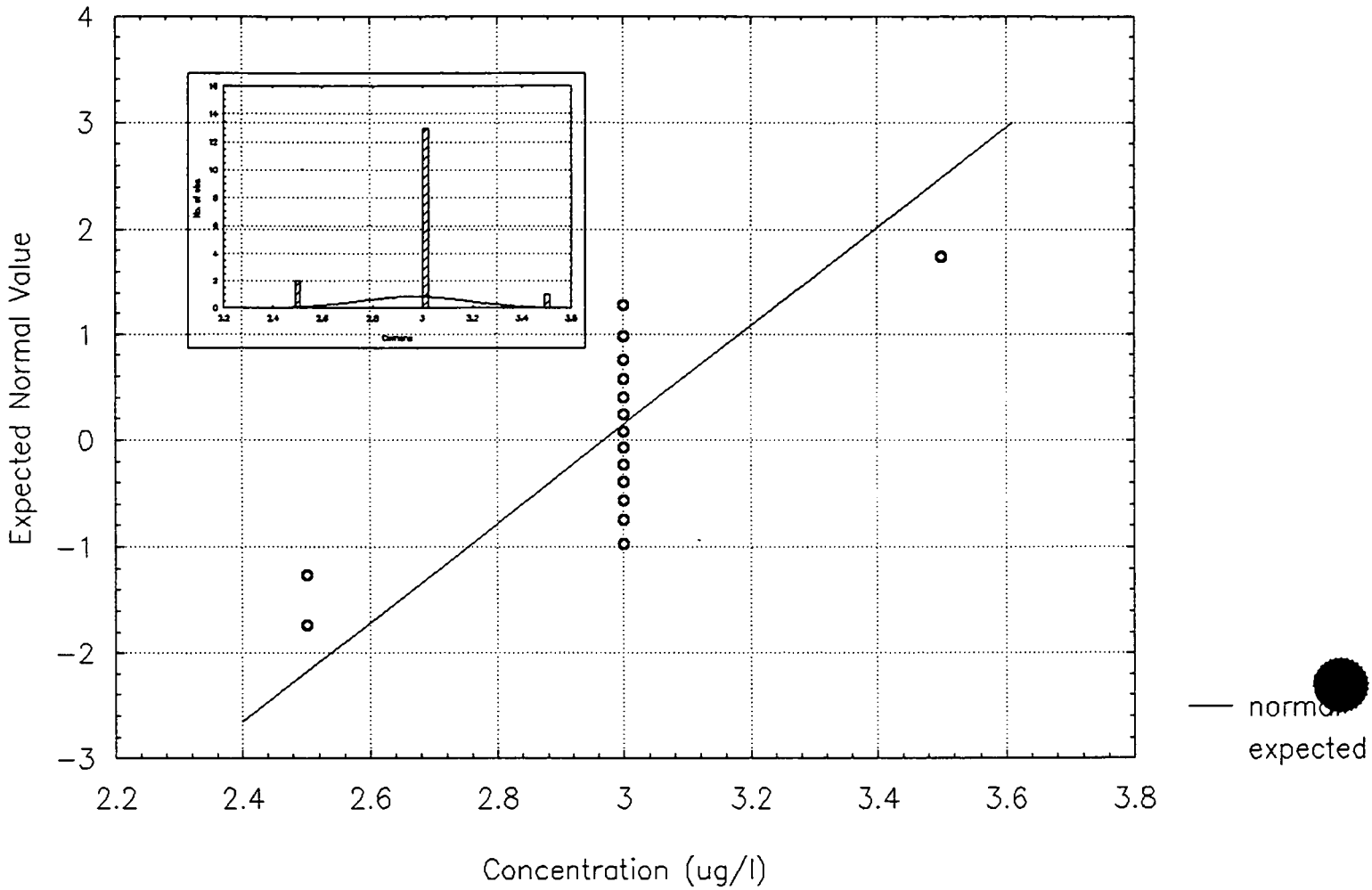


000421

Normal Probability Plot For
1,2-Dichloroethene
In The Background Surface Soils

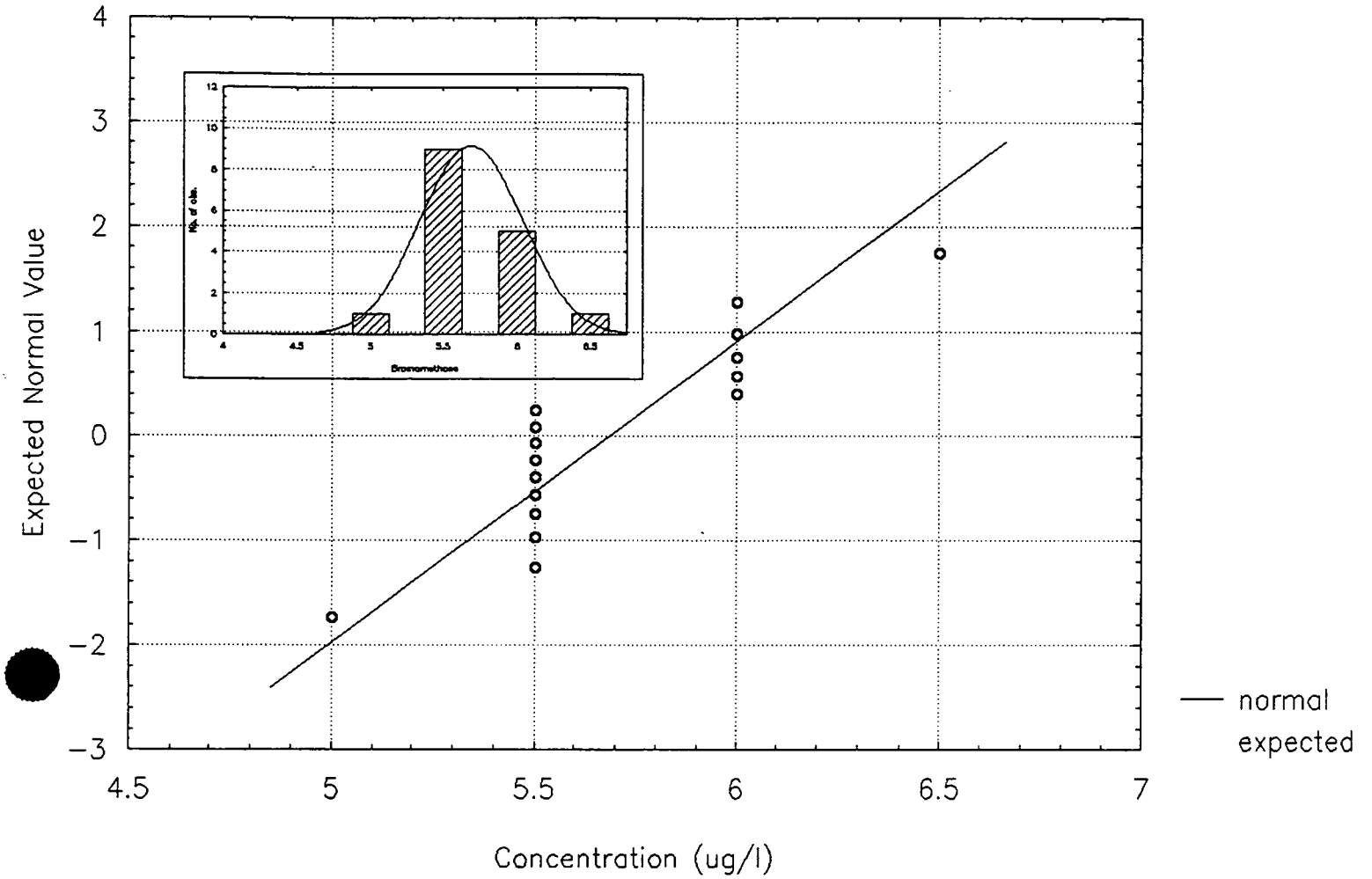


Normal Probability Plot For
Cumene
In The Background Surface Soils

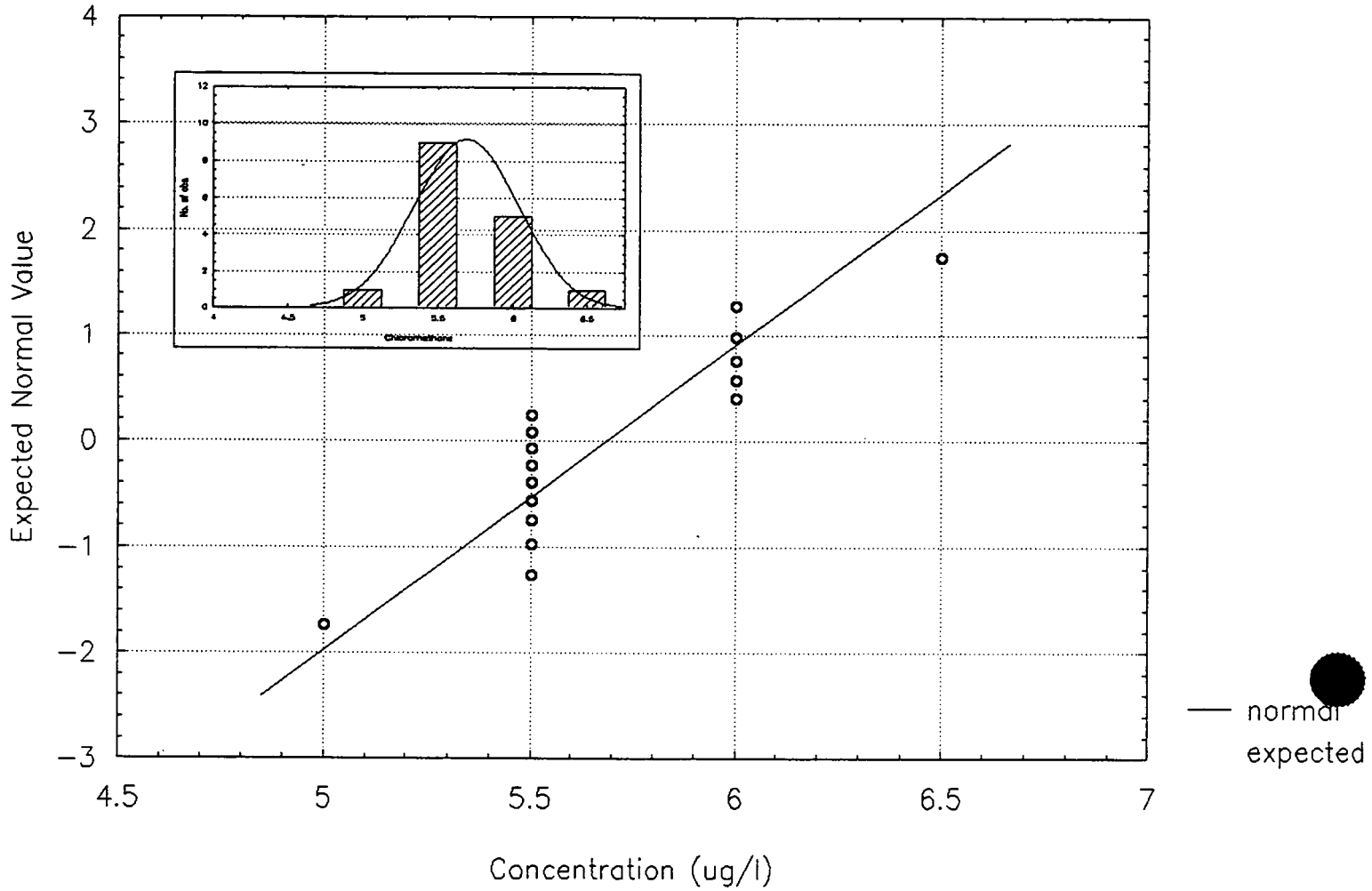


000423

Normal Probability Plot for
Bromomethane
in Background Surface Soils

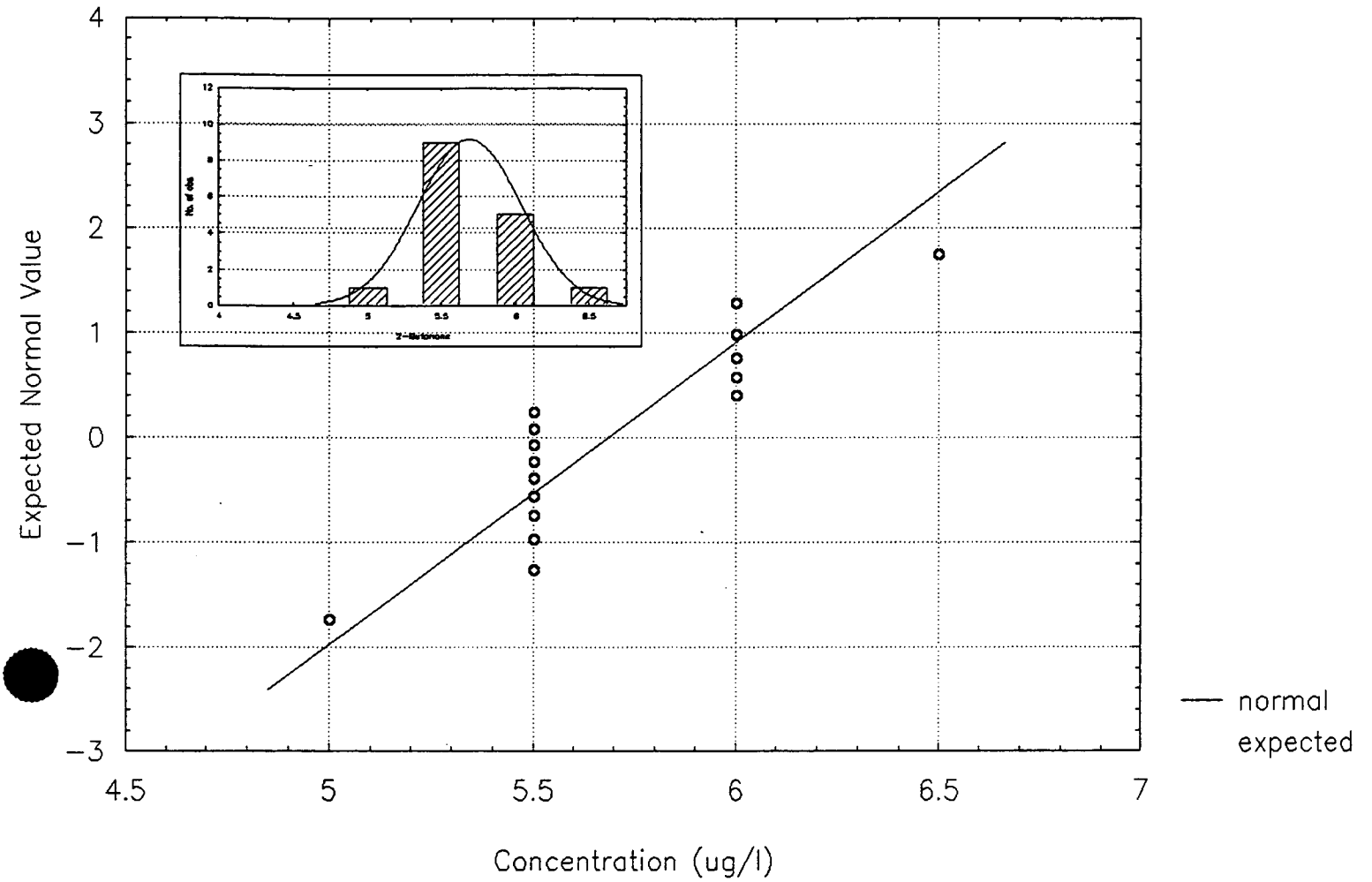


Normal Probability Plot for
Chloromethane
in Background Surface Soils

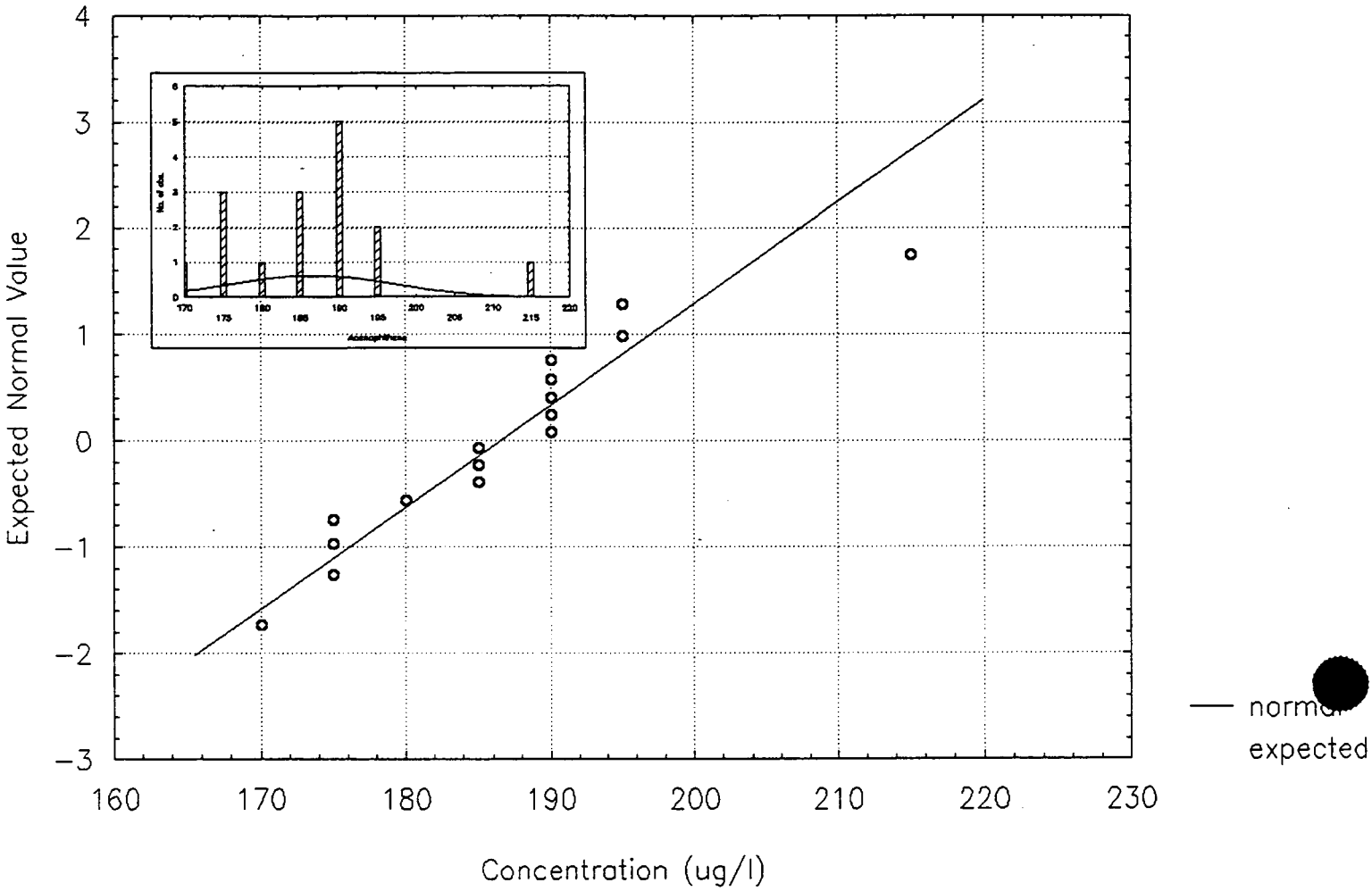


000425

Normal Probability Plot for
2-Butanone
in Background Surface Soils

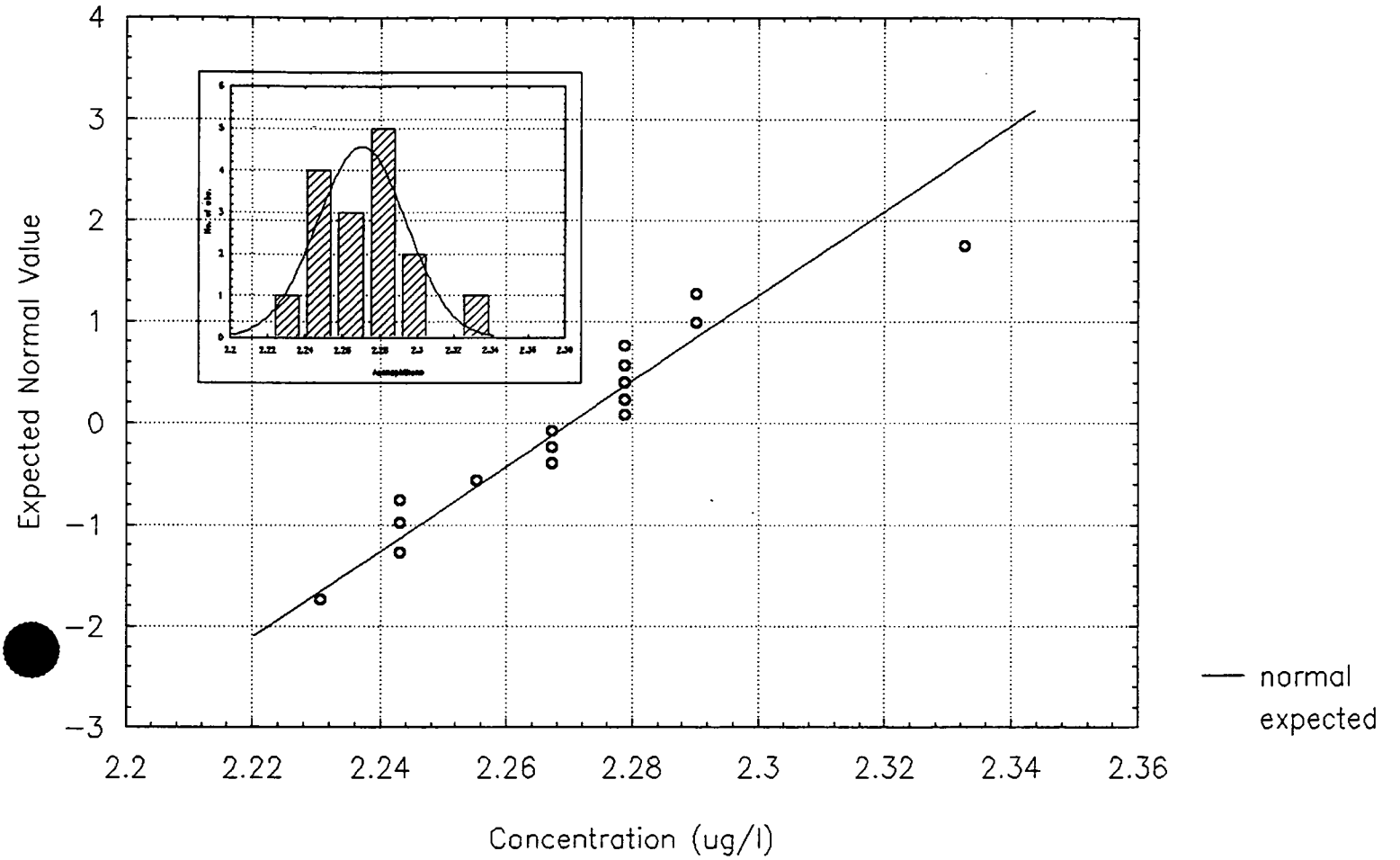


Normal Probability Plot for
Acenaphthene
in Background Soil Samples

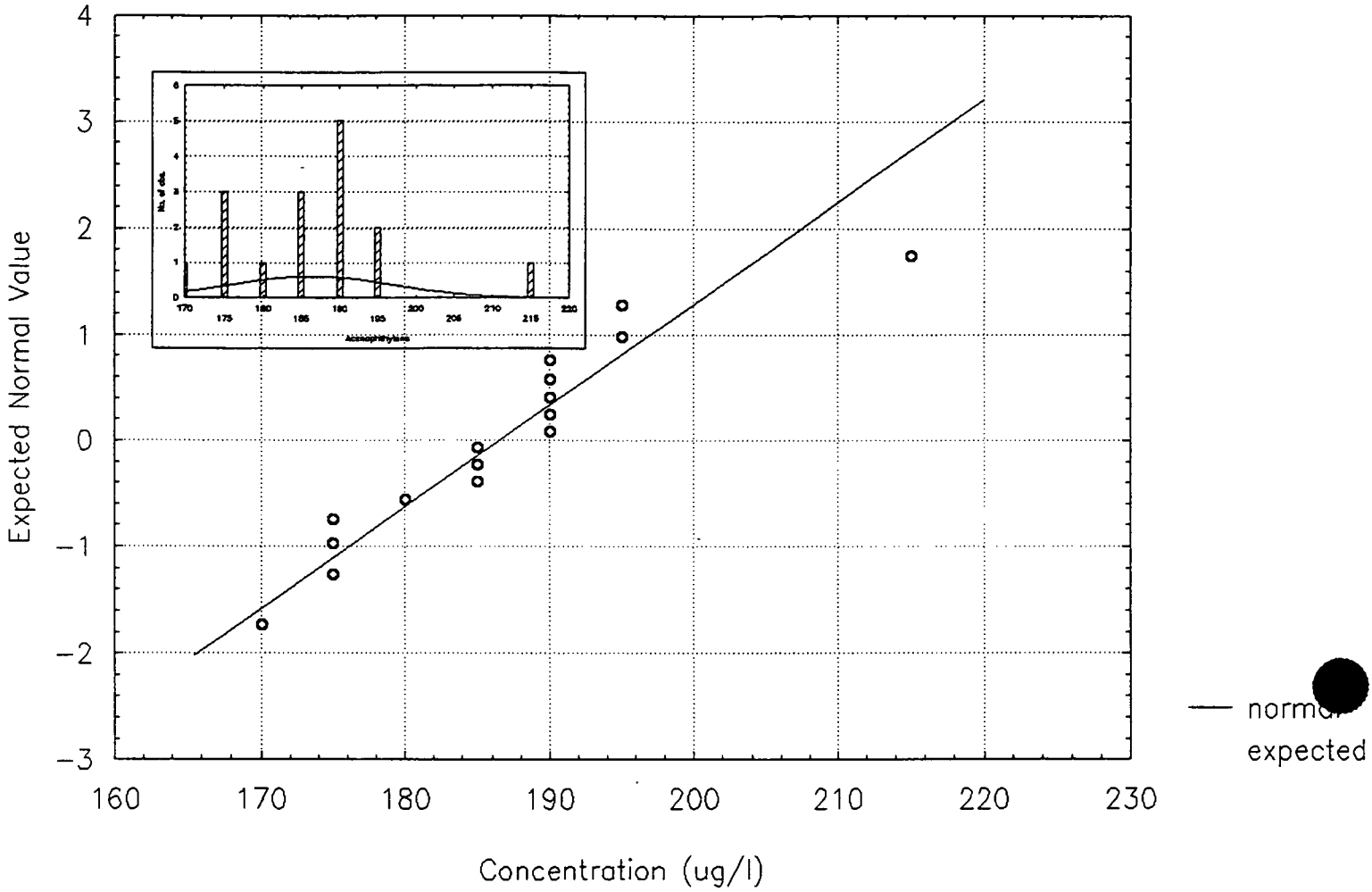


000427

Normal Probablility Plot for
Log Base 10 of
Acenaphthene
in Background Soil Samples

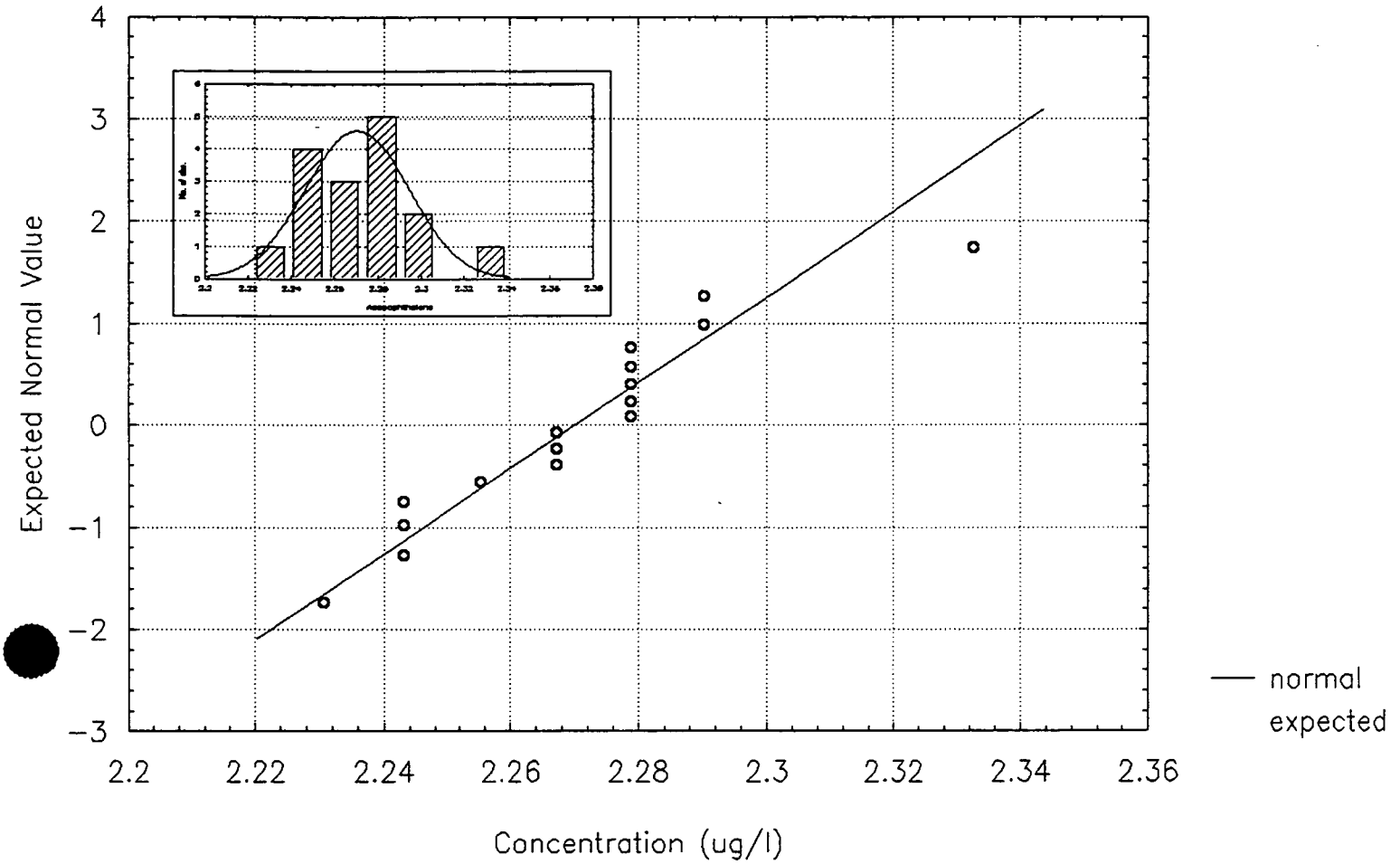


Normal Probability Plot for
Acenaphthylene
in Background Soil Samples

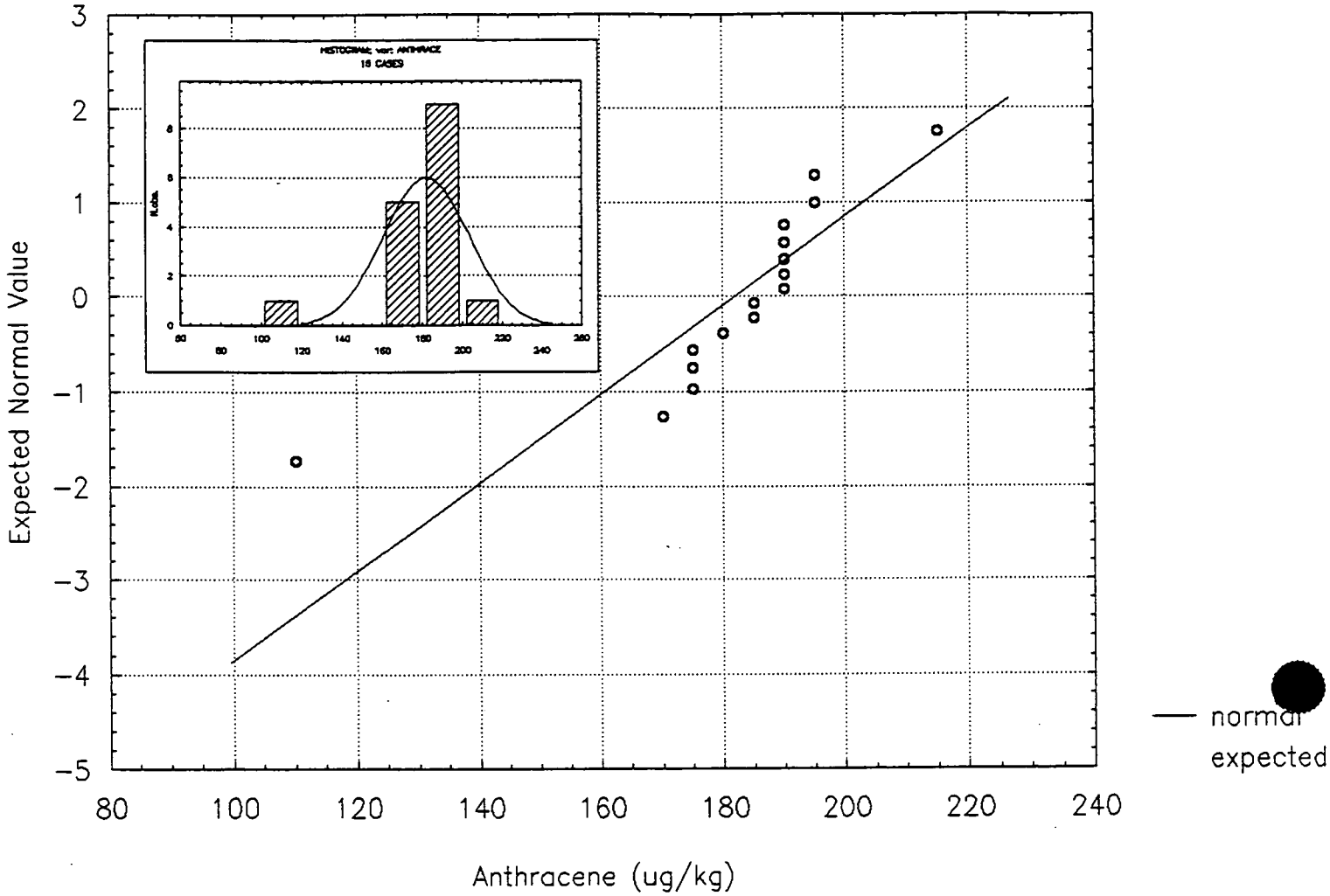


000429

Normal Probablility Plot for
Log Base 10 of
Acenaphthylene
in Background Soil Samples

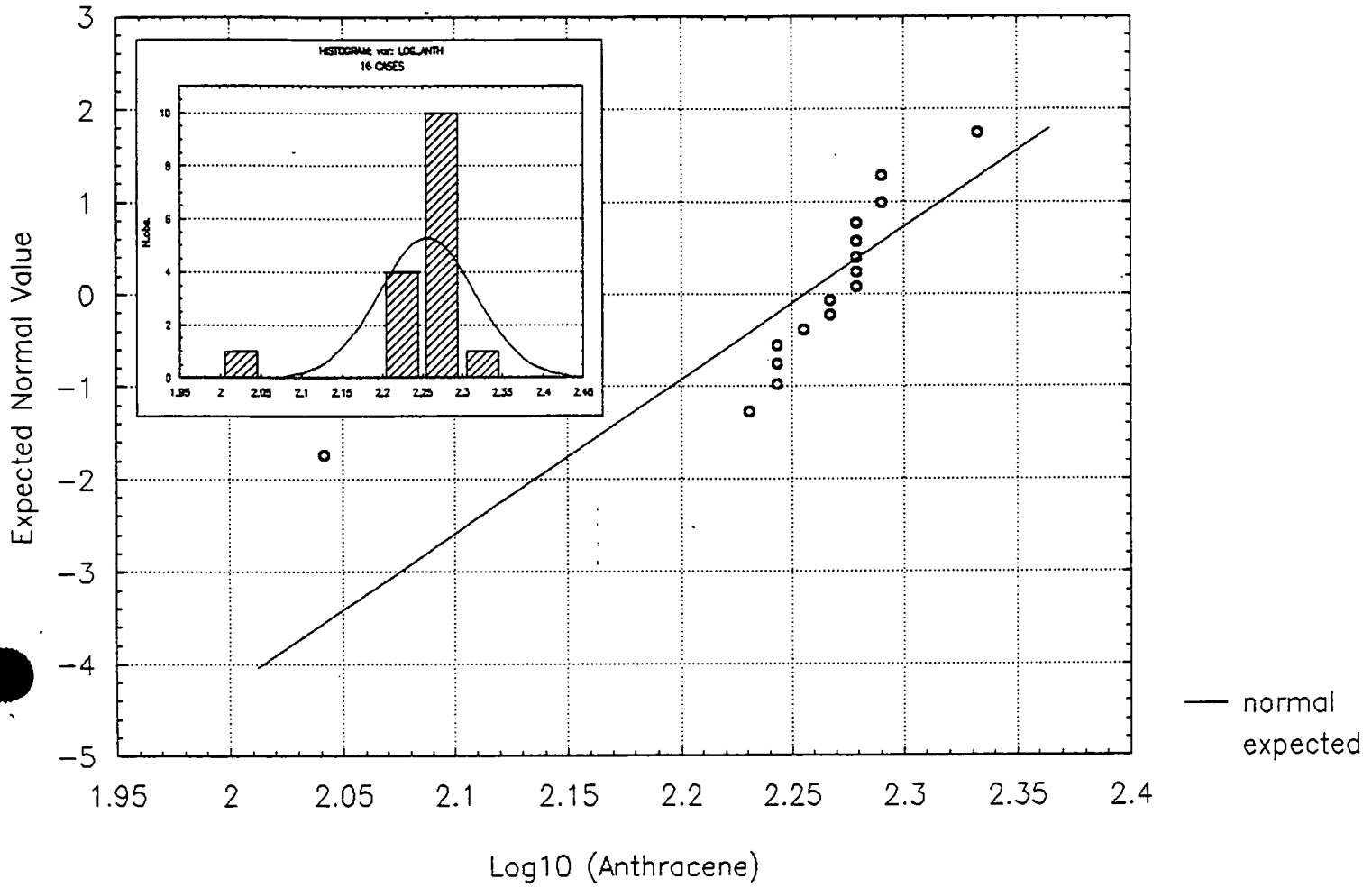


Normal Probablility Plot for Anthracene
in Background Surface Soils

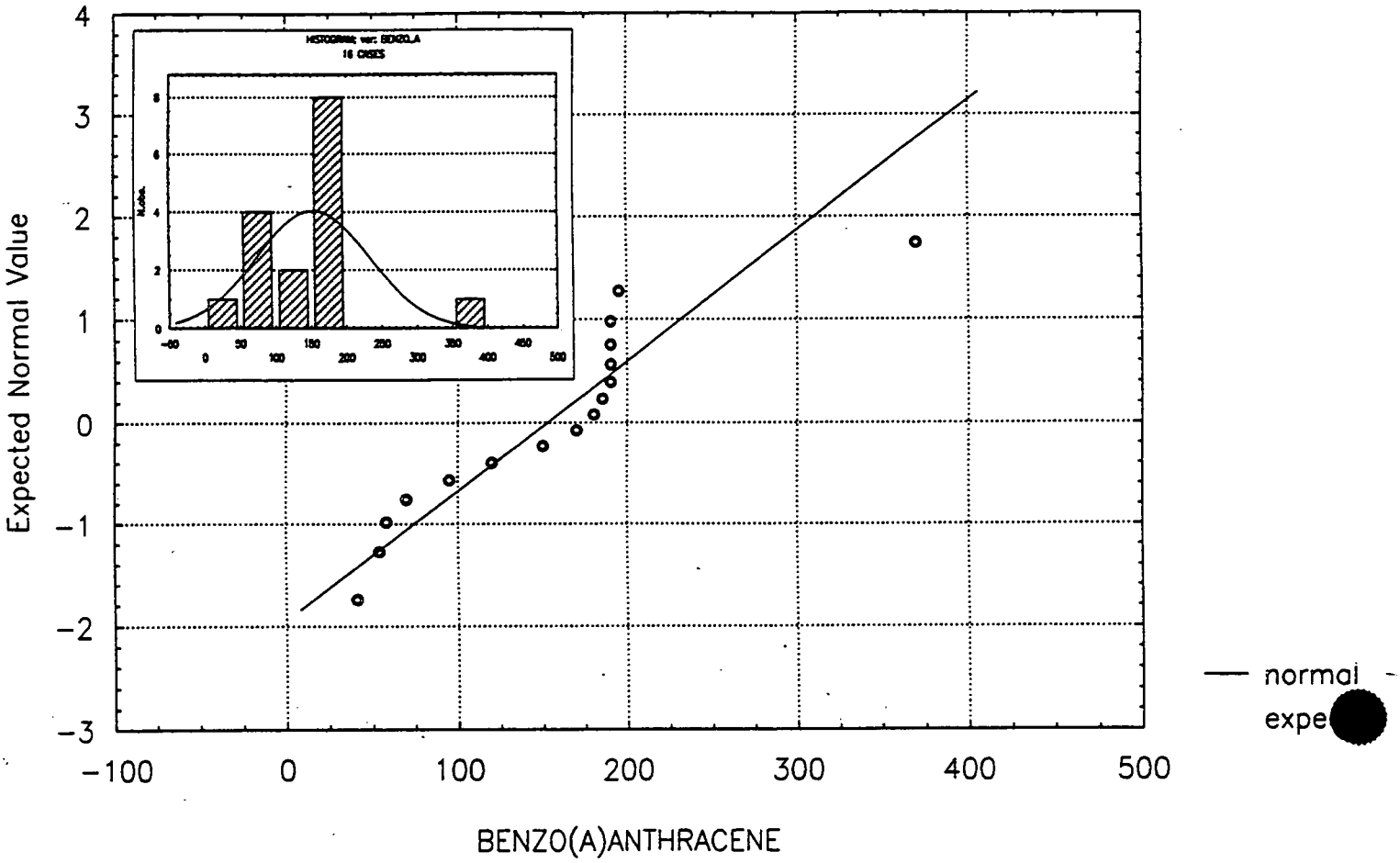


000431

Normal Probablility Plot for the Log Base 10 Transform of Anthracene in Background Surface Soils

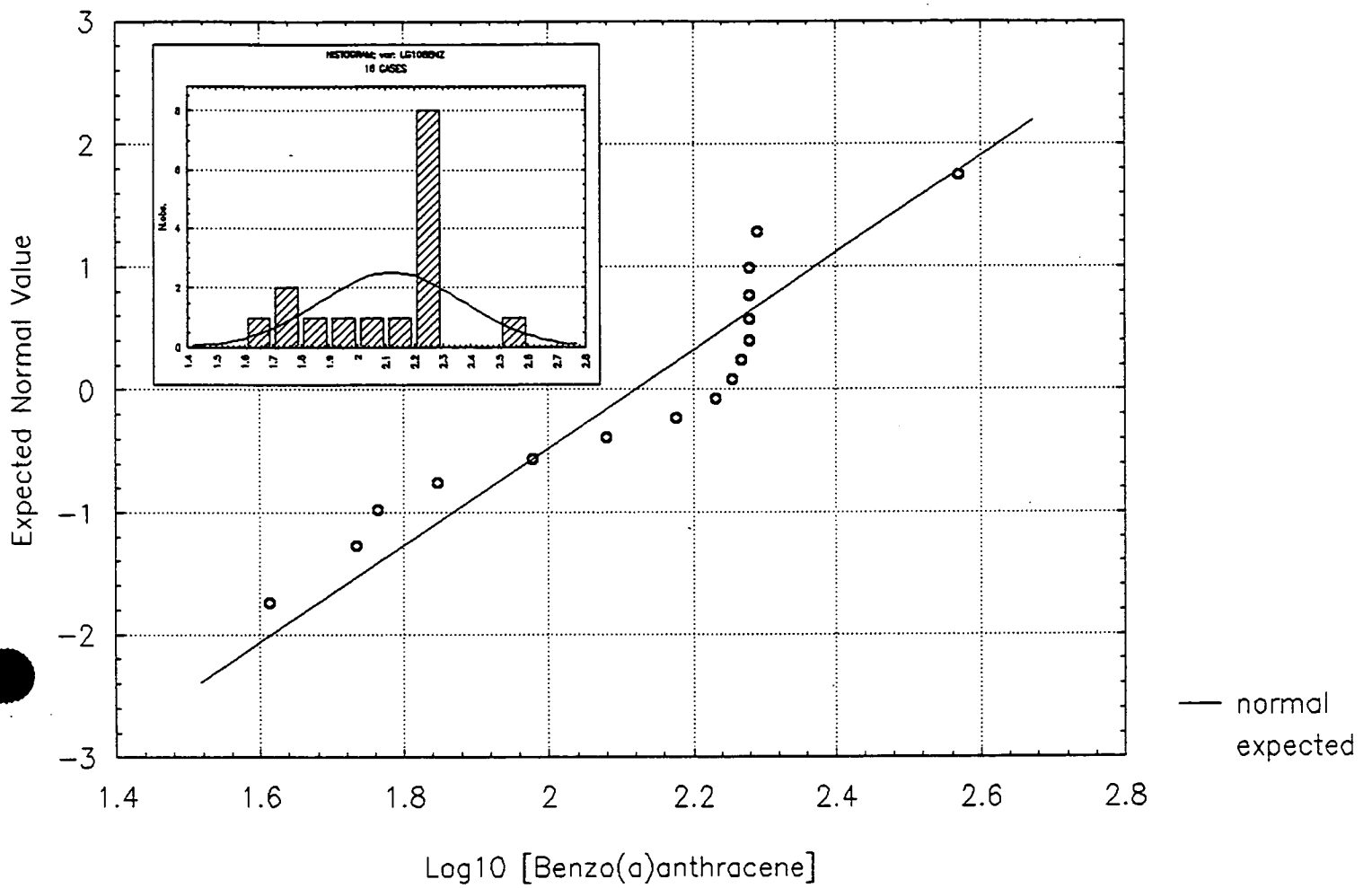


Normal Probablility Plot
for Benzo(a)anthracene in Surface Soils

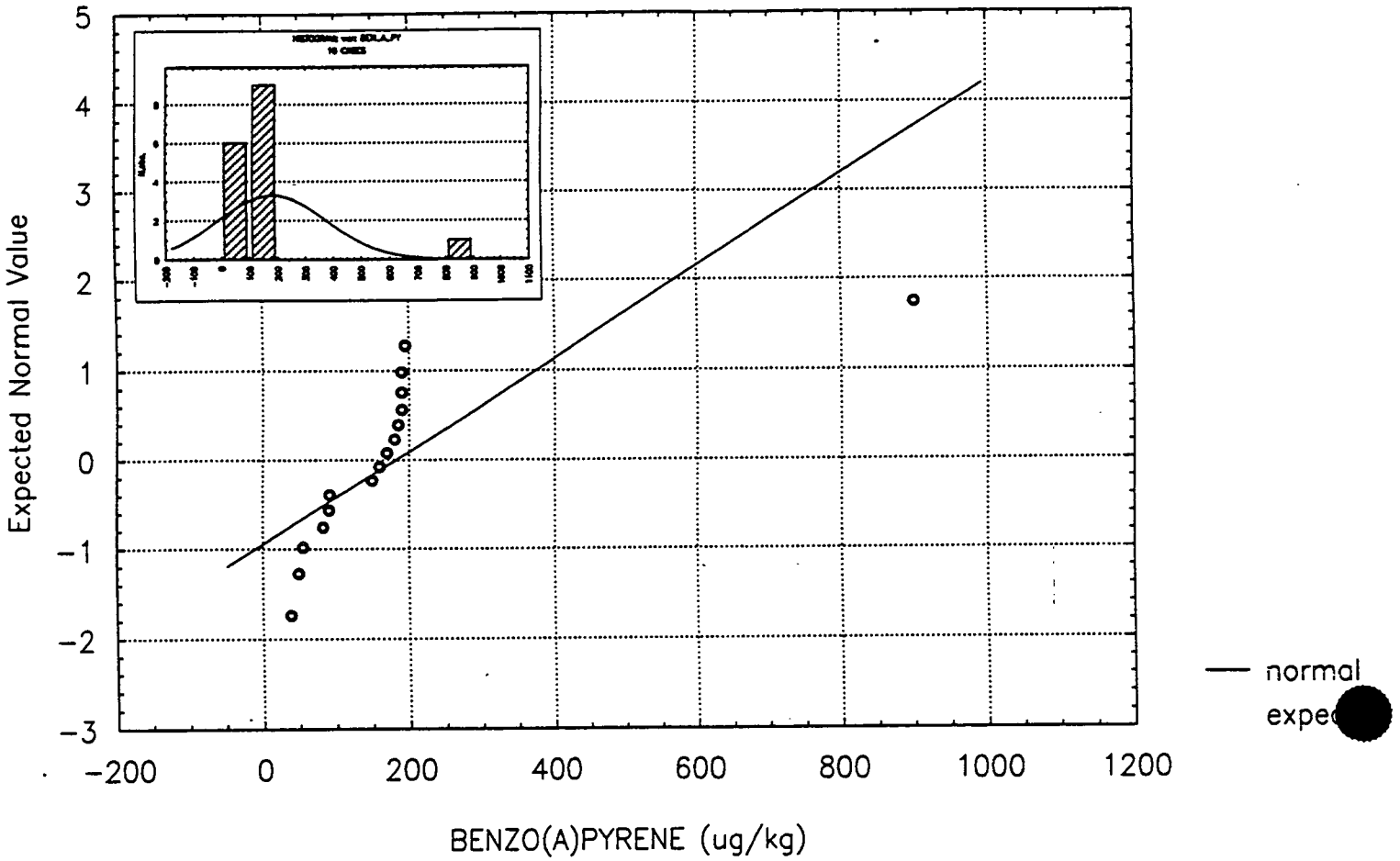


000433

Normal Probablility Plot for the Log
Base 10 Transform of Benzo(a)anthracene
in Background Surface Soils

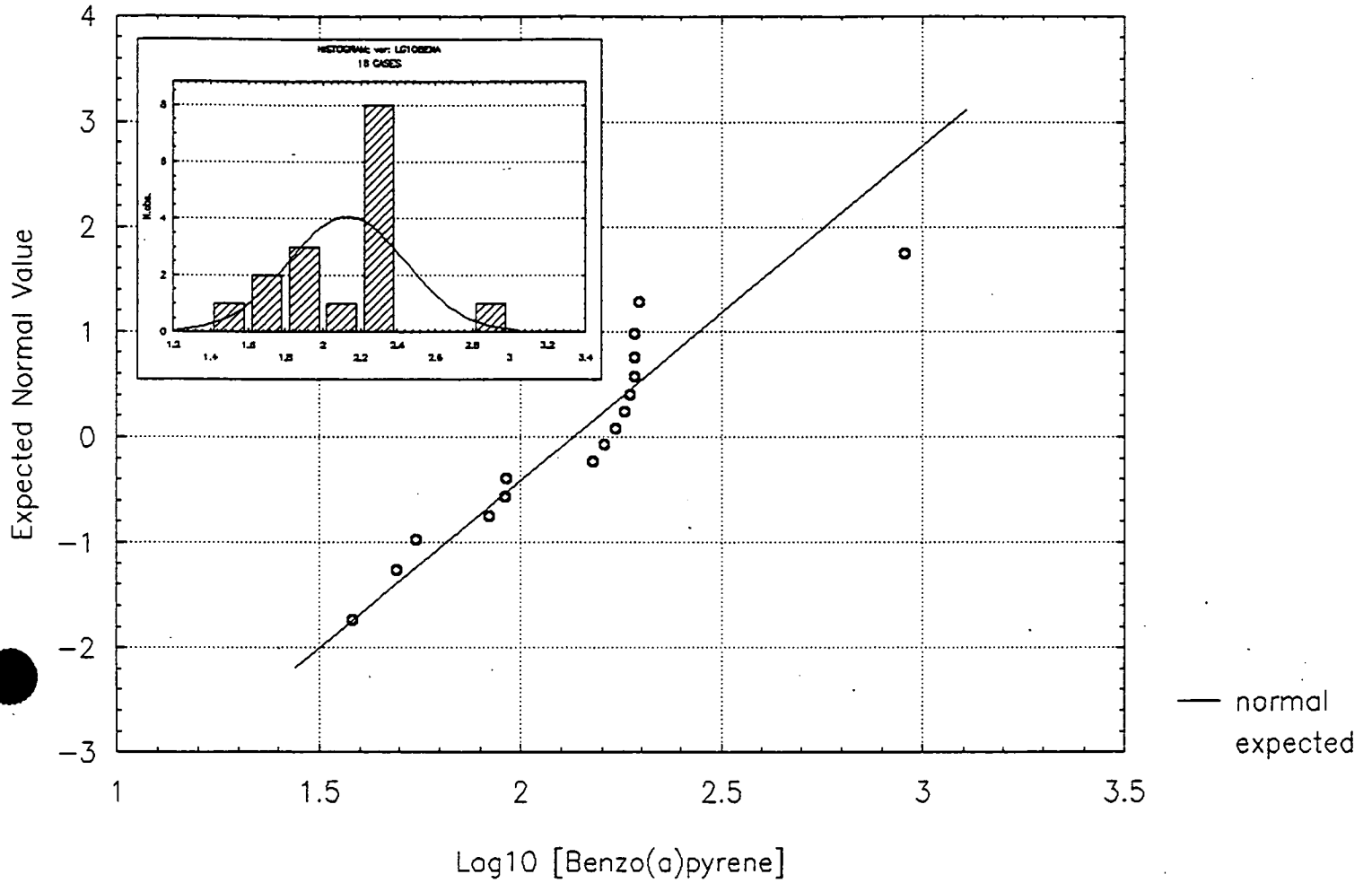


Normal Probablility Plot
for Benzo(a)pyrene in Surface Soils

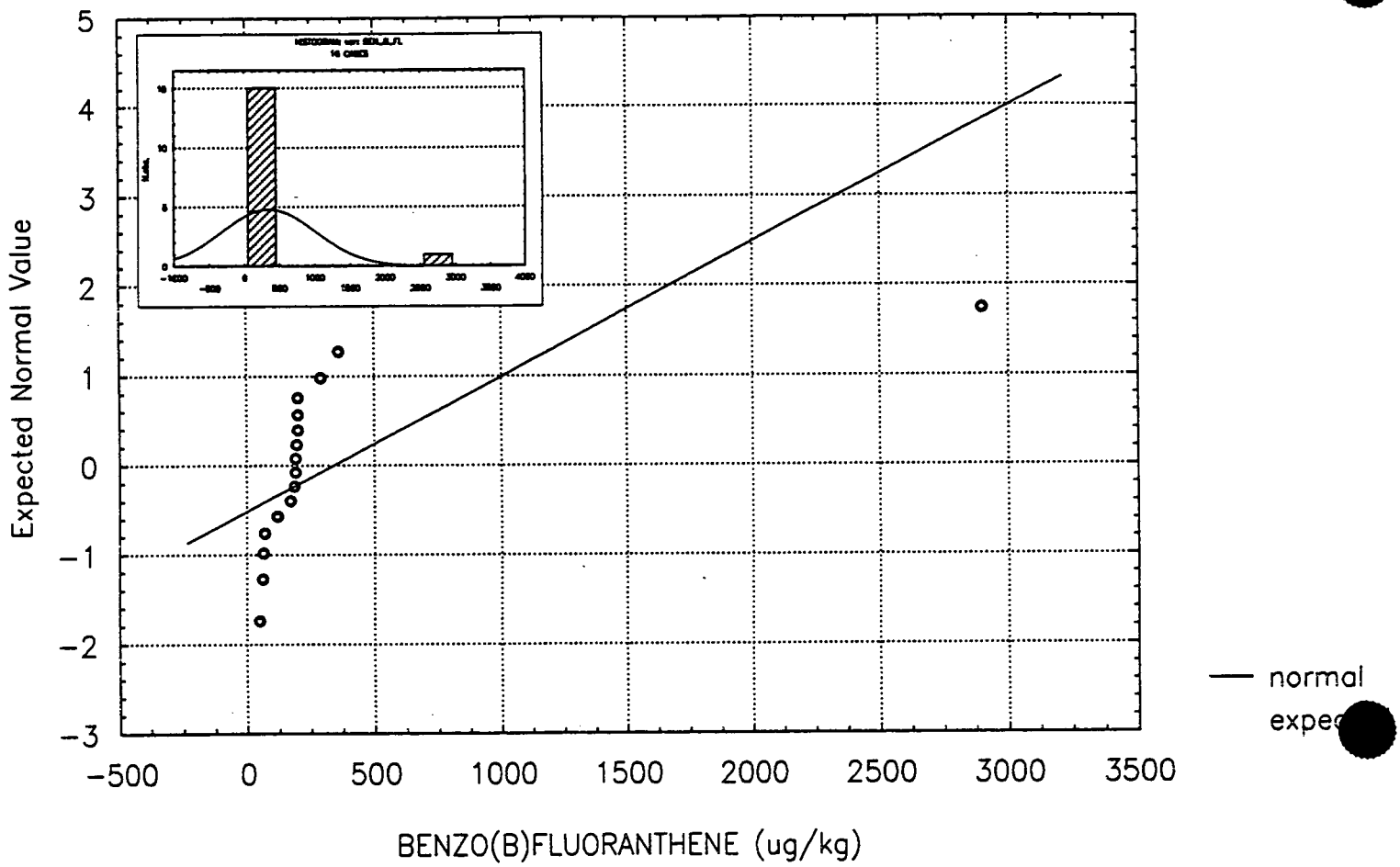


000435

Normal Probablility Plot for the Log
Base 10 Transform of Benzo(a)pyrene
in Background Surface Soils

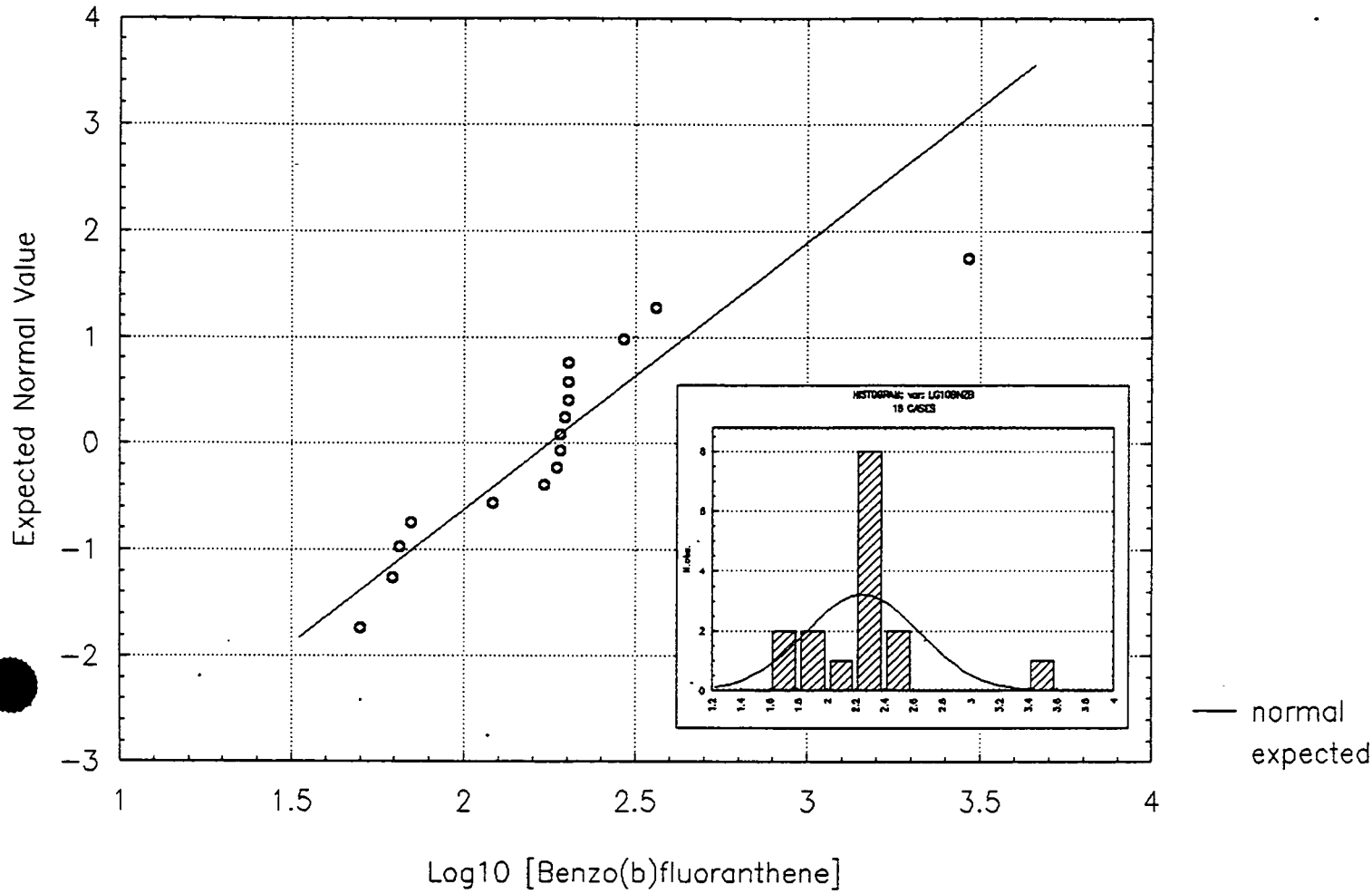


Normal Probablility Plot
for Benzo(b)fluoranthene in Surface Soils

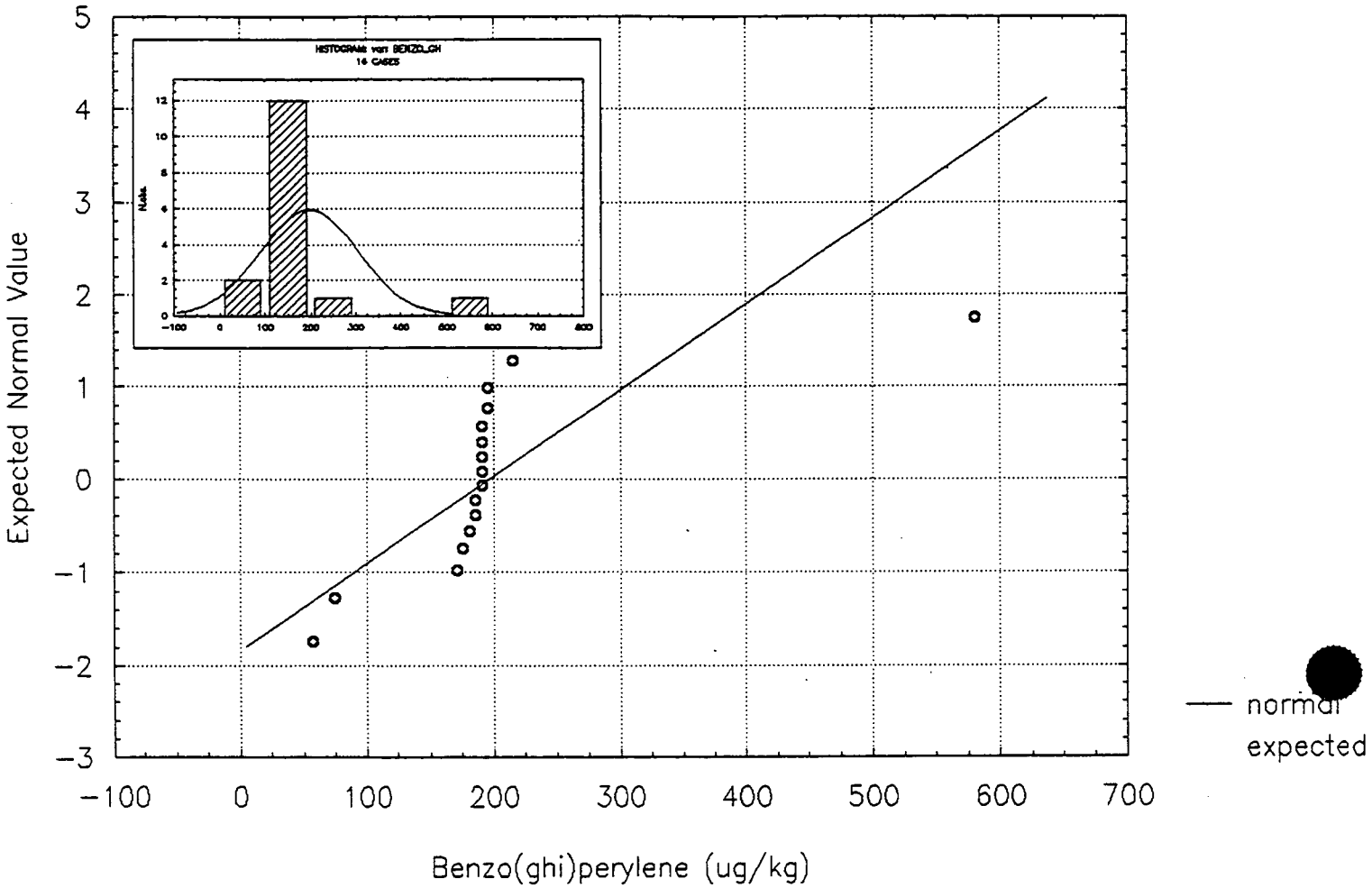


000437

Normal Probablility Plot for the Log
Base 10 Transform of Benzo(b)fluoranthene
in Background Surface Soil

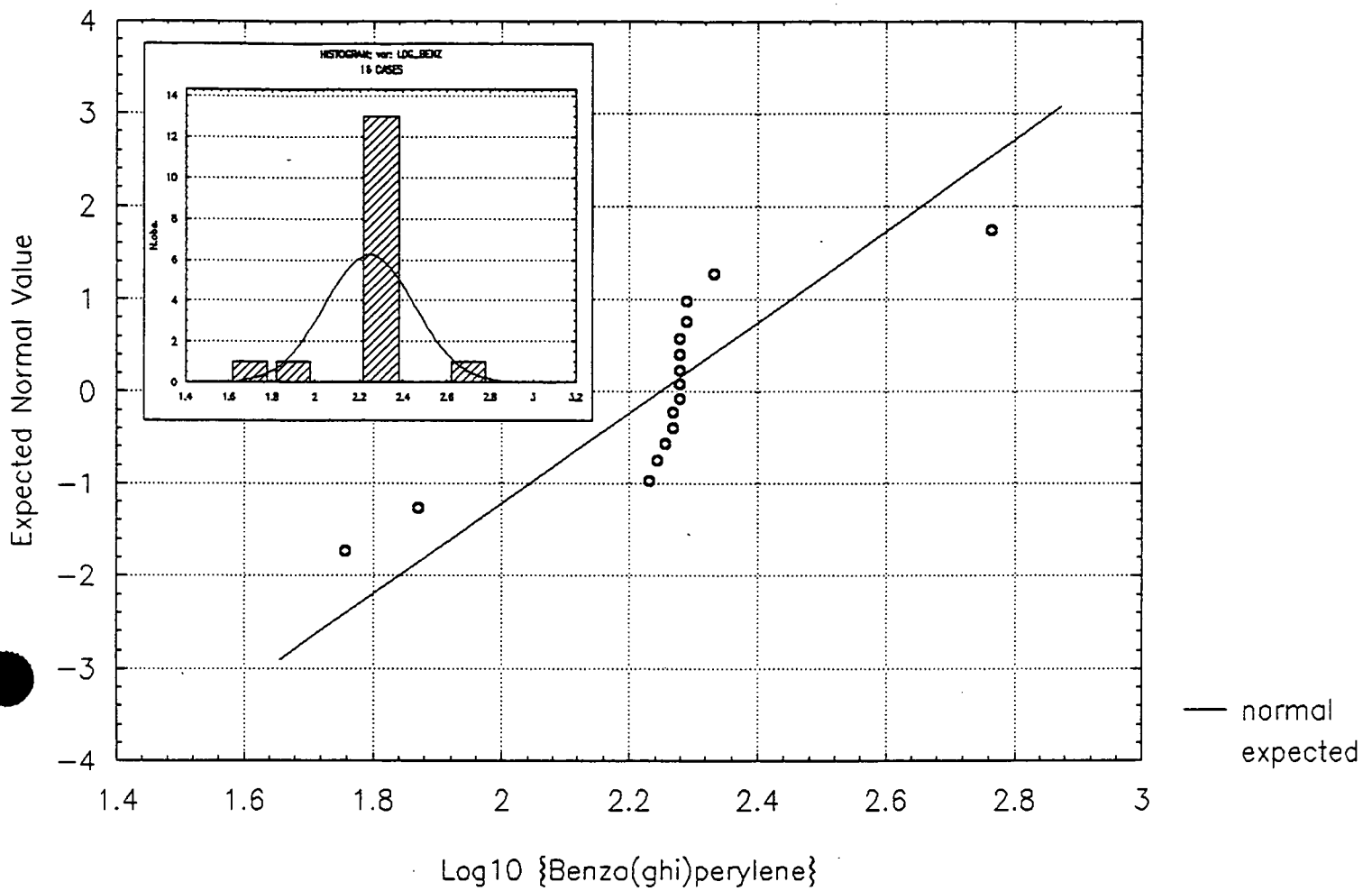


Normal Probablility Plot for
Benzo(ghi)perylene in Background
Surface Soil

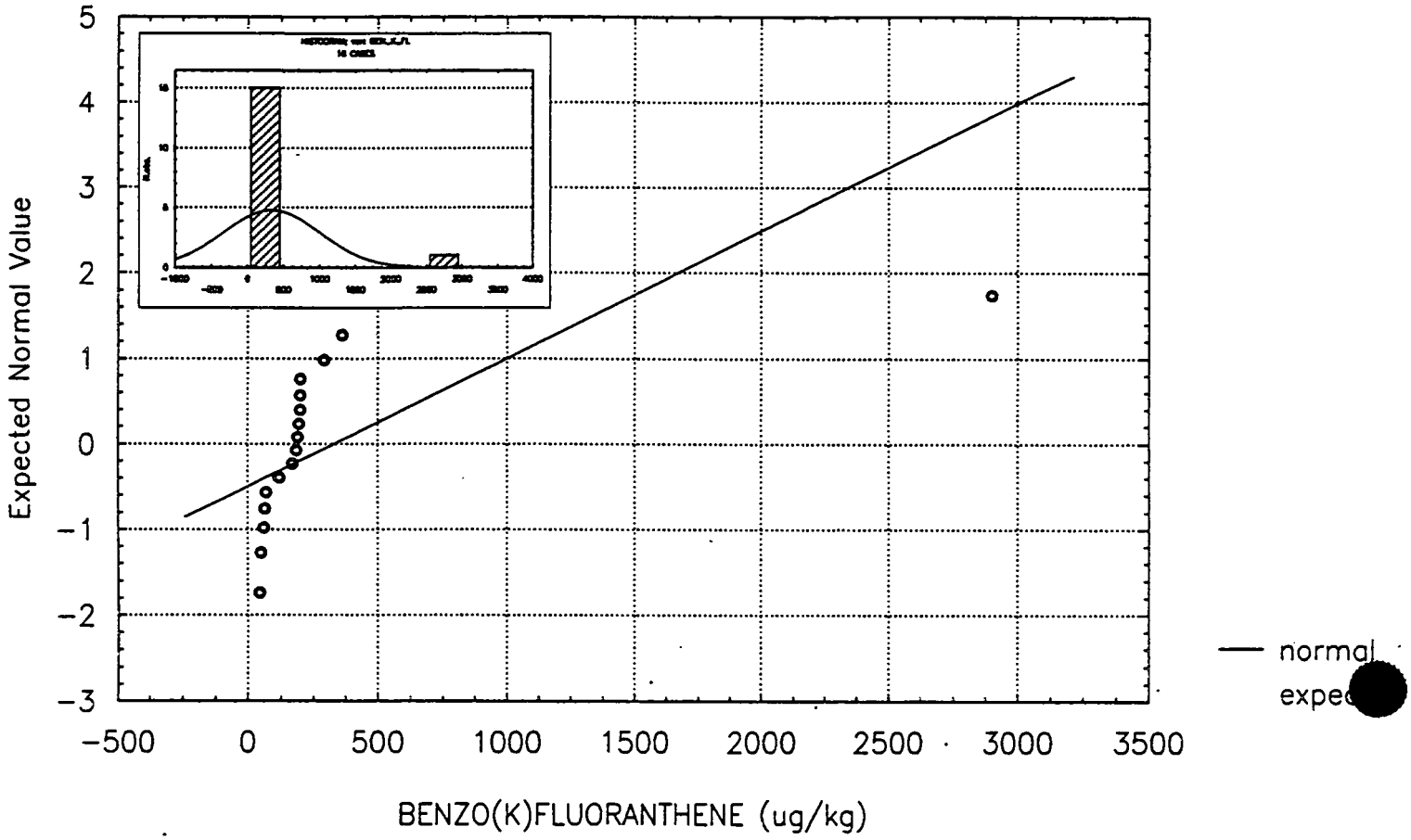


000439

Normal Probablility Plot for the Log
Base 10 Transform of Benzo(ghi)perylene
in Background Surface Soil

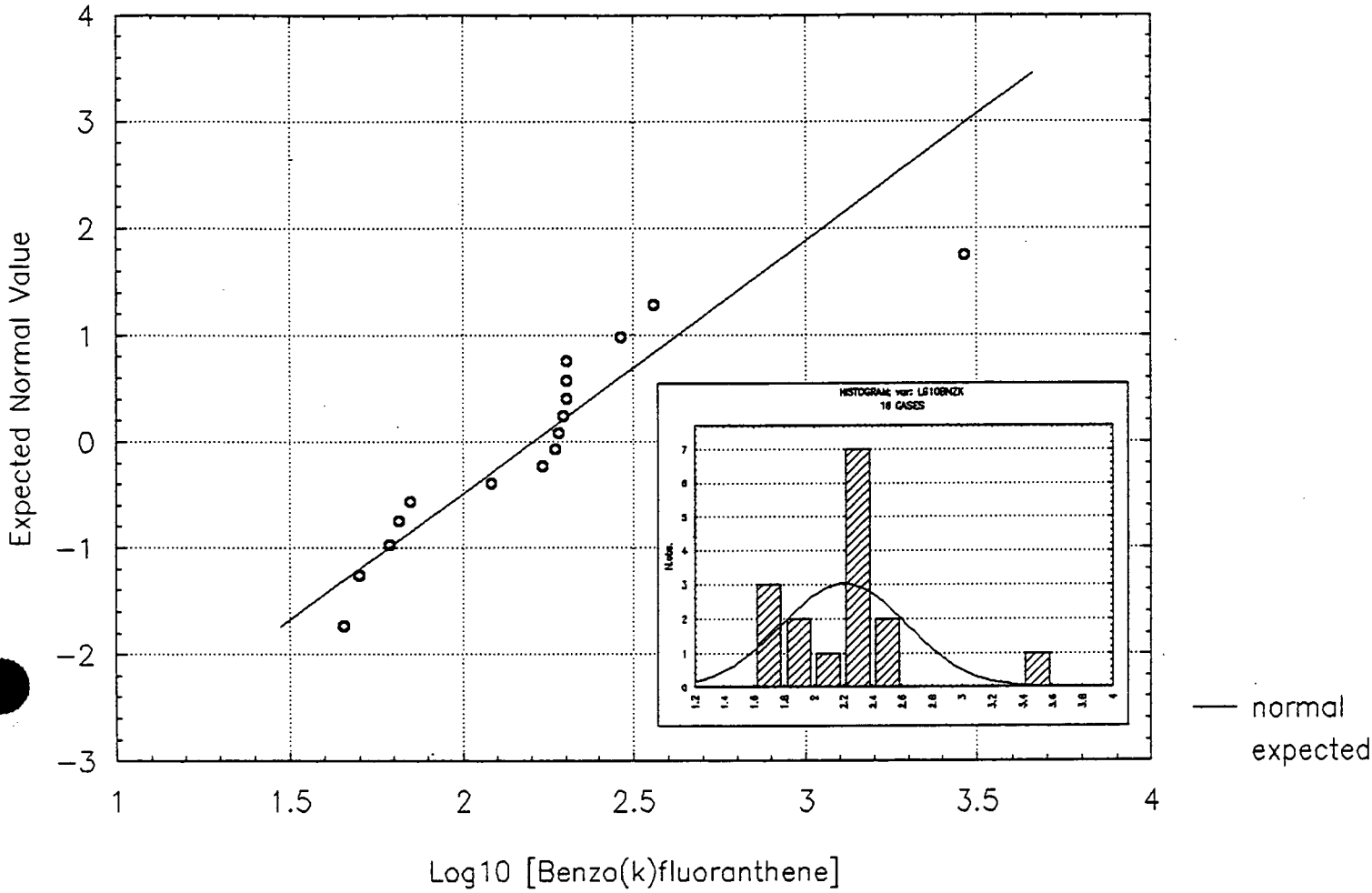


Normal Probablility Plot
for Benzo(k)fluoranthene in
Background Surface Soils

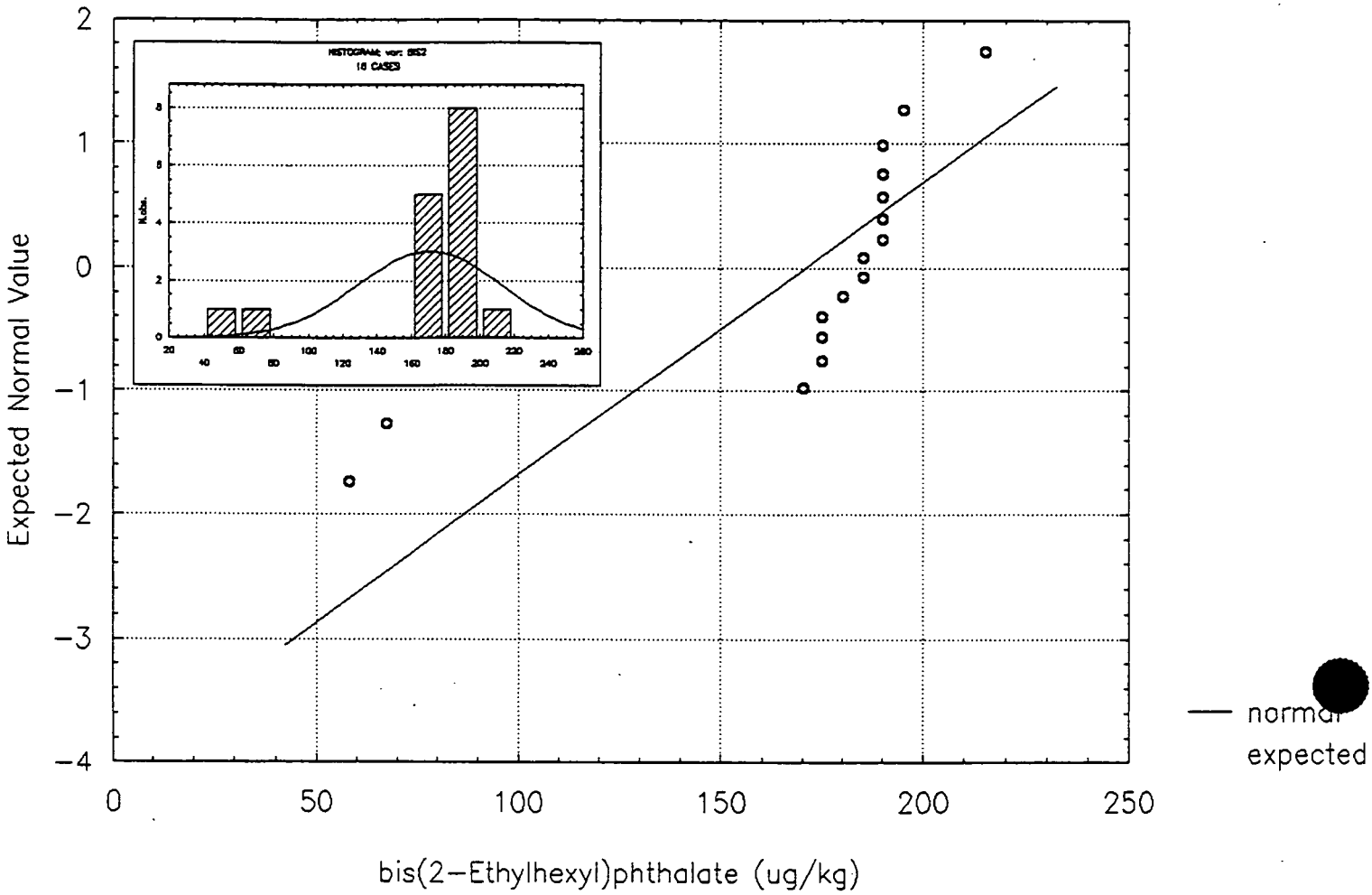


000441

Normal Probablility Plot for the Log
Base 10 Transform of Benzo(k)fluoranthene
in Background Surface Soils

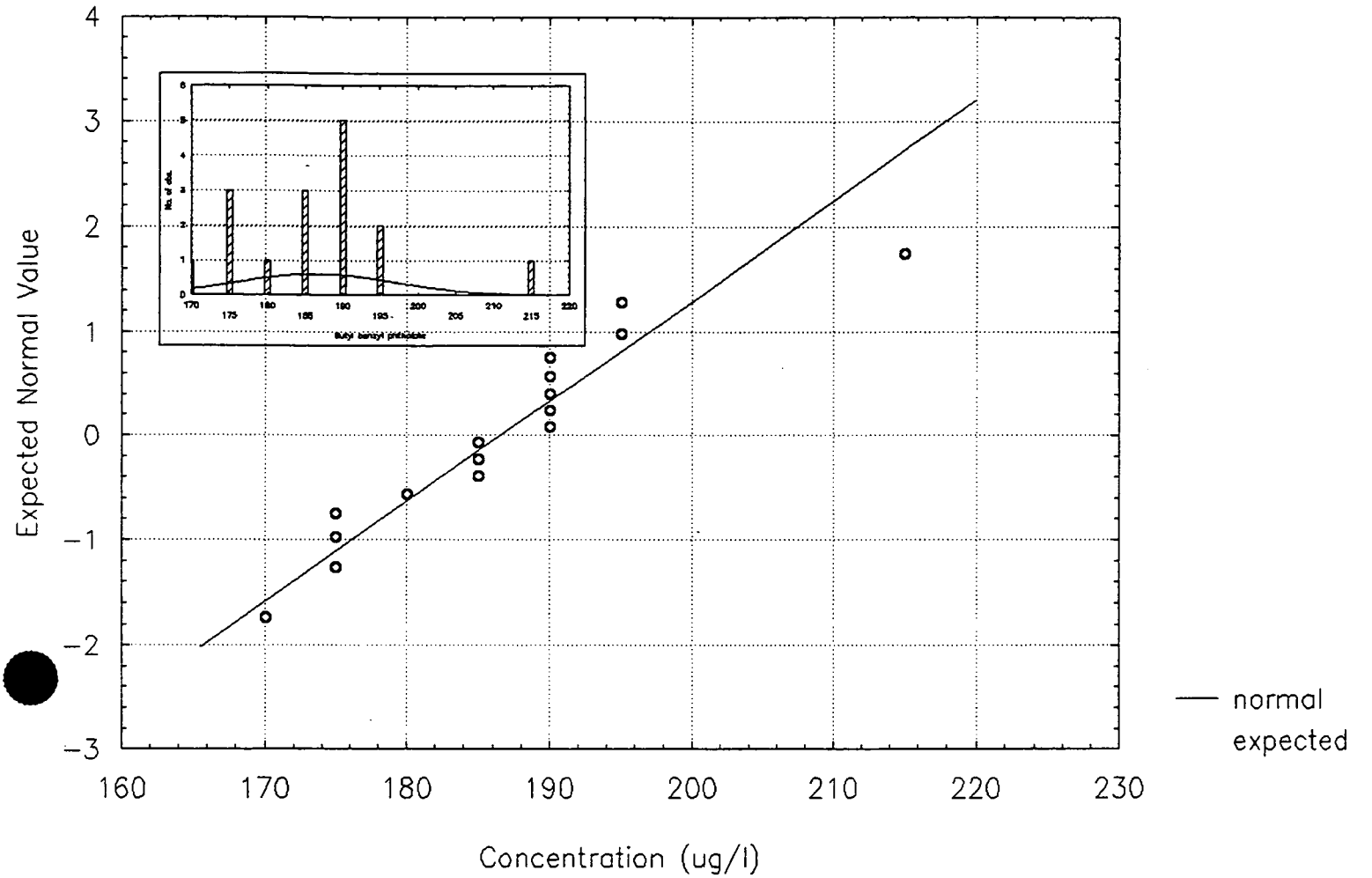


Normal Probablility Plot for
bis(2-Ethylhexyl)phthalate in Background
Surface Soils

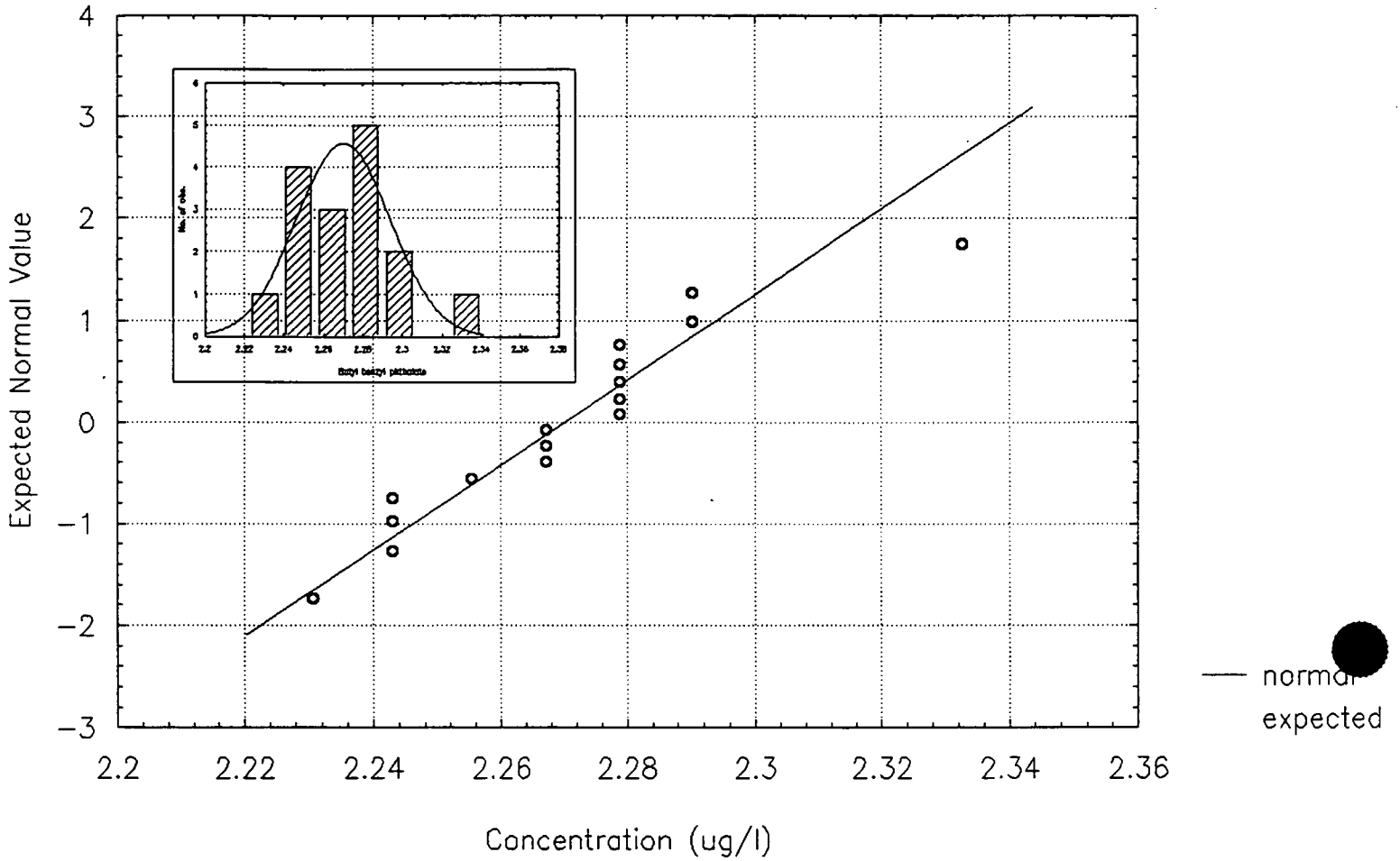


000443

Normal Probability Plot for
Butyl benzyl phthalate
in Background Soil Samples

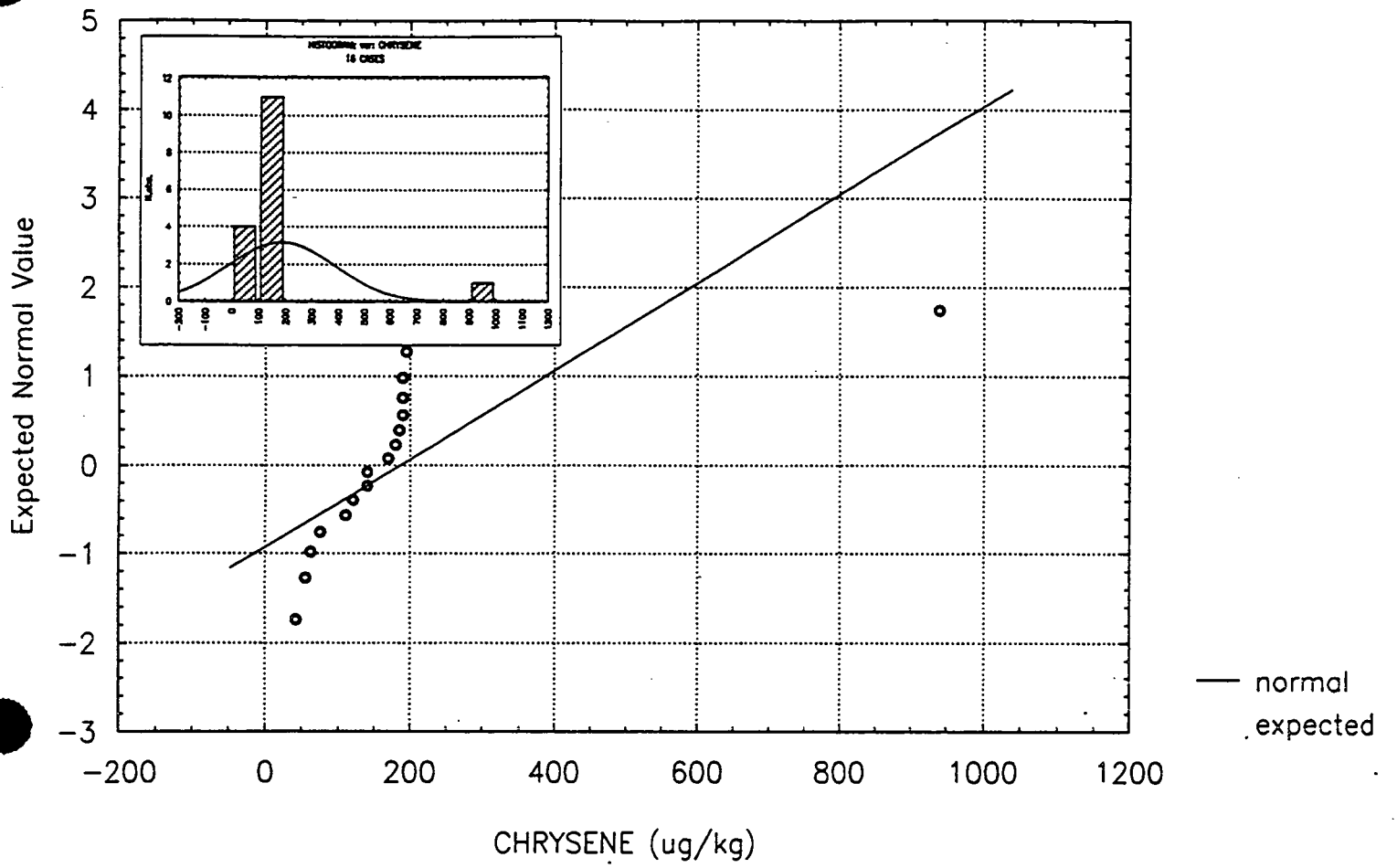


Normal Probablility Plot for
Log Base 10 of
Butyl benzyl phthalate
in Background Soil Samples

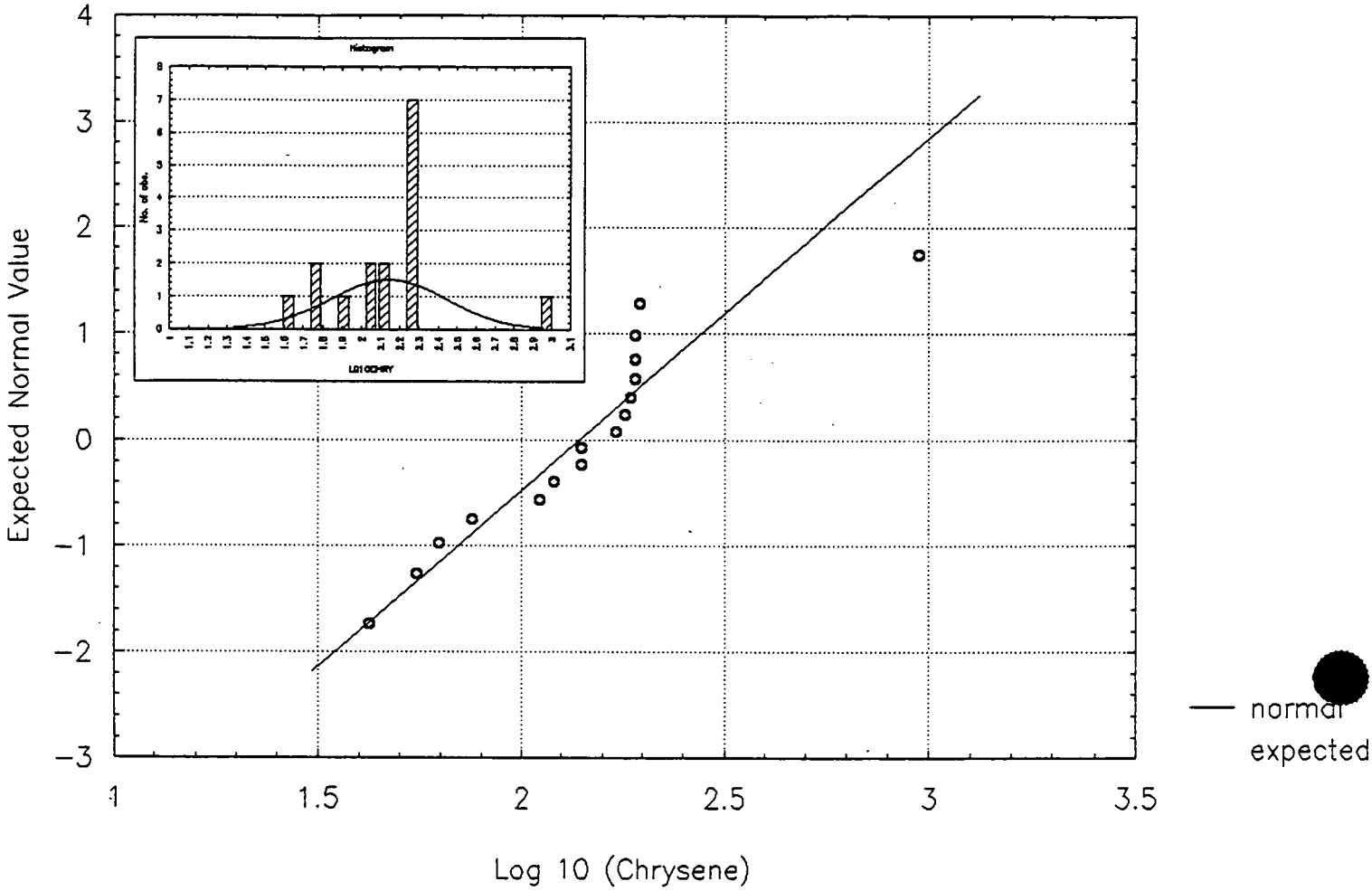


000445

Normal Probablility Plot
for Chrysene in Surface Soils

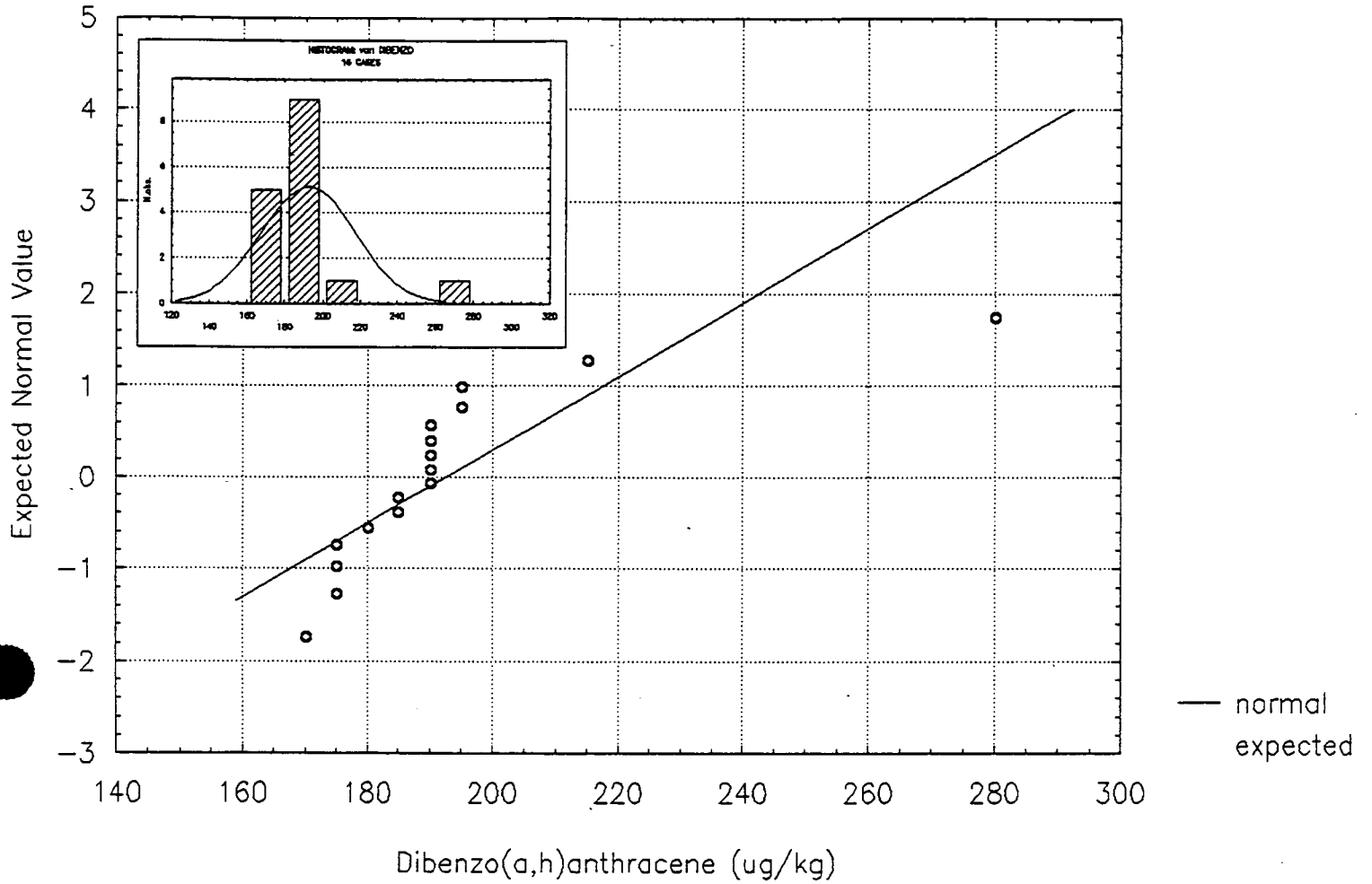


Normal Probablility Plot for the Log Base 10 Transform of Chrysene in Background Surface Soil

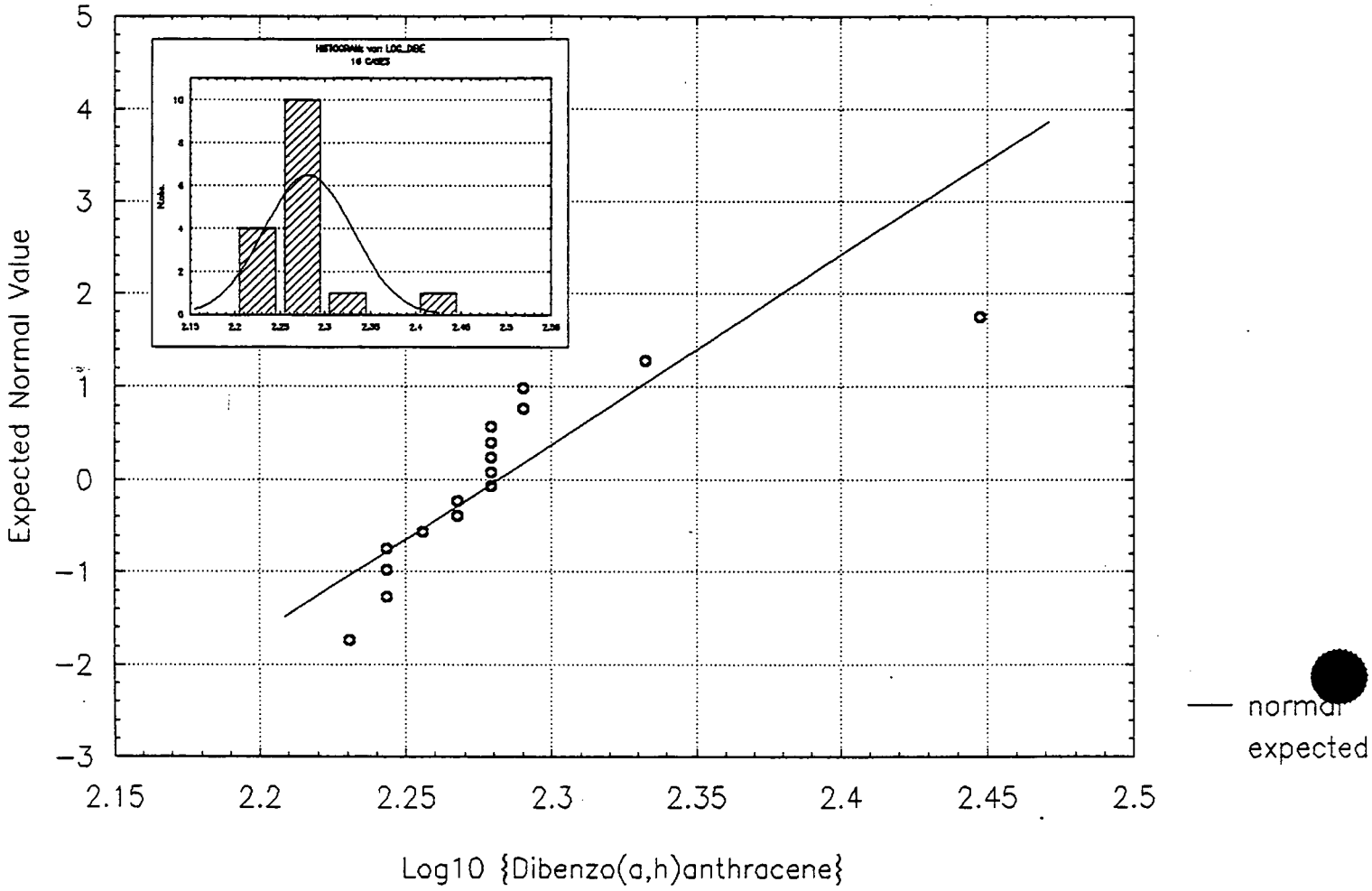


000447

Normal Probablility Plot for
Dibenzo(a,h)anthracene in Background
Surface Soils

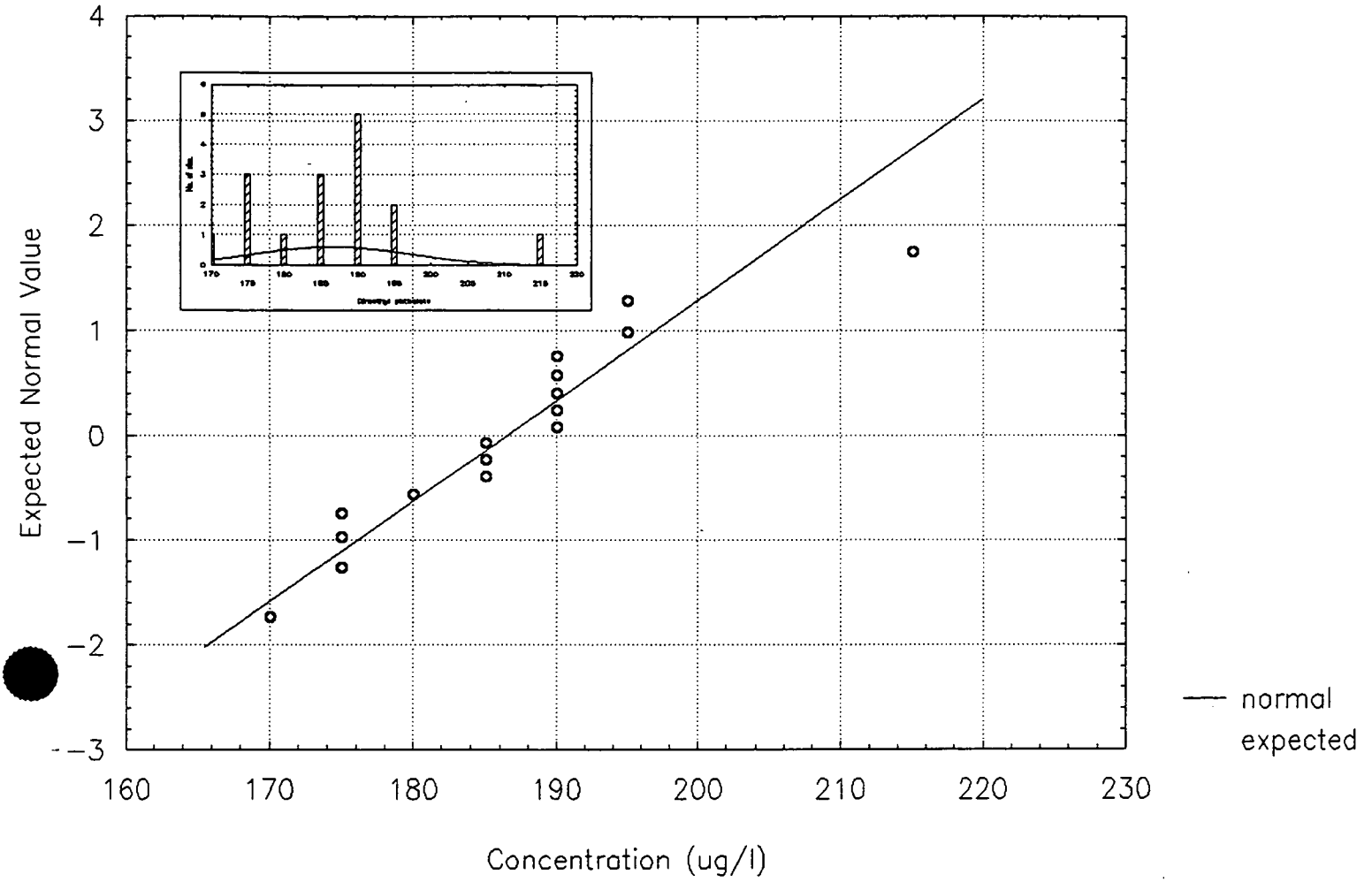


Normal Probablility Plot for the Log
Base 10 Transform of Dibenzo(ah)anthracene
in Background Surface Soils

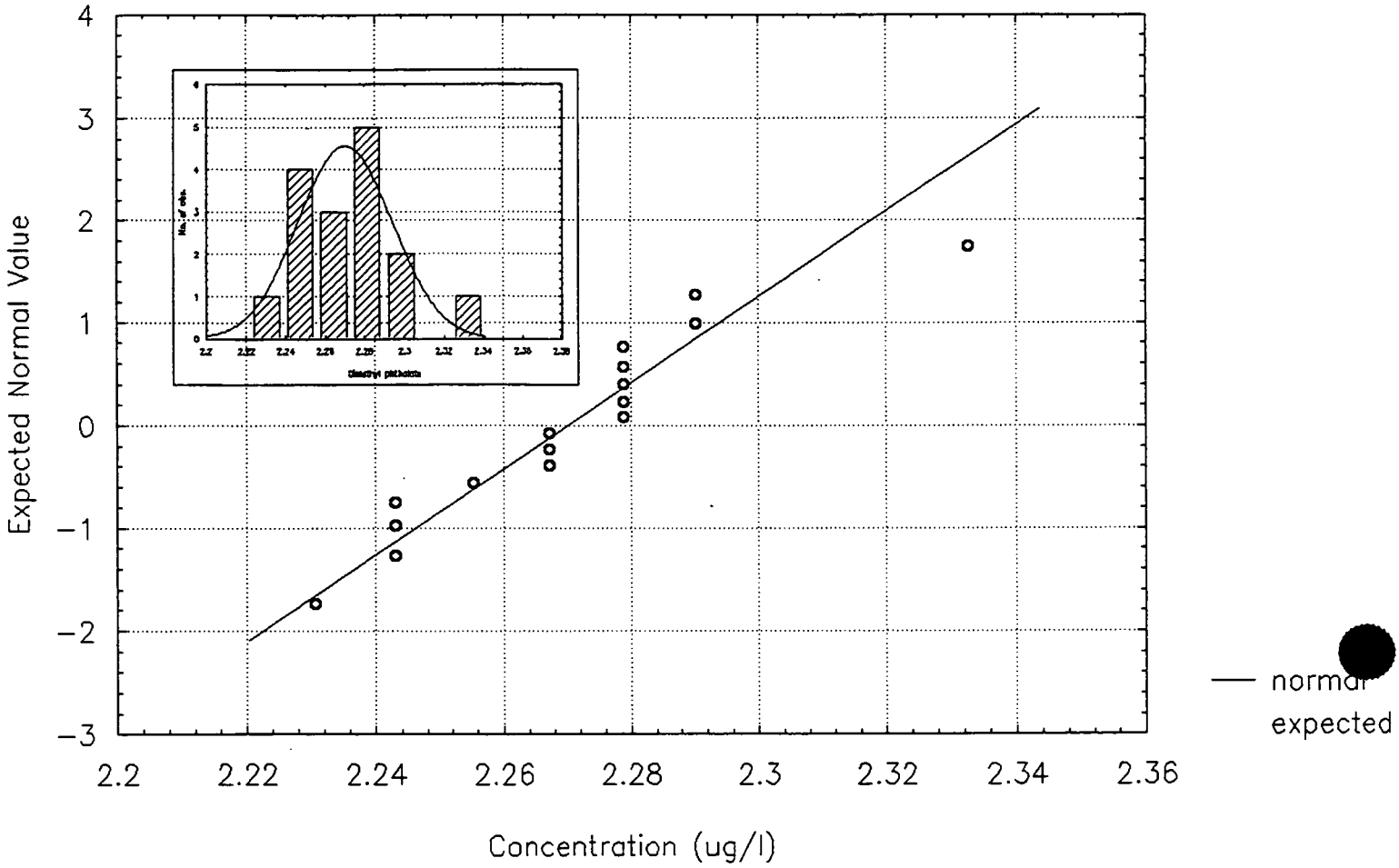


000449

Normal Probability Plot for
Dimethyl phthalate
in Background Soil Samples

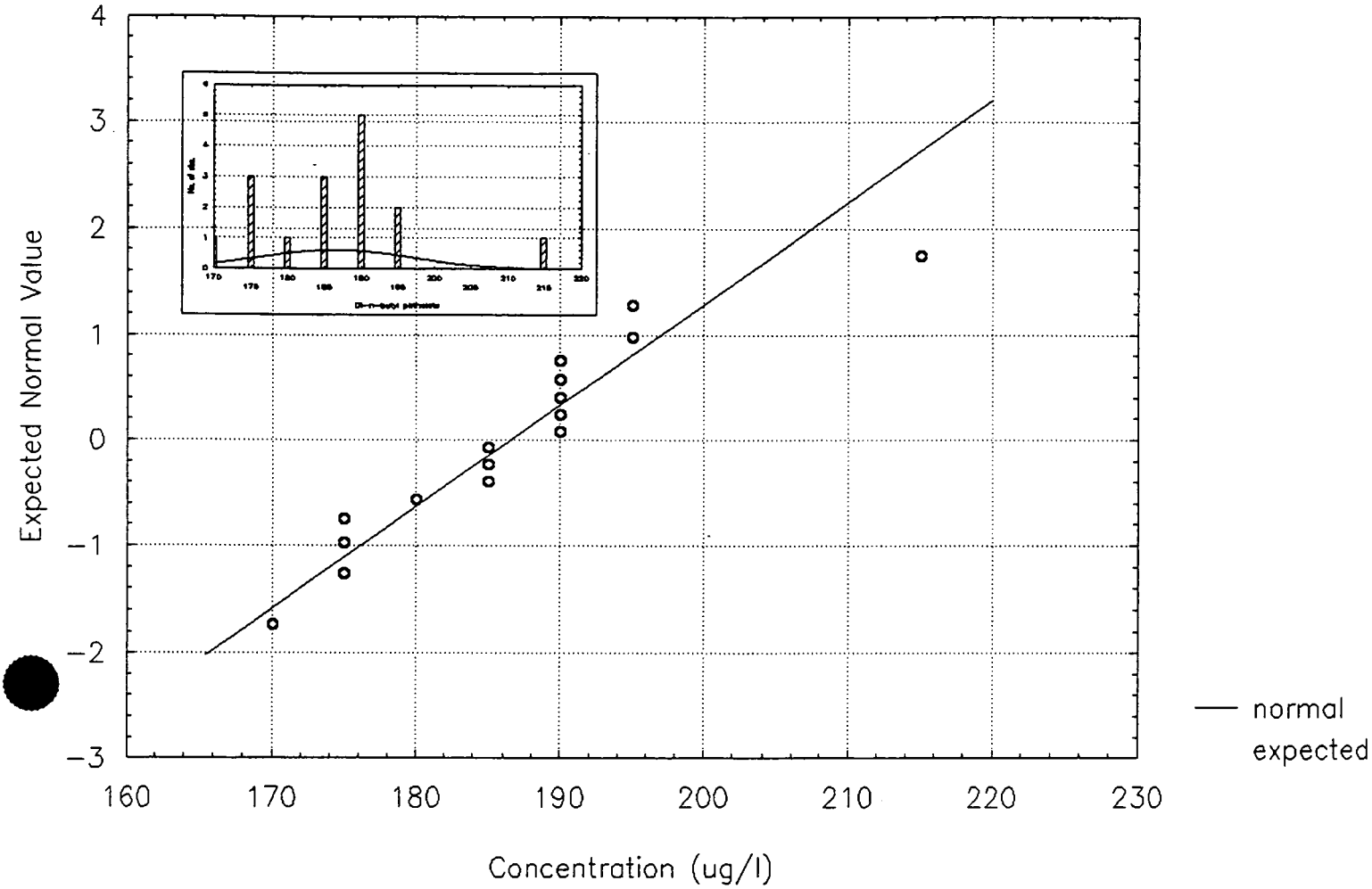


Normal Probablility Plot for
Log Base 10 of
Dimethyl phthalate
in Background Soil Samples

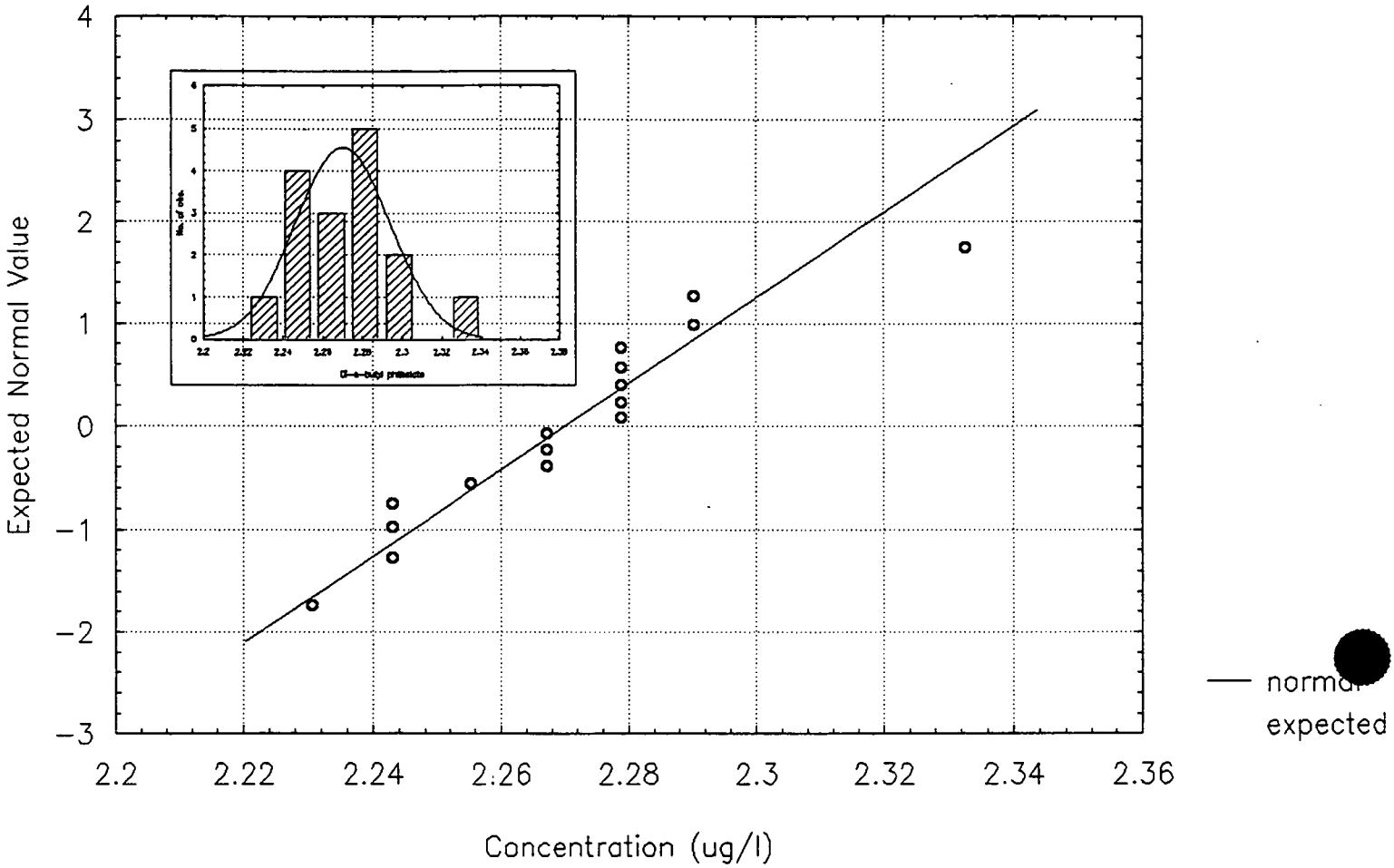


000451

Normal Probability Plot for
Di-n-butyl phthalate
in Background Soil Samples

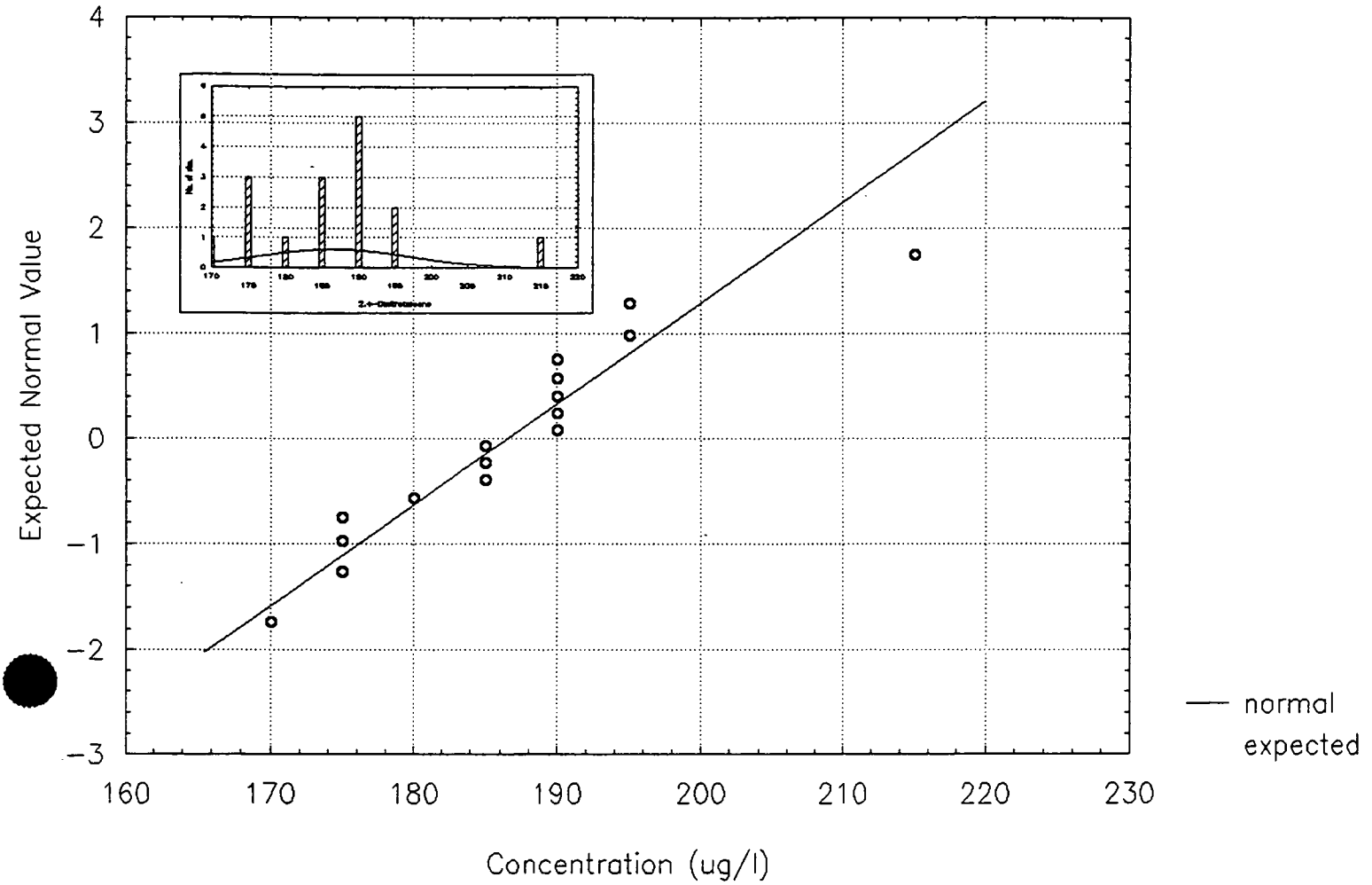


Normal Probablility Plot for
Log Base 10 of
Di-n-butyl phthalate
in Background Soil Samples

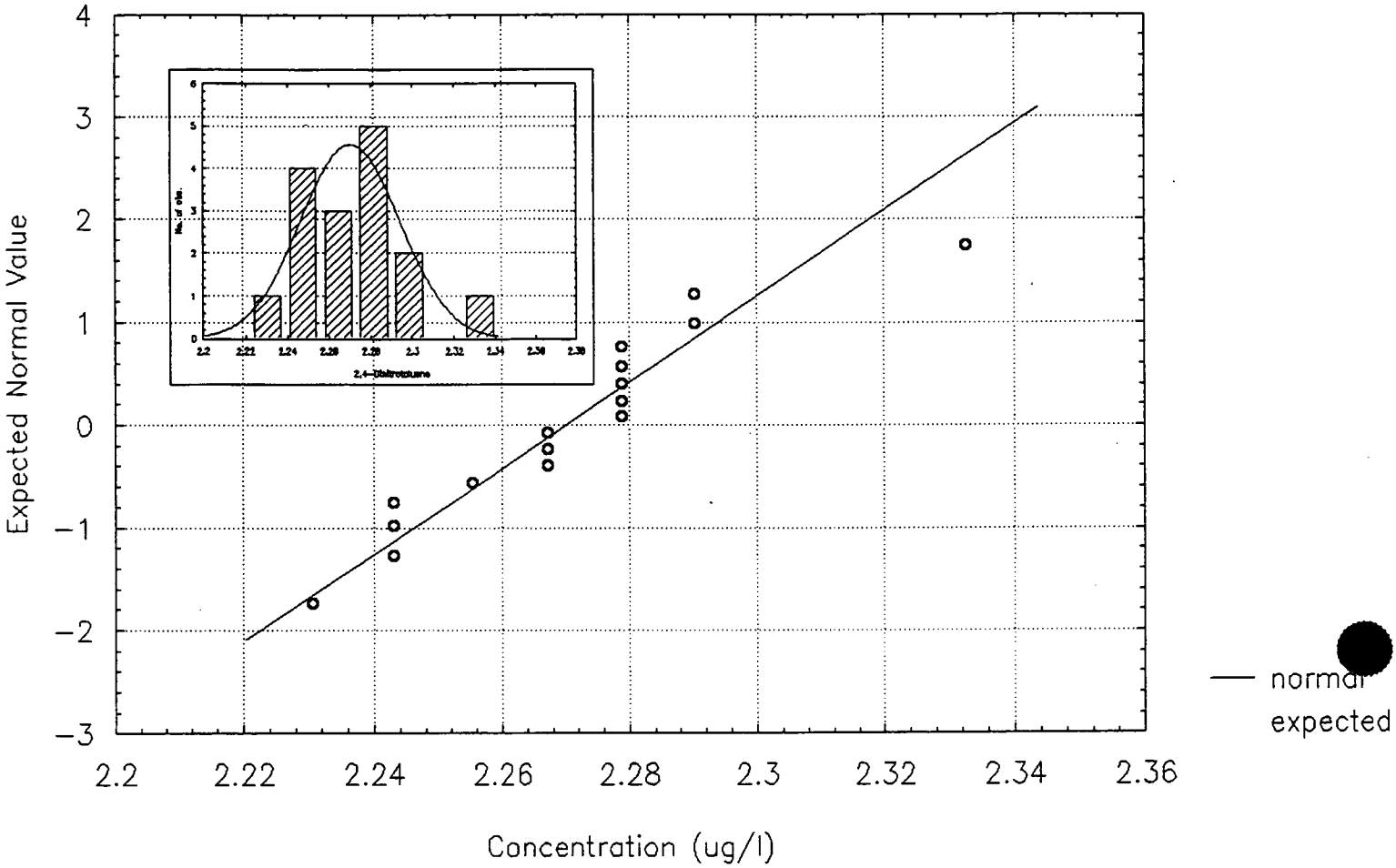


000453

Normal Probability Plot for
2,4-Dinitrotoluene
in Background Soil Samples

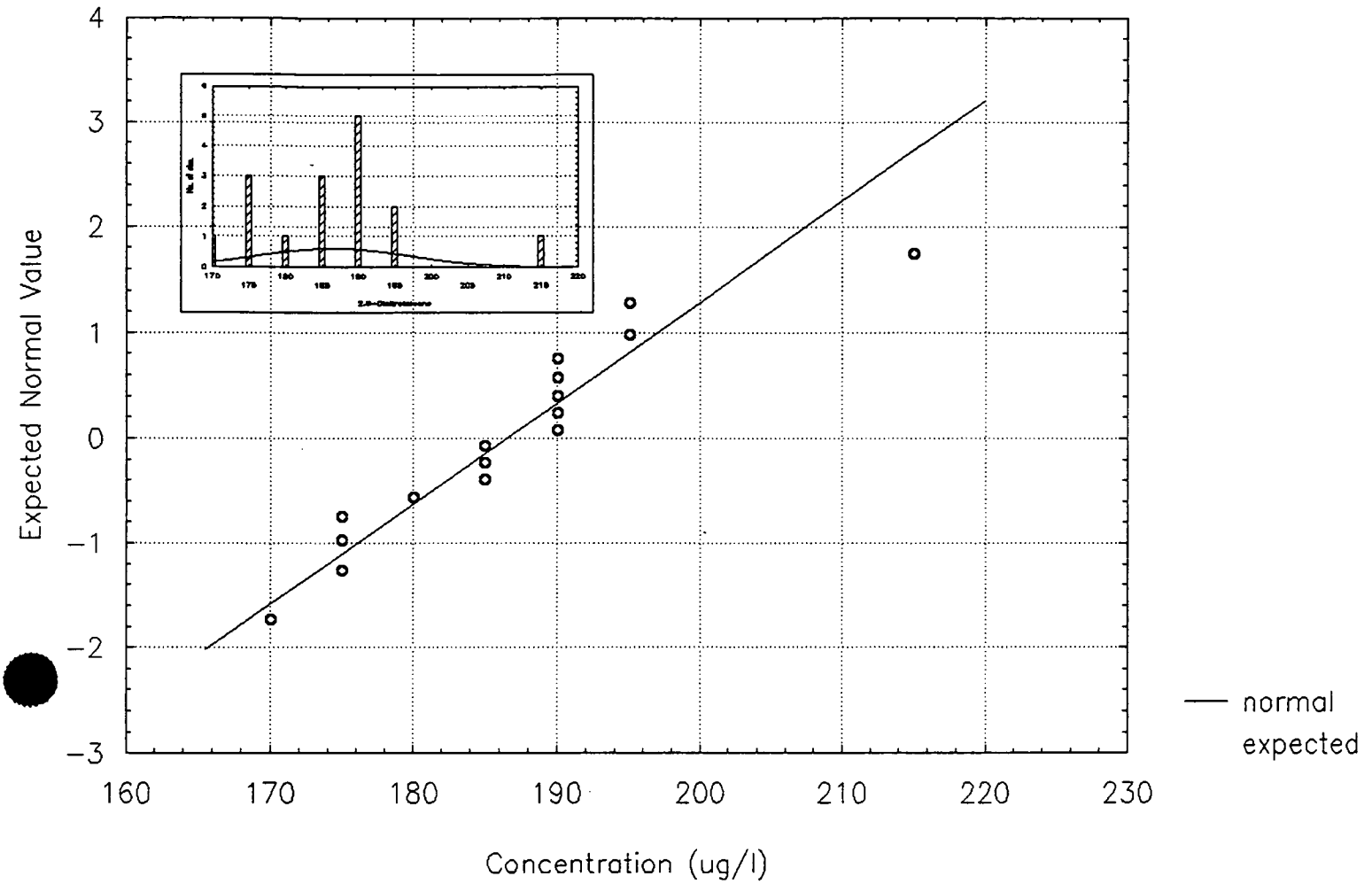


Normal Probablility Plot for
Log Base 10 of
2,4-Dinitrotoluene
in Background Soil Samples

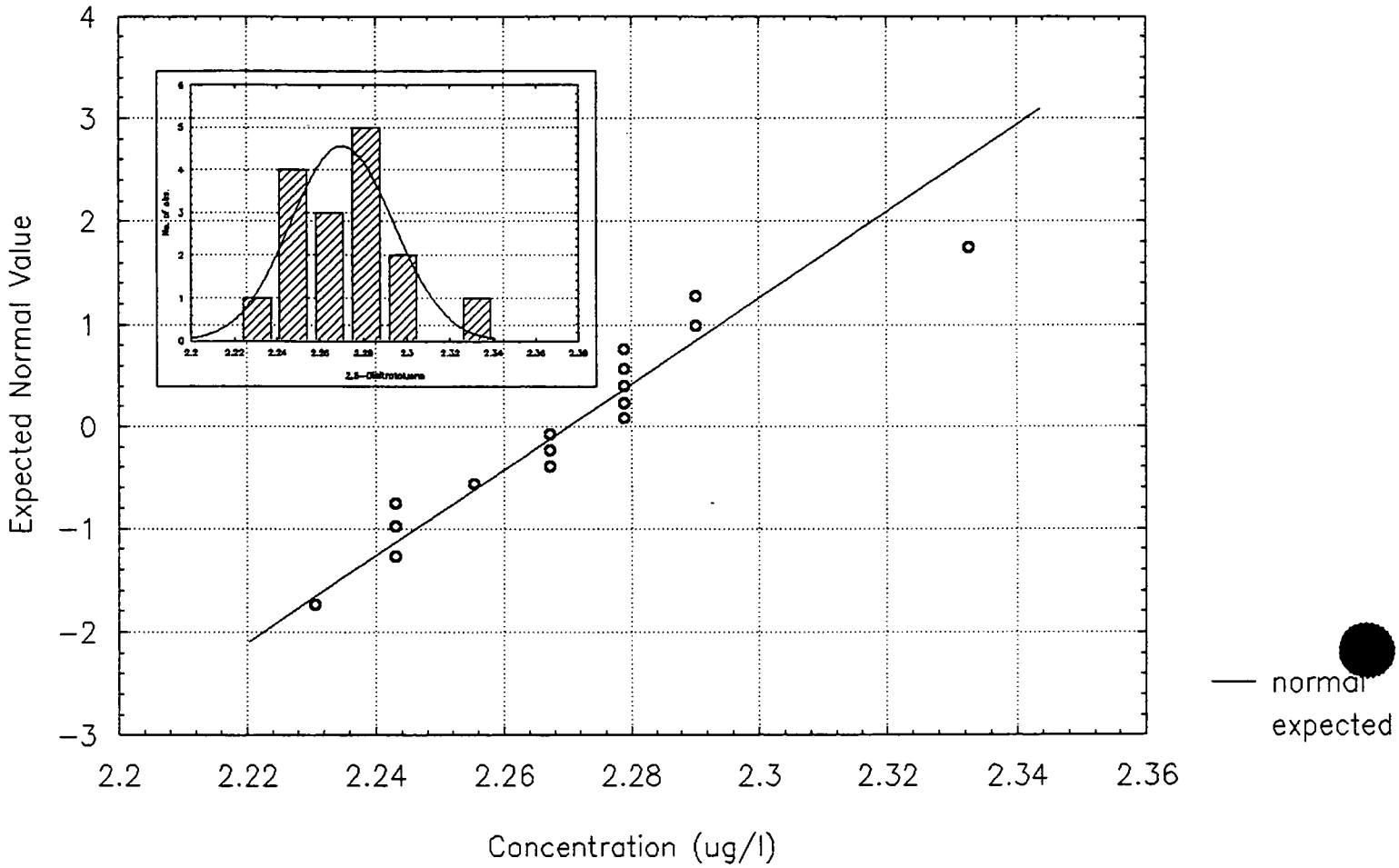


000455

Normal Probability Plot for
2,6-Dinitrotoluene
in Background Soil Samples

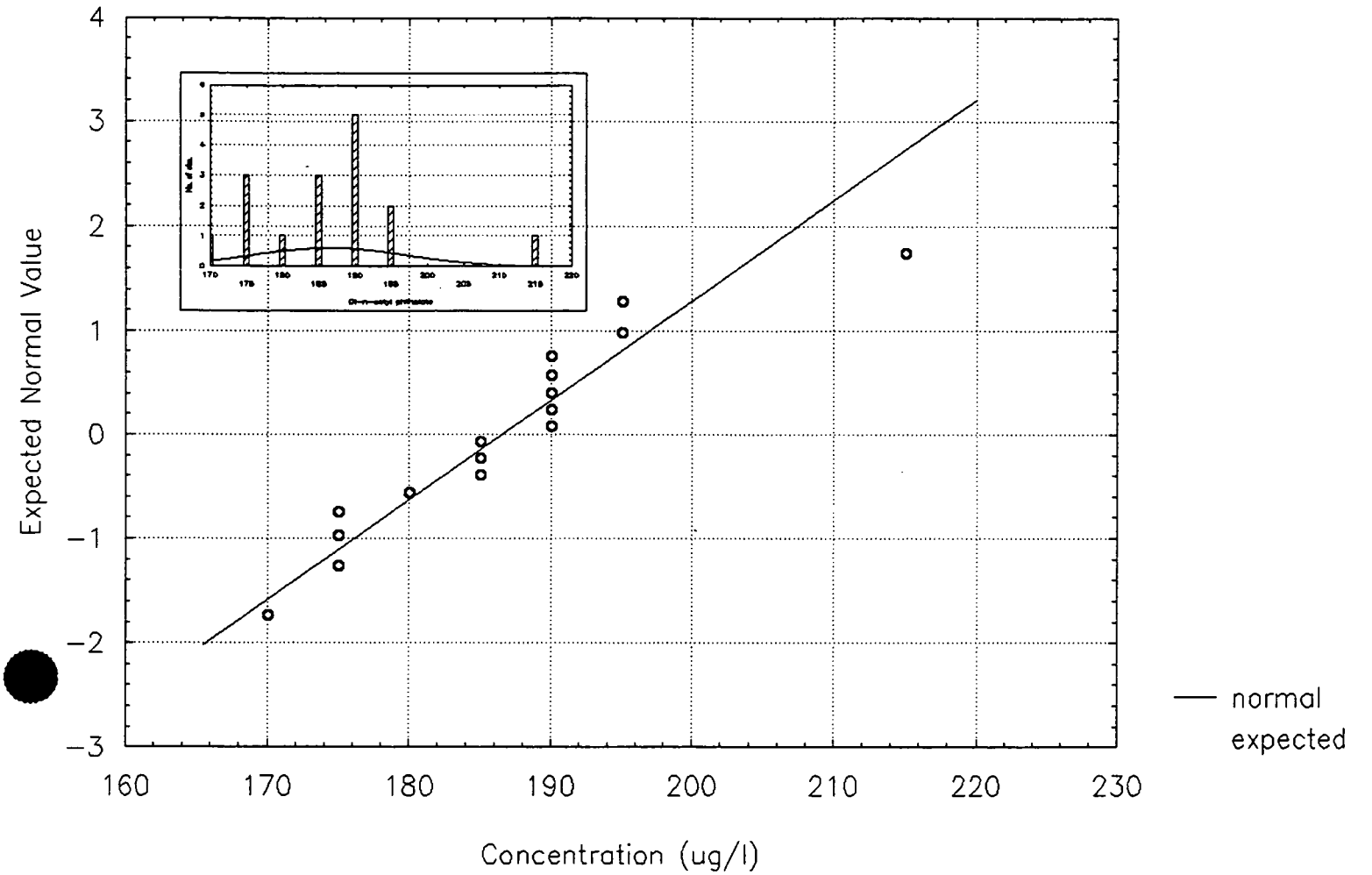


Normal Probablility Plot for
Log Base 10 of
2,6-Dinitrotoluene
in Background Soil Samples

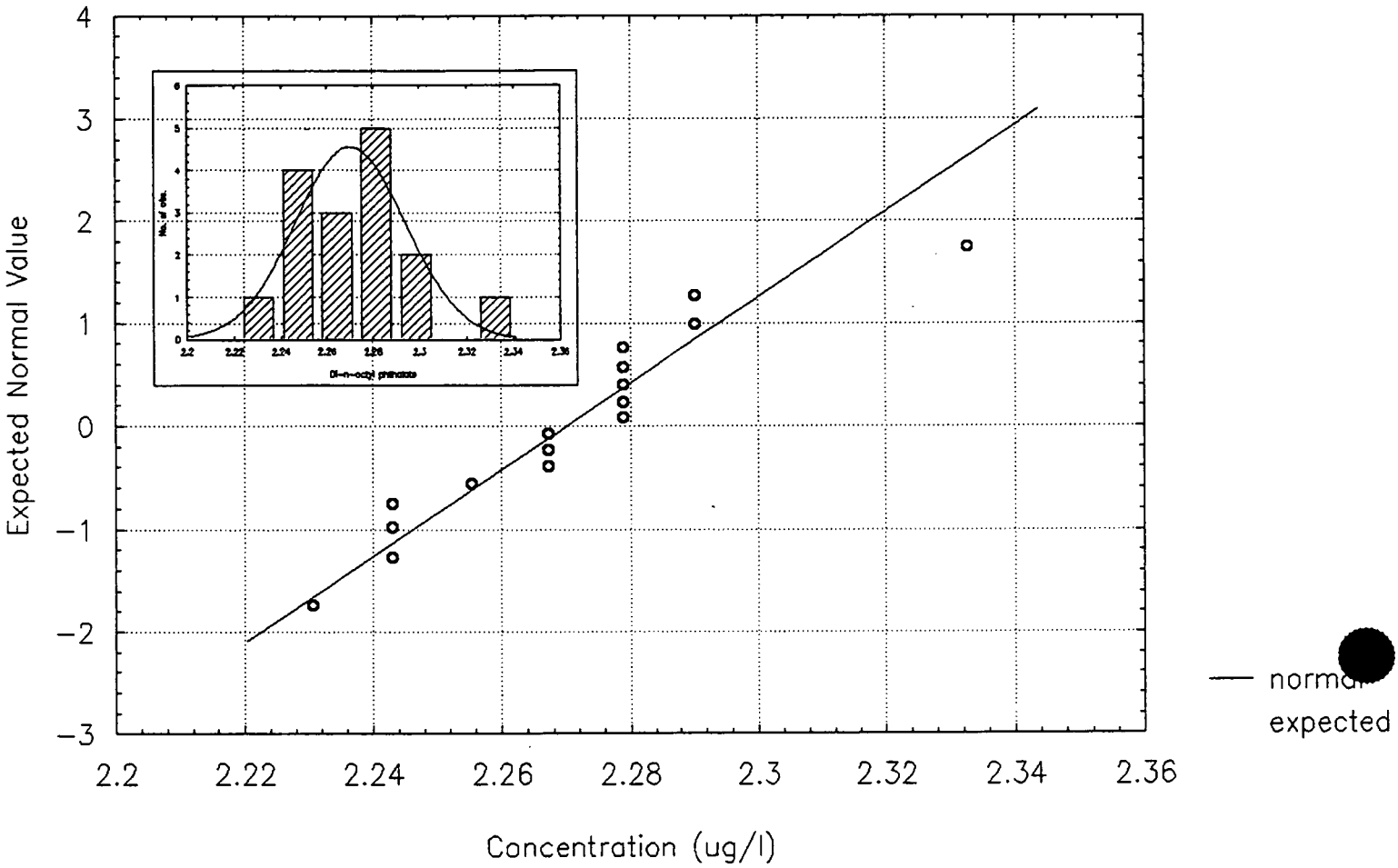


000457

Normal Probability Plot for
di–n–octyl phthalate
in Background Soil Samples

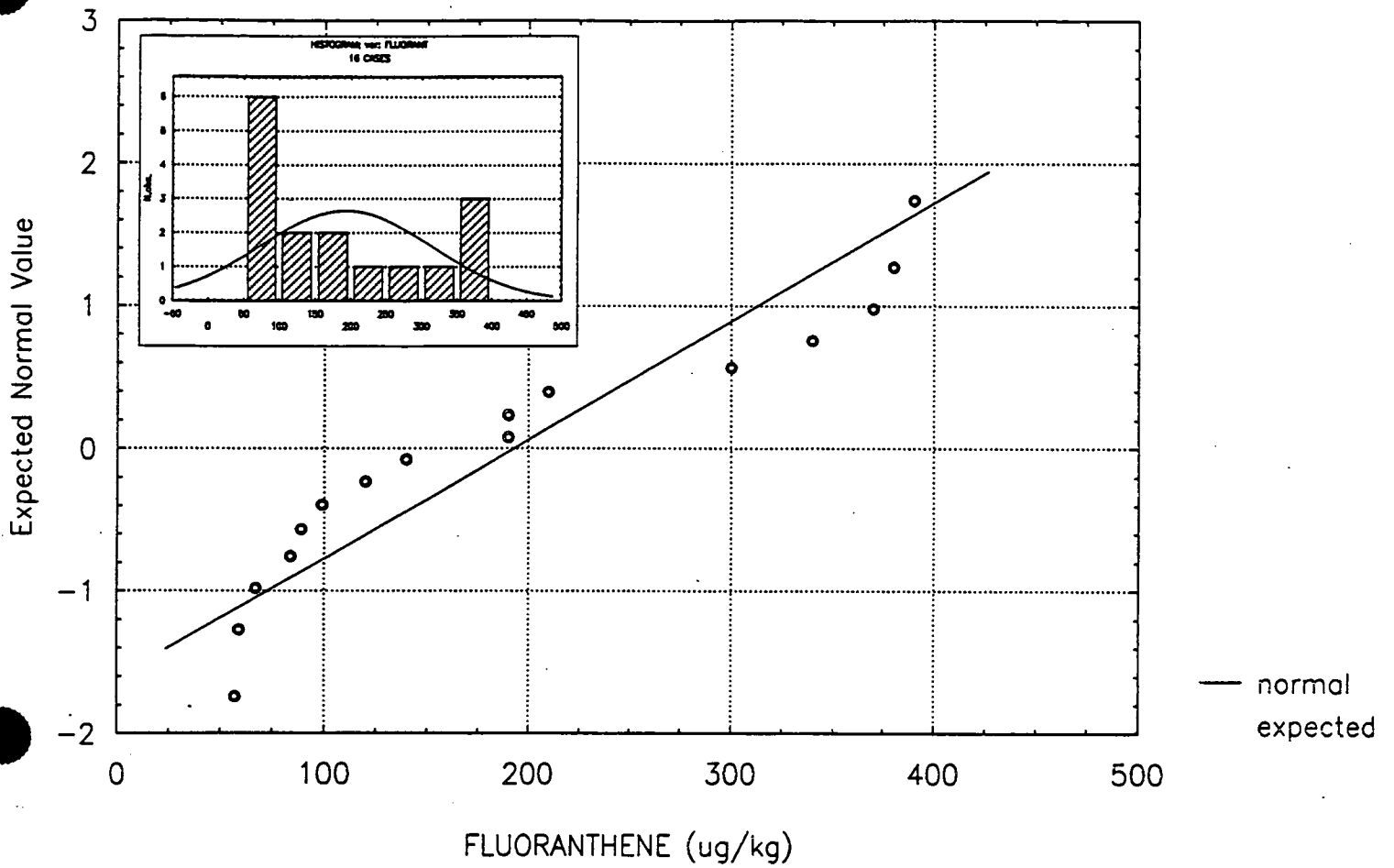


Normal Probablility Plot for
Log Base 10 of
Di-n-octyl phthalate
in Background Soil Samples

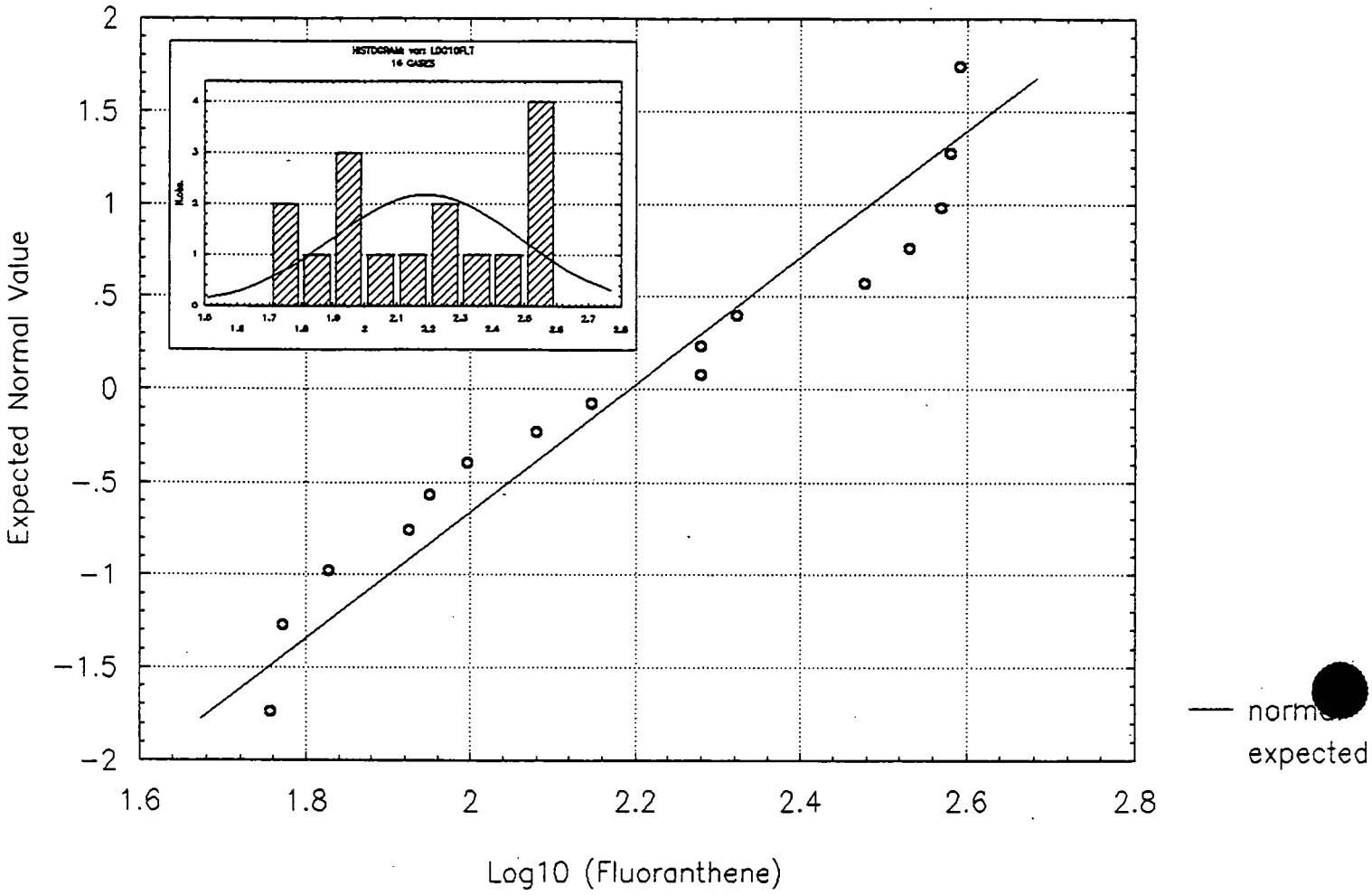


CCC459

Normal Probablility Plot
for Fluoranthene in Surface Soils

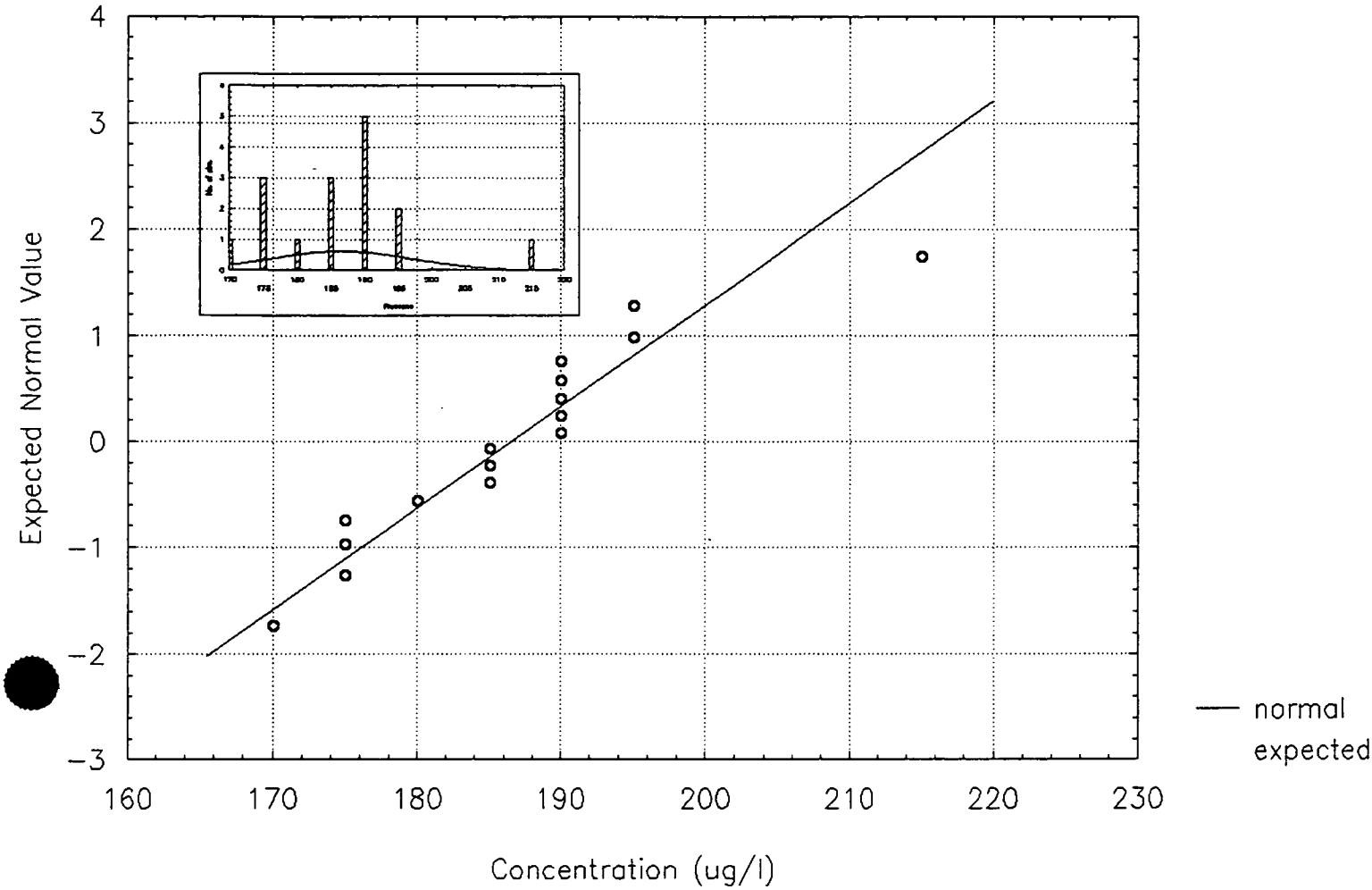


Normal Probablility Plot for the Log
Base 10 Transform of Fluoranthene in
Background Surface Soil

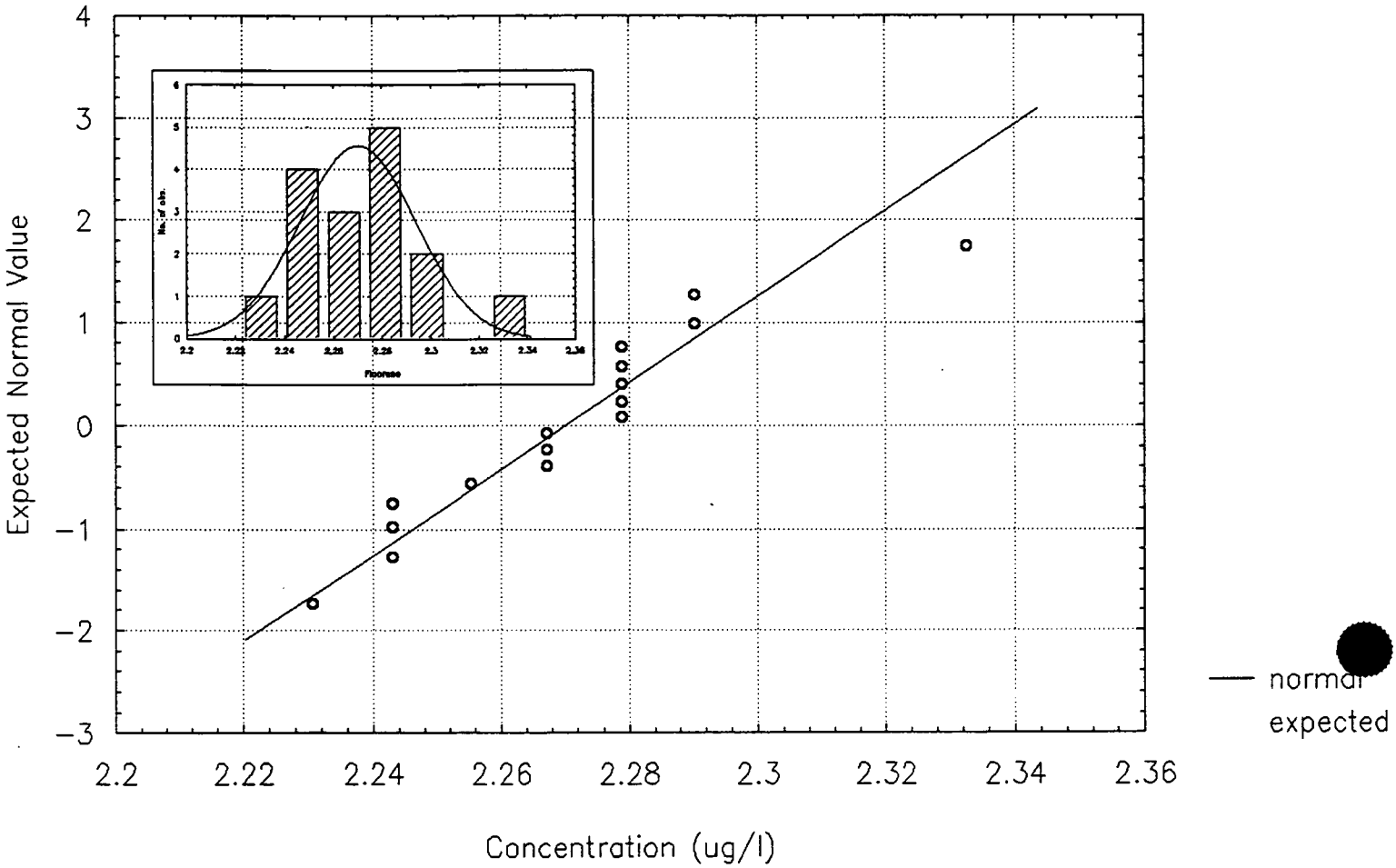


000461

Normal Probability Plot for
Fluorene
in Background Soil Samples

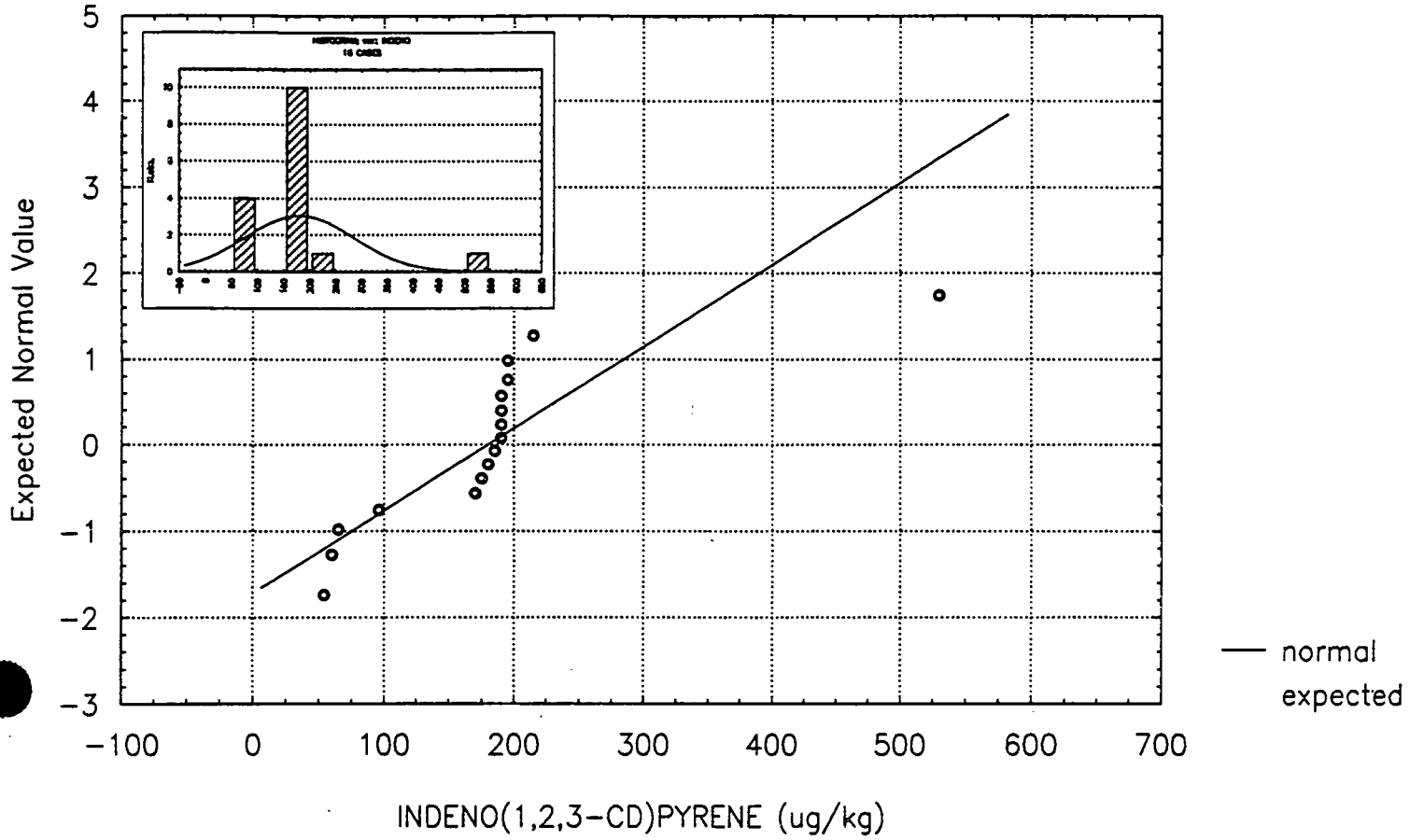


Normal Probablility Plot for
Log Base 10 of
Fluorene
in Background Soil Samples

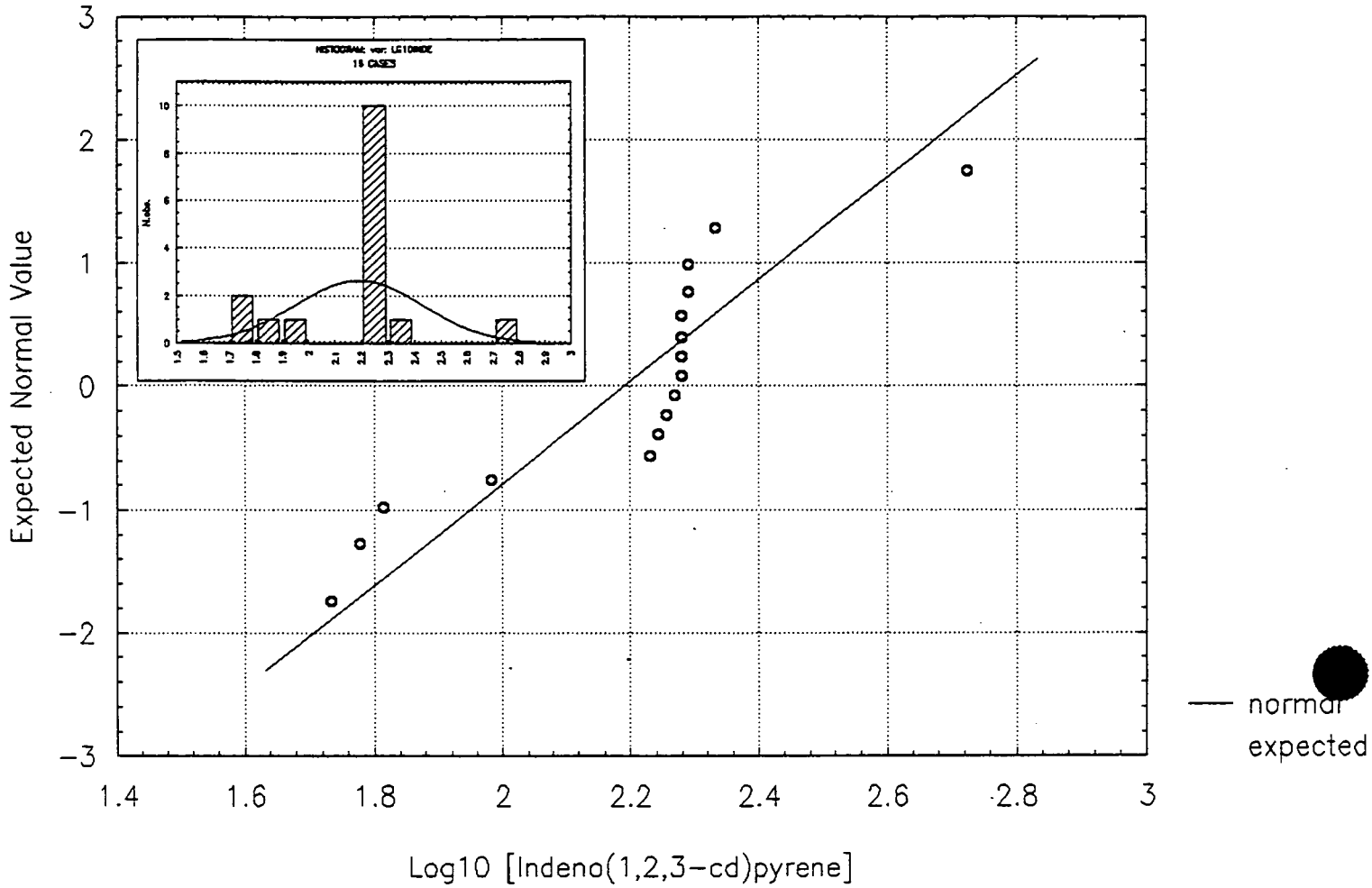


000463

Normal Probablility Plot
for Indeno(1,2,3-cd)pyrene in
Background Surface Soils

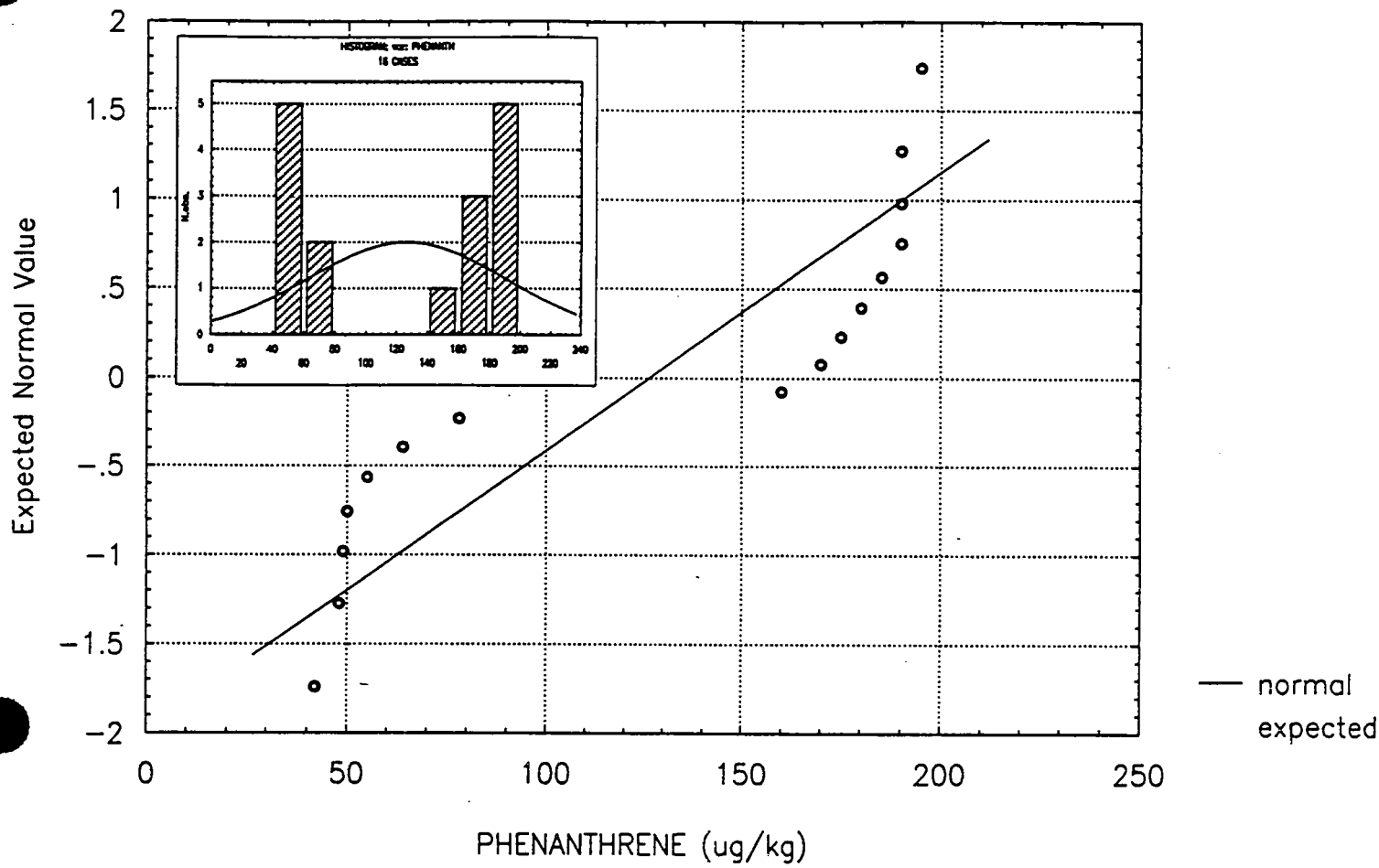


Normal Probablility Plot for the Log
Base 10 Transform of Indeno(1,2,3-cd)pyrene
in Background Surface Soil

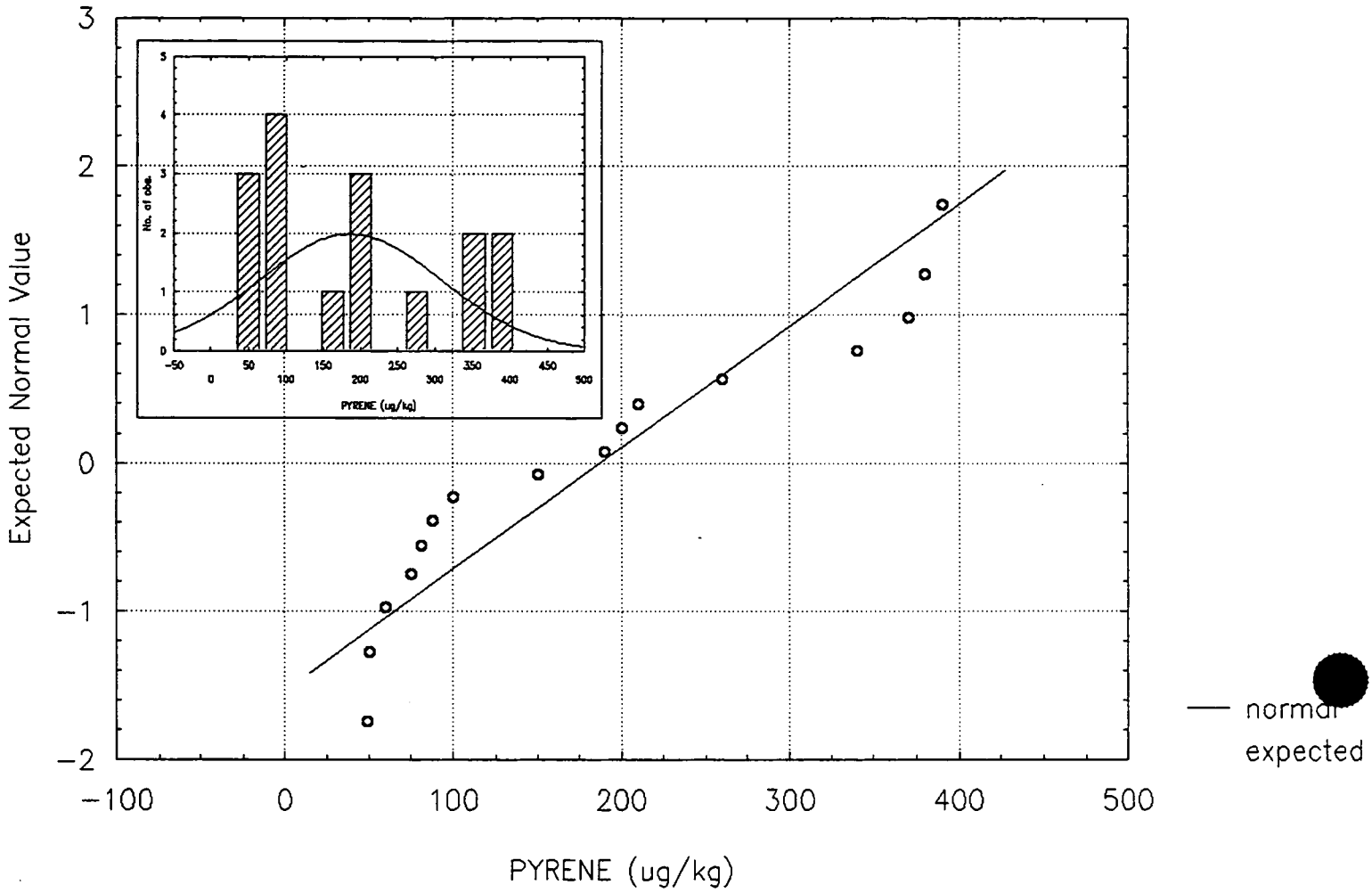


000465

Normal Probablility Plot
for Phenanthrene in Surface Soils

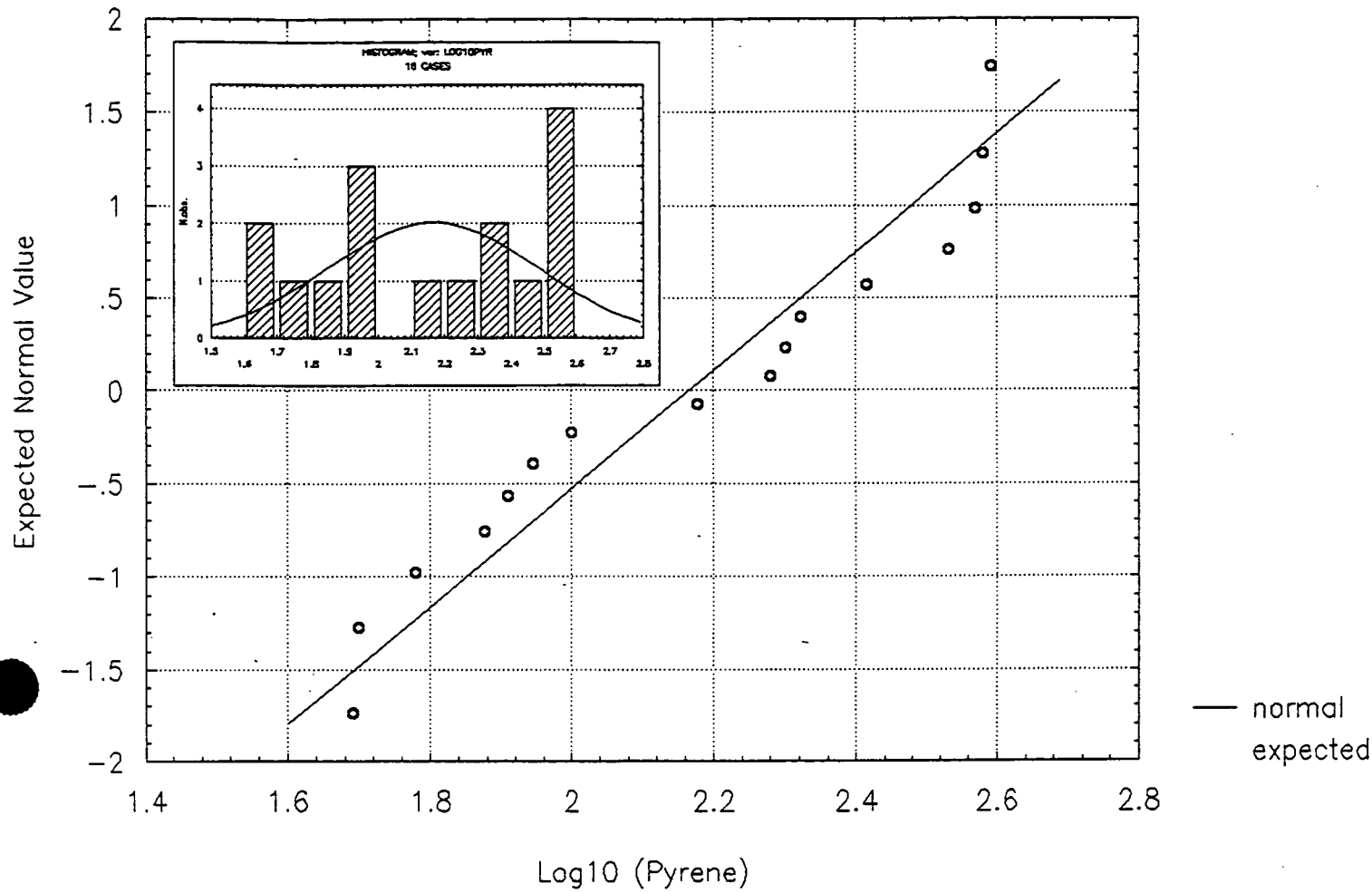


Normal Probablility Plot
for Pyrene in Background
Surface Soils

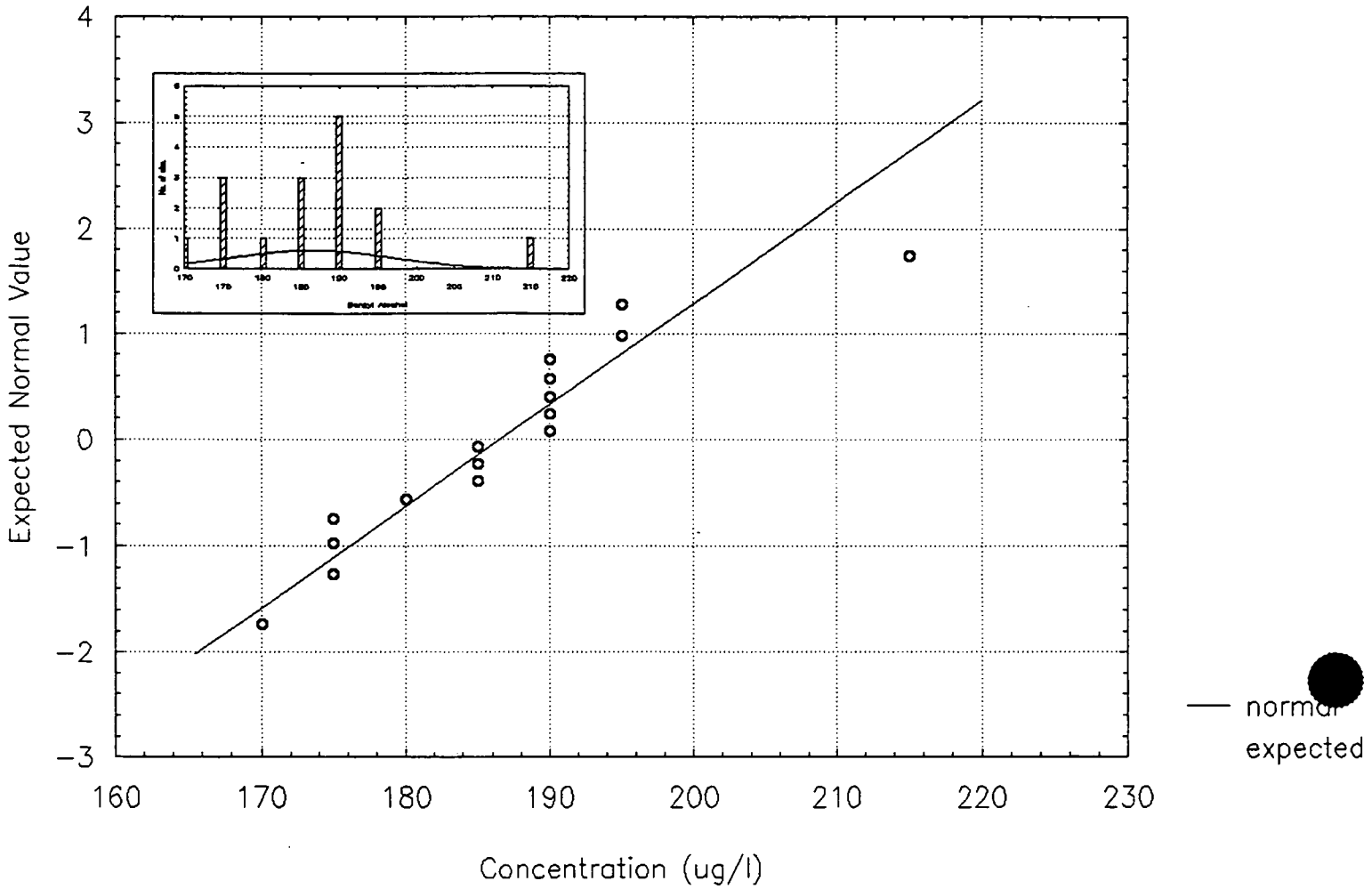


000467

Normal Probablility Plot for the Log Base 10 Transform of Pyrene in Background Surface Soils

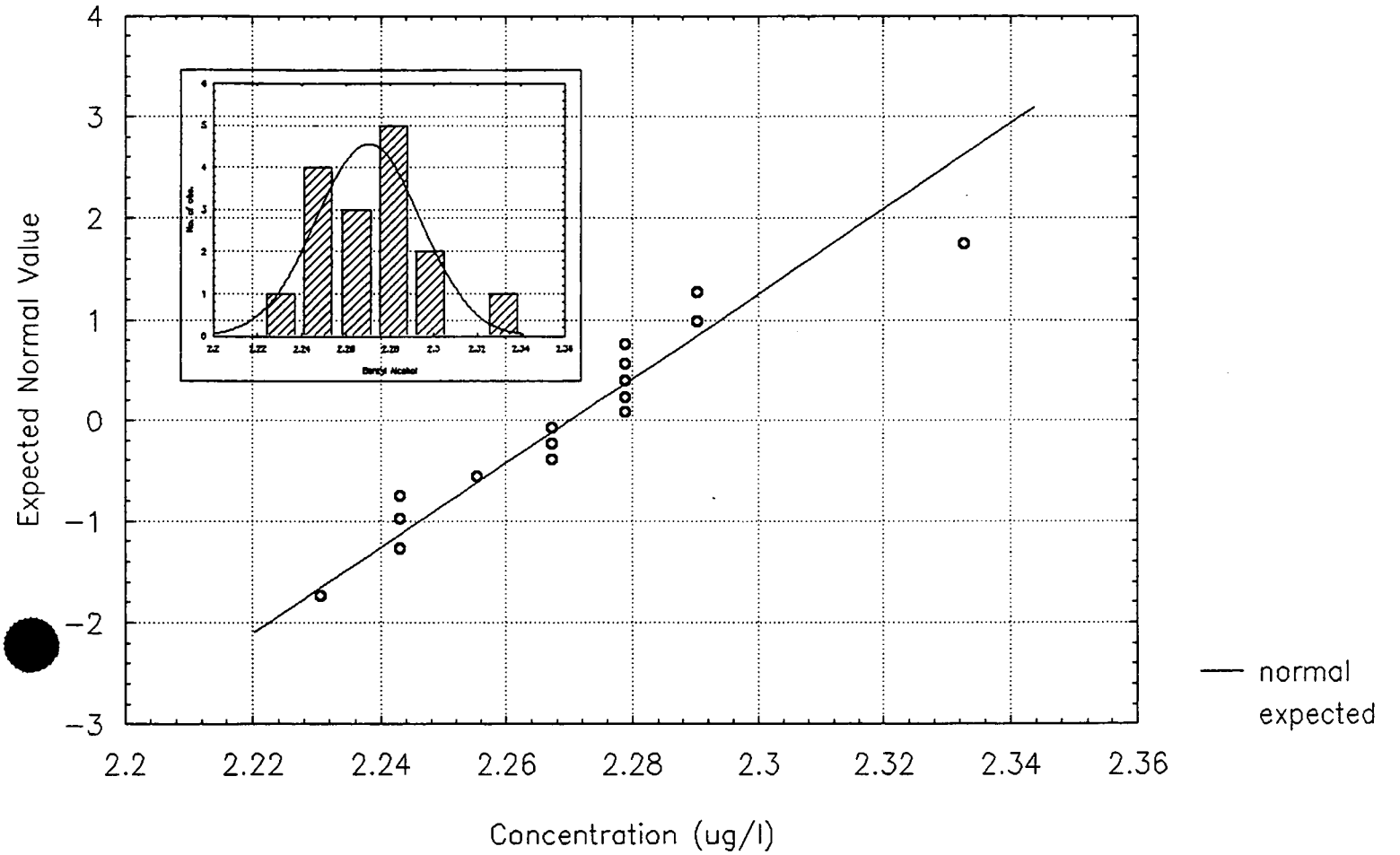


Normal Probability Plot for
Benzyl alcohol
in Background Soil Samples

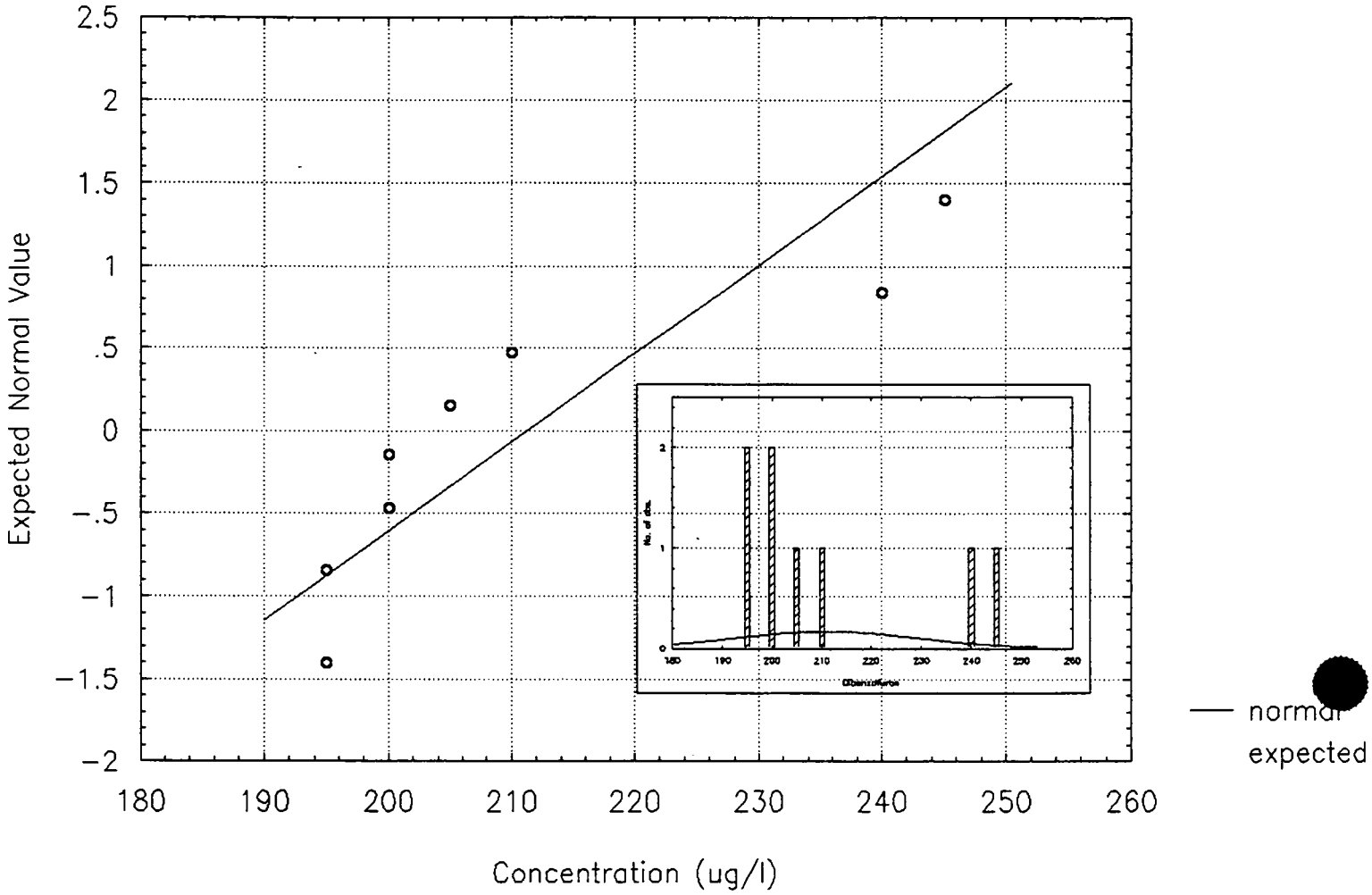


000469

Normal Probablility Plot for
Log Base 10 of
Benzyl Alcohol
in Background Soil Samples

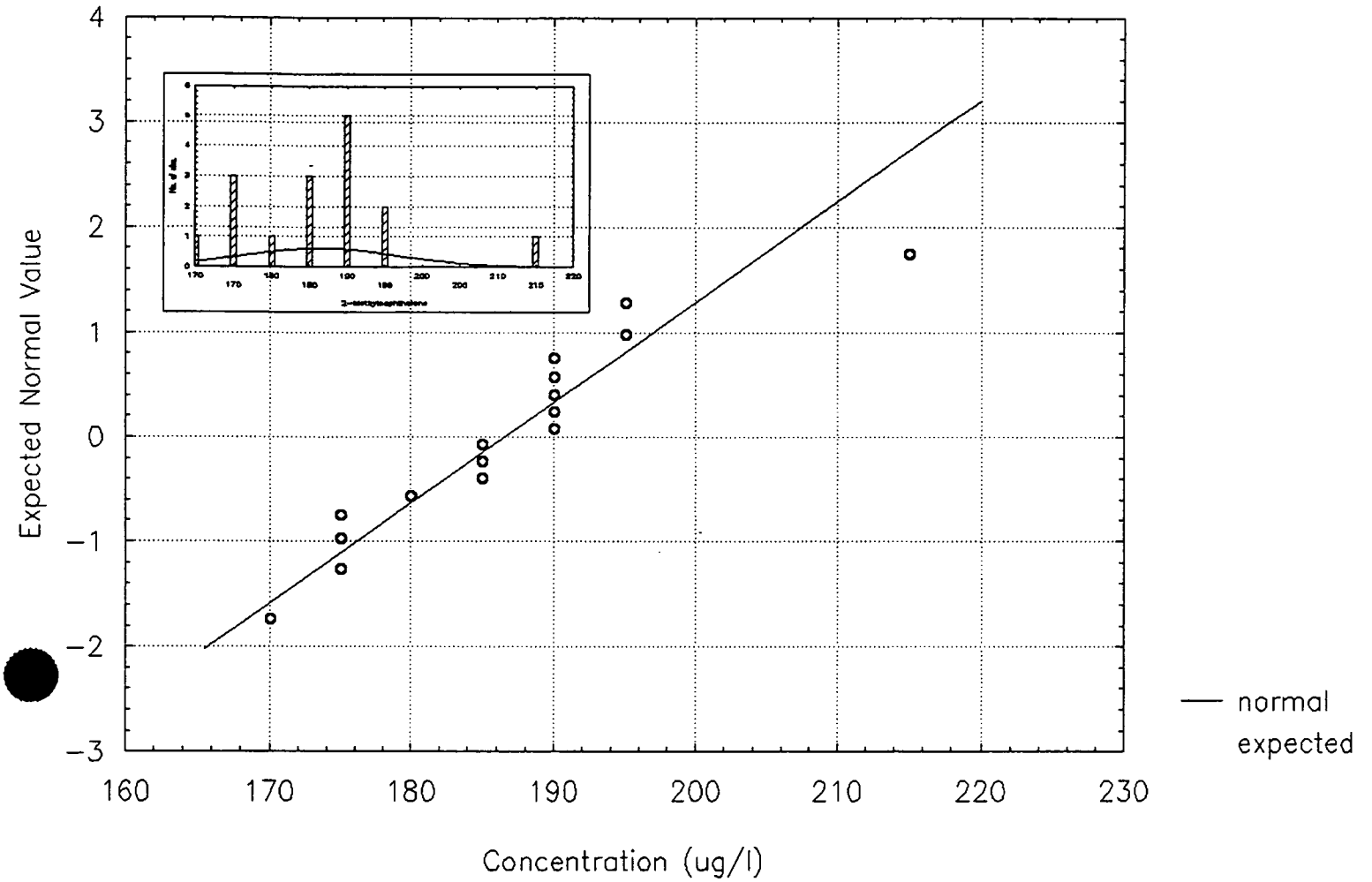


Normal Probablility Plot of
Dibenzofuran
in Background Soil Samples

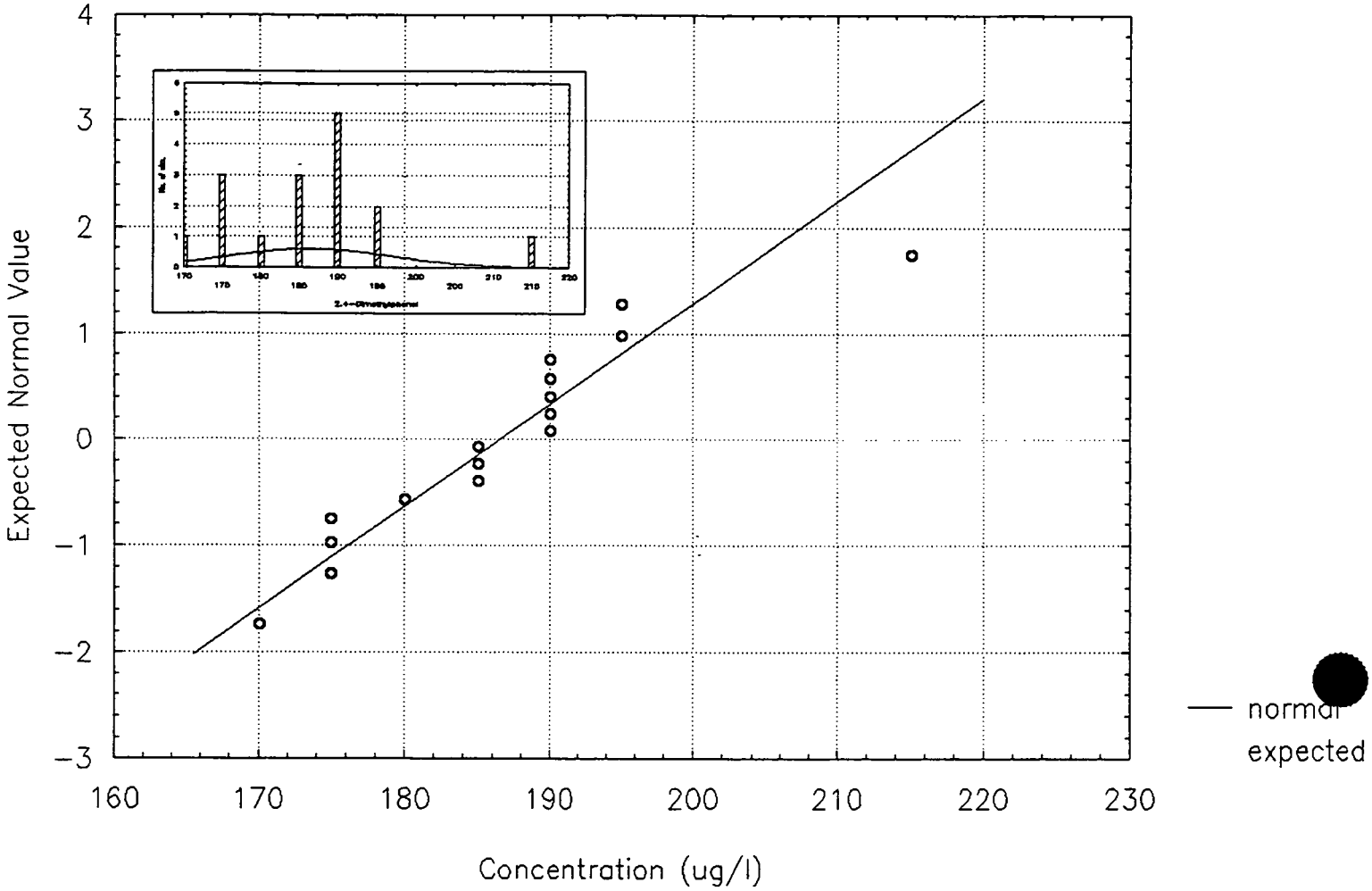


000471

Normal Probability Plot for
2-Methylnaphthalene
in Background Soil Samples

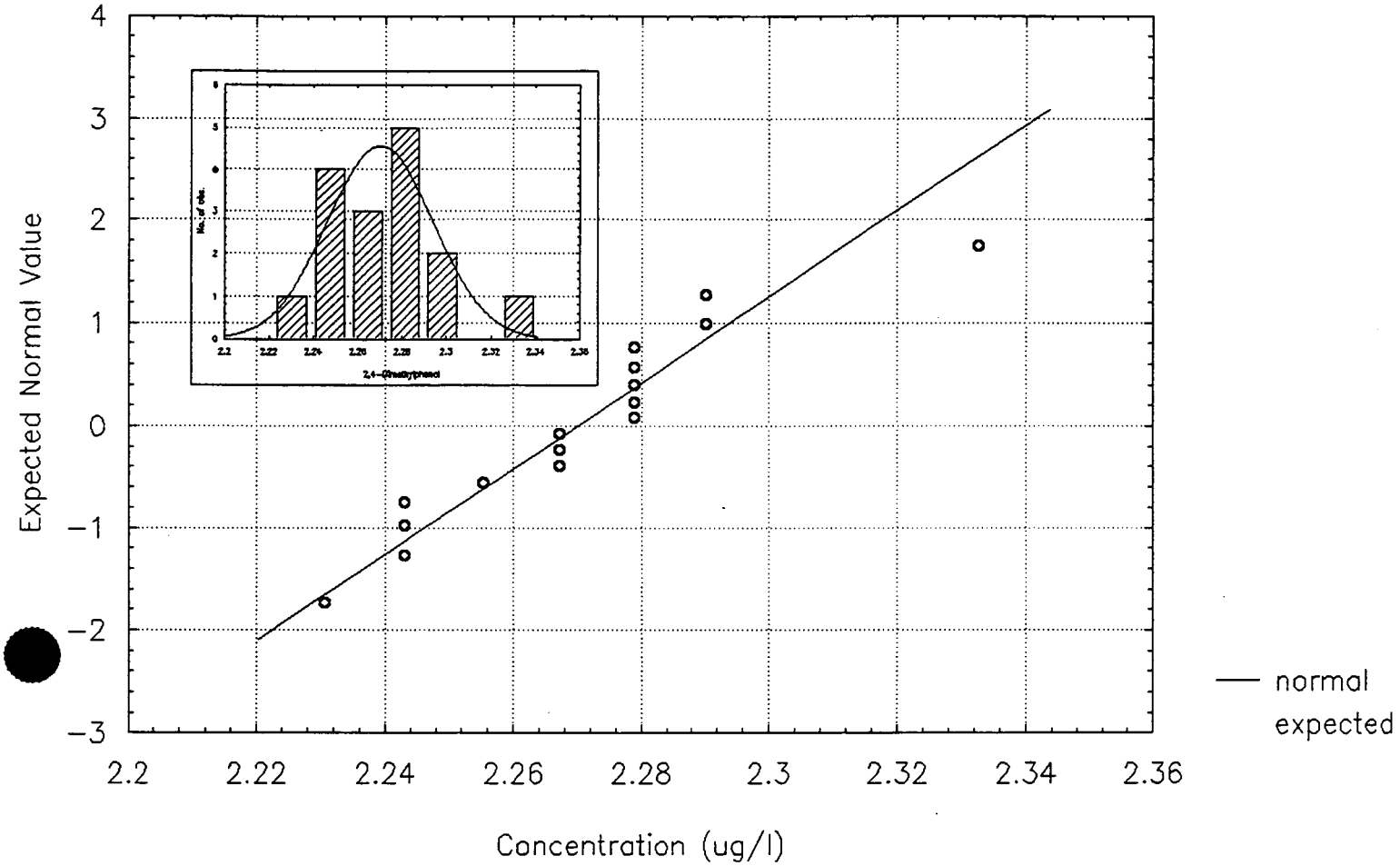


Normal Probability Plot for
2,4-Dimethy~~lnaphthalene~~ phenol
in Background Soil Samples

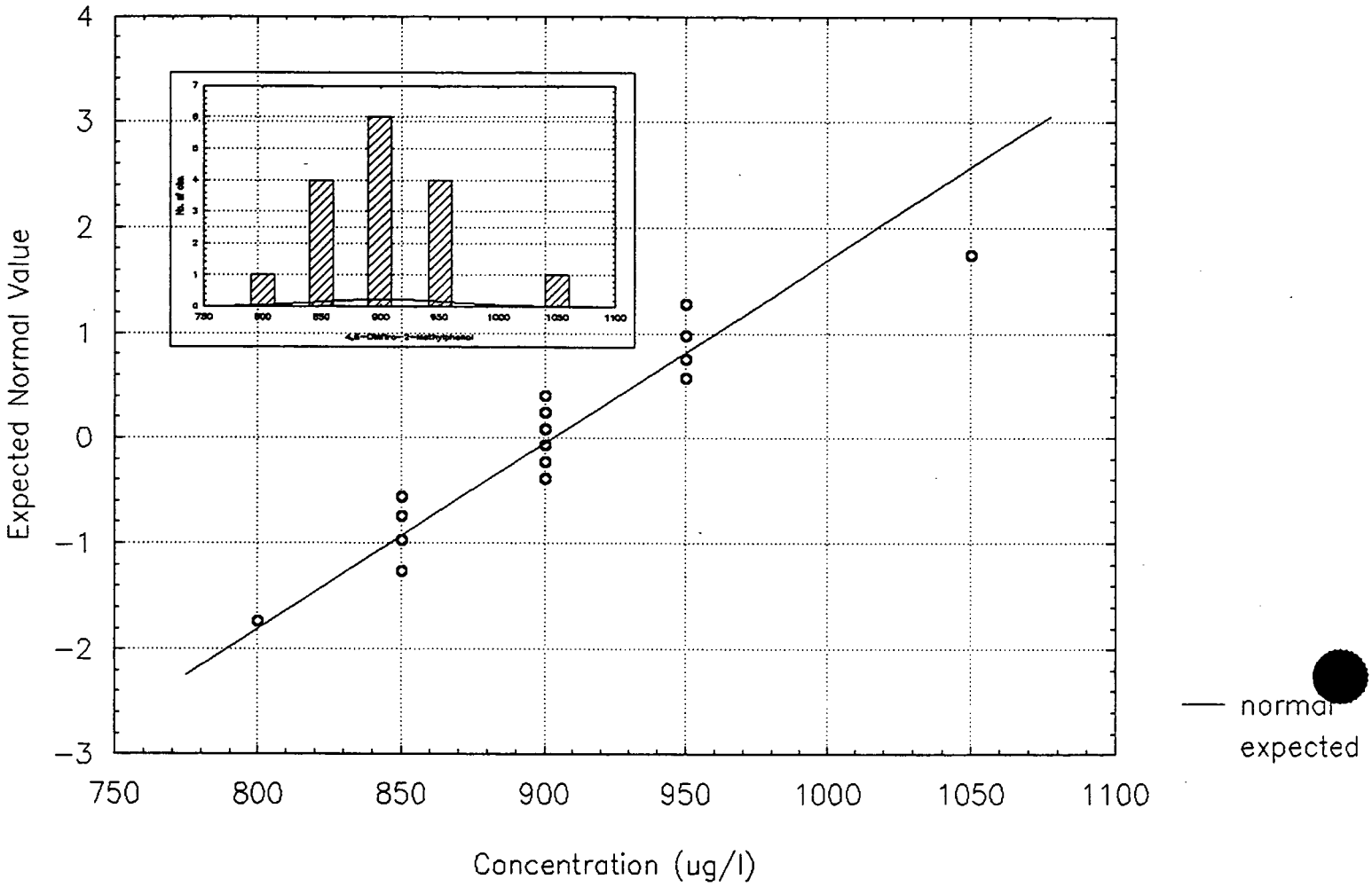


000473

Normal Probablility Plot for
Log Base 10 of
2,4-Dimethylphenol
in Background Soil Samples

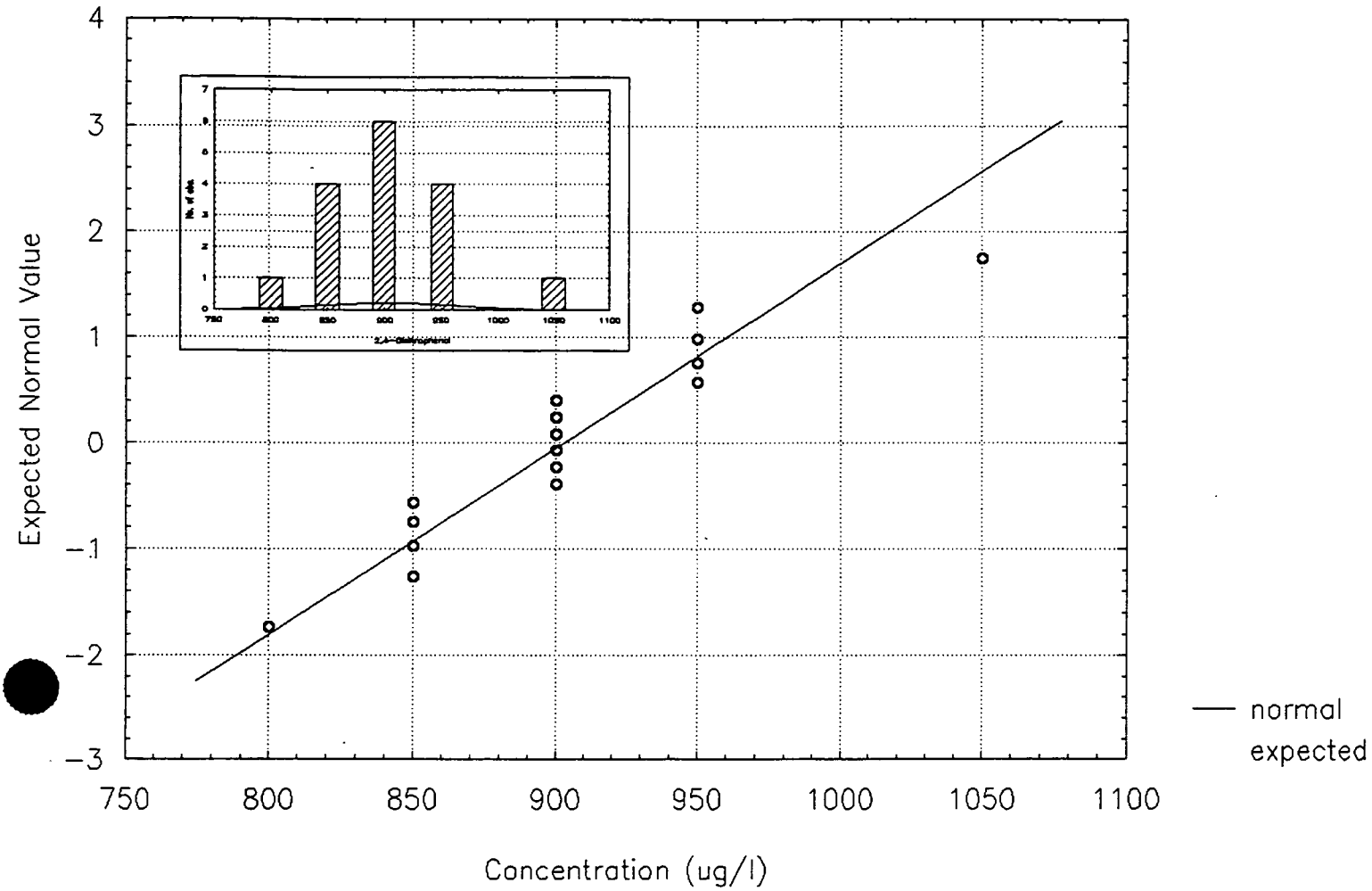


Normal Probablility Plot for
4,6-Dinitro-2-Methylphenol
in Background Surface Soils

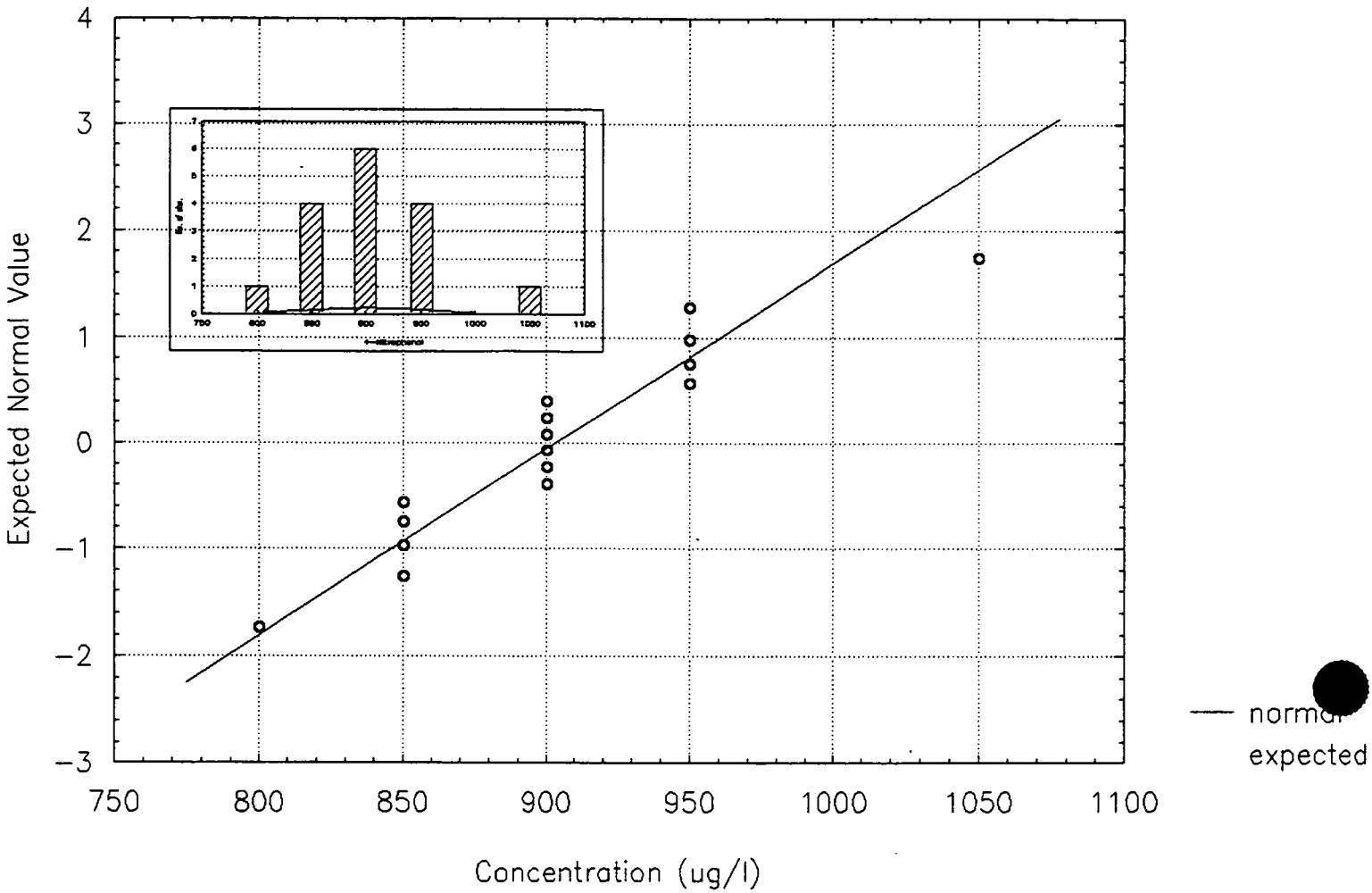


000475

Normal Probablility Plot for
2,4–Dinitrophenol
in Background Surface Soils

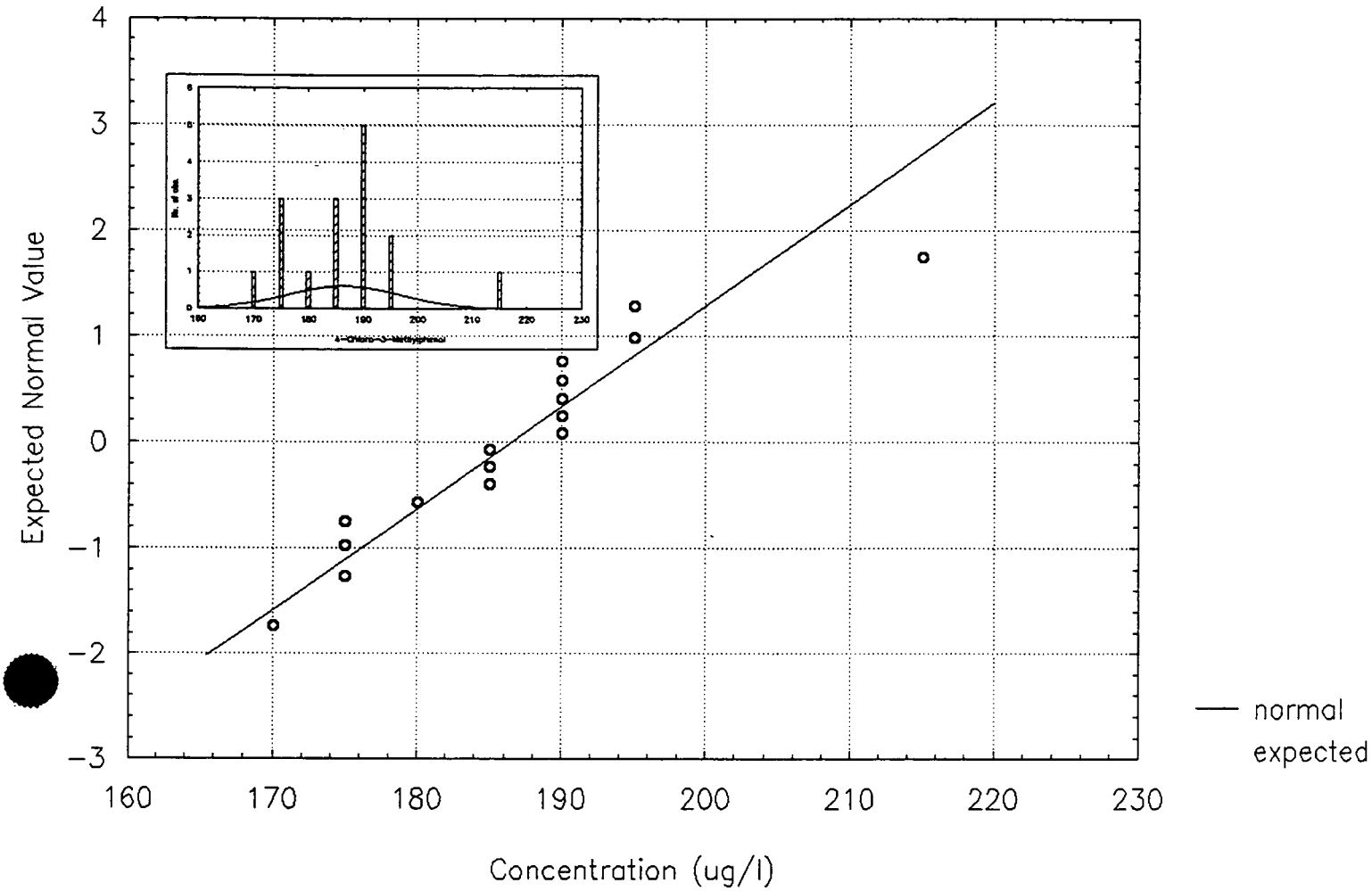


Normal Probablility Plot for
4-Nitrophenol
in Background Surface Soils

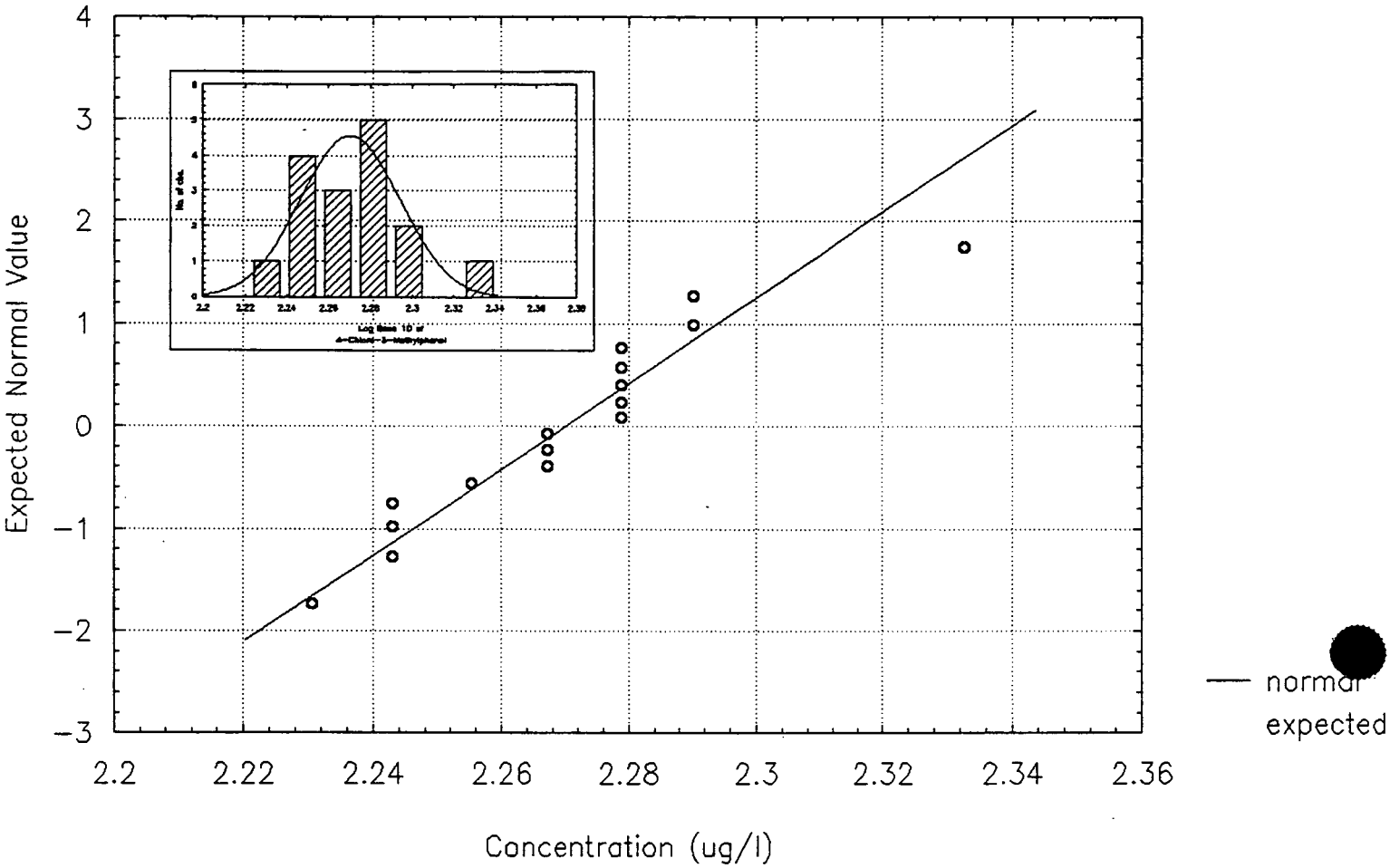


000477

Normal Probablility Plot for
4-Chloro-3-Methylphenol
in Background Surface Soils

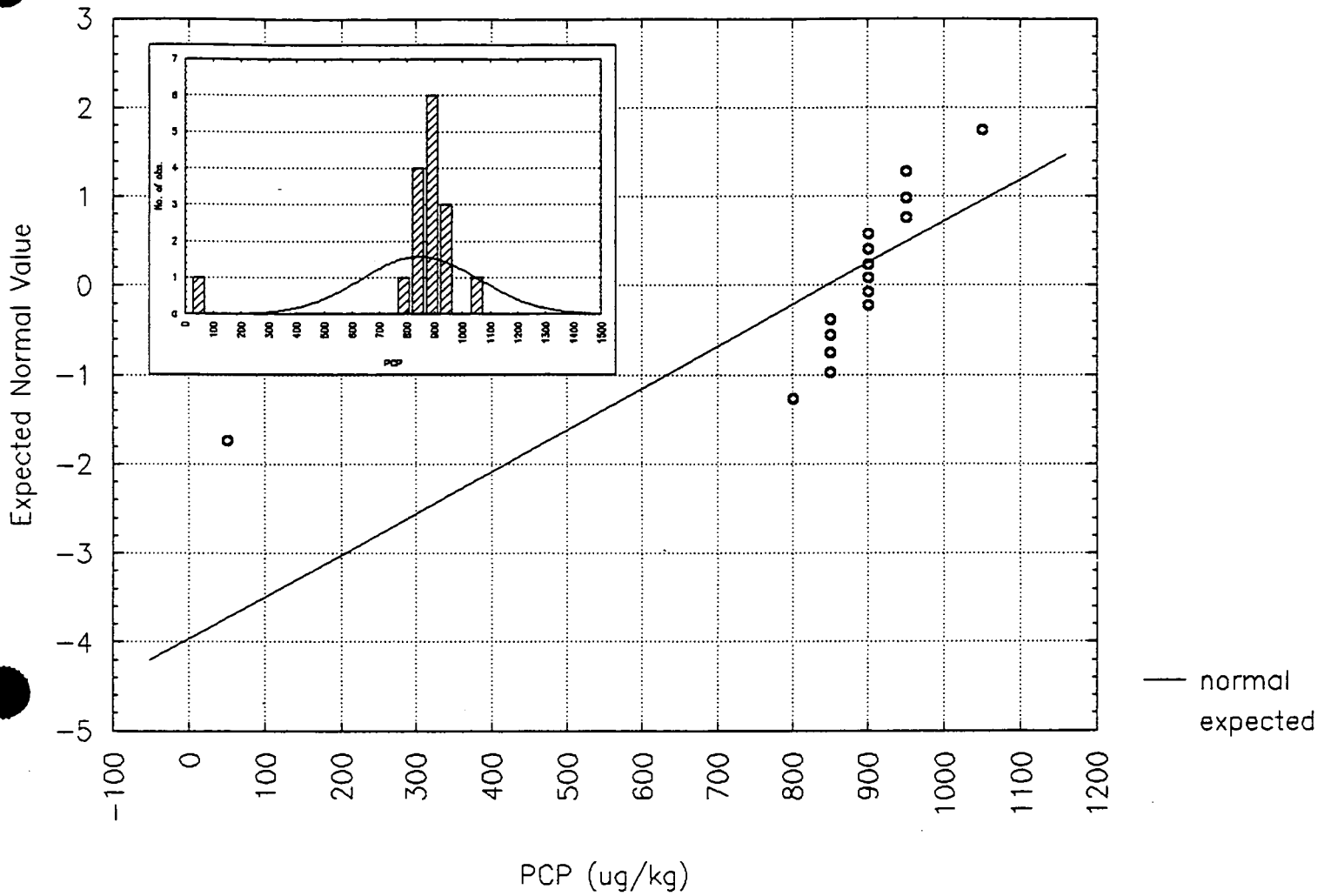


Normal Probablility Plot for
log Base 10 of
4-chloro-3-Methylphenol
in Background Surface Soils

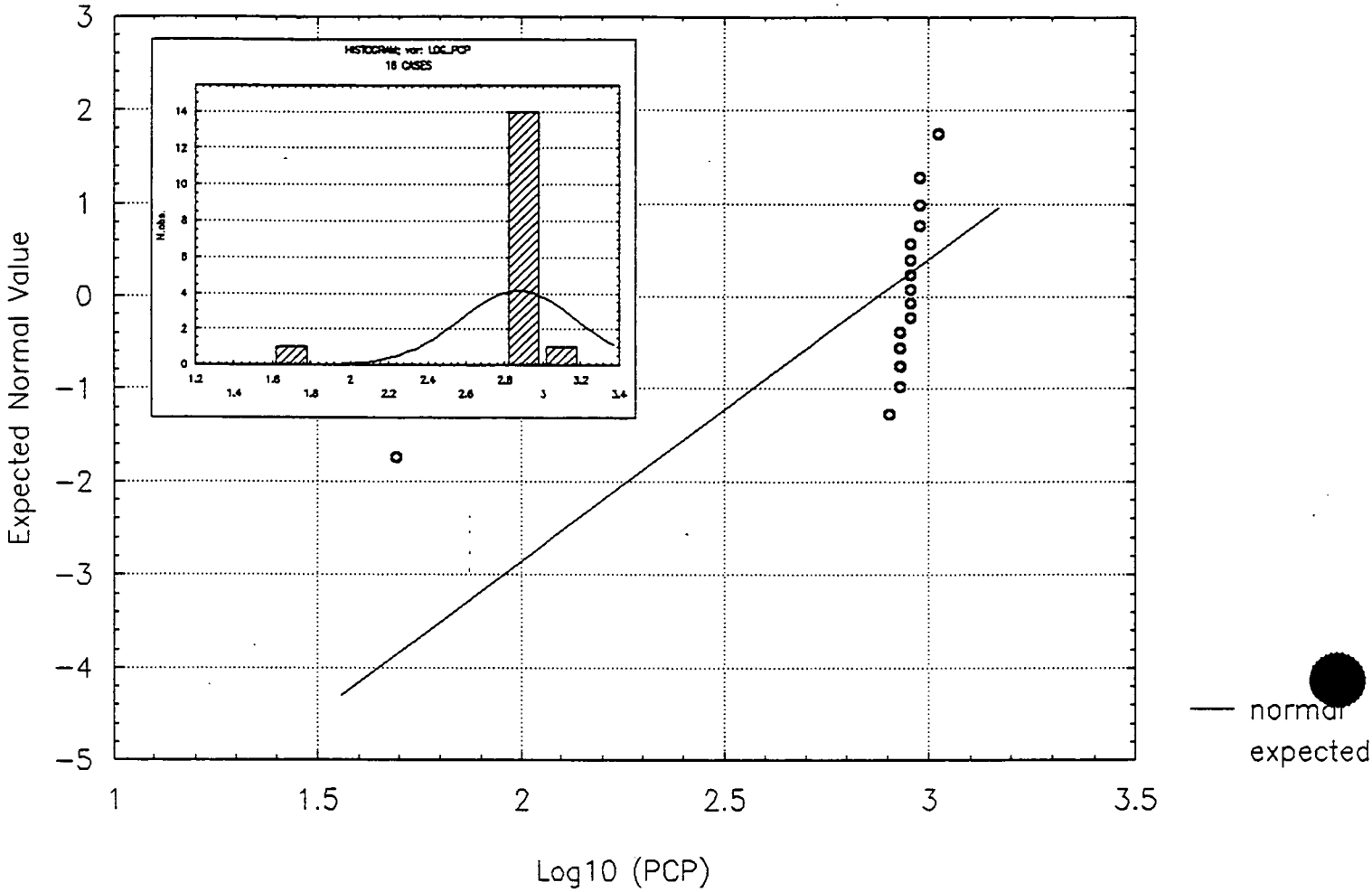


000479

Normal Probablility Plot for Pentachlorophenol
in Background Surface Soils

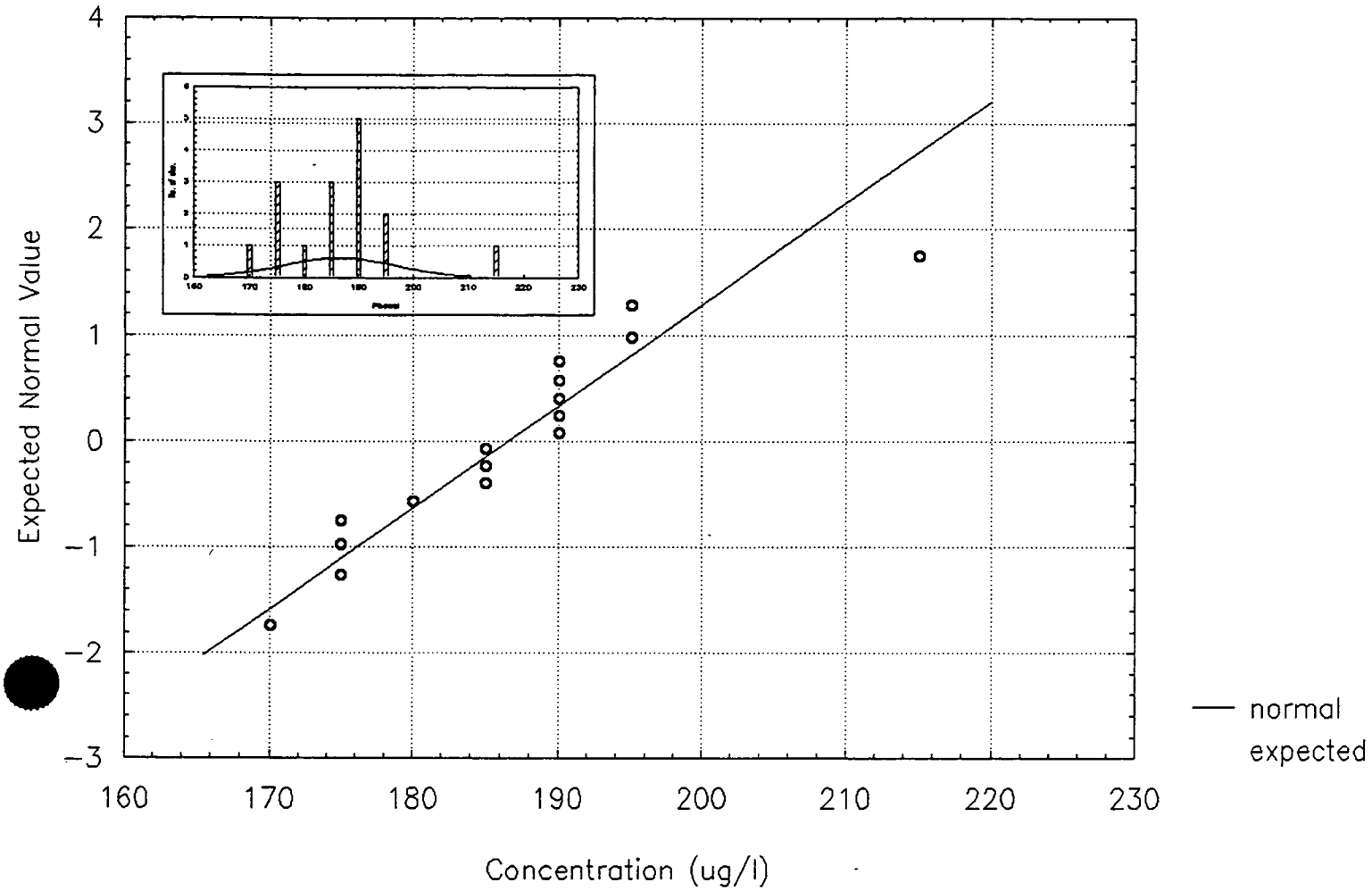


Normal Probablility Plot for the Log
Base 10 Transform of Pentachlorophenol
in Background Surface Soil

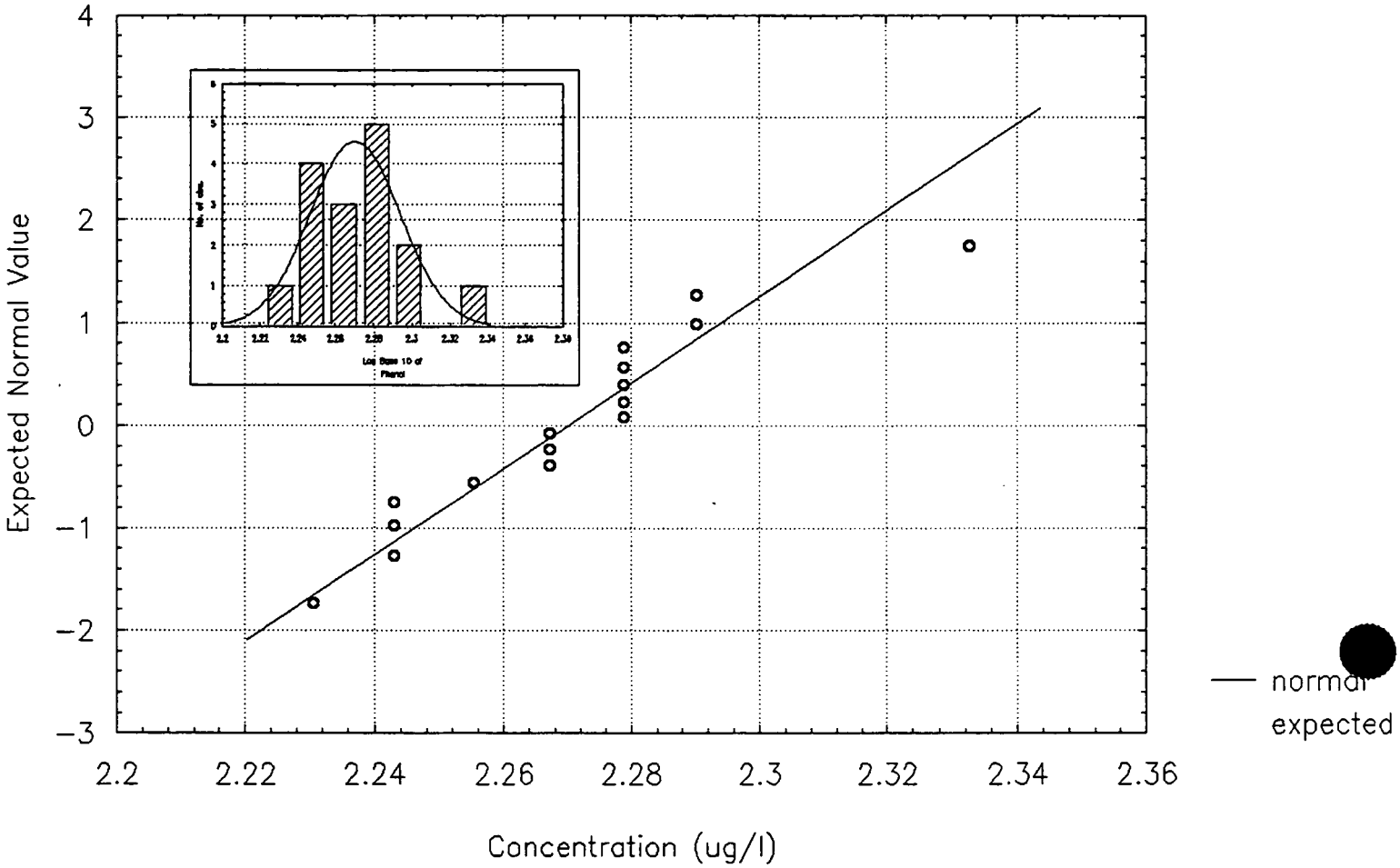


000481

Normal Probablility Plot for
Phenol
in Background Surface Soils

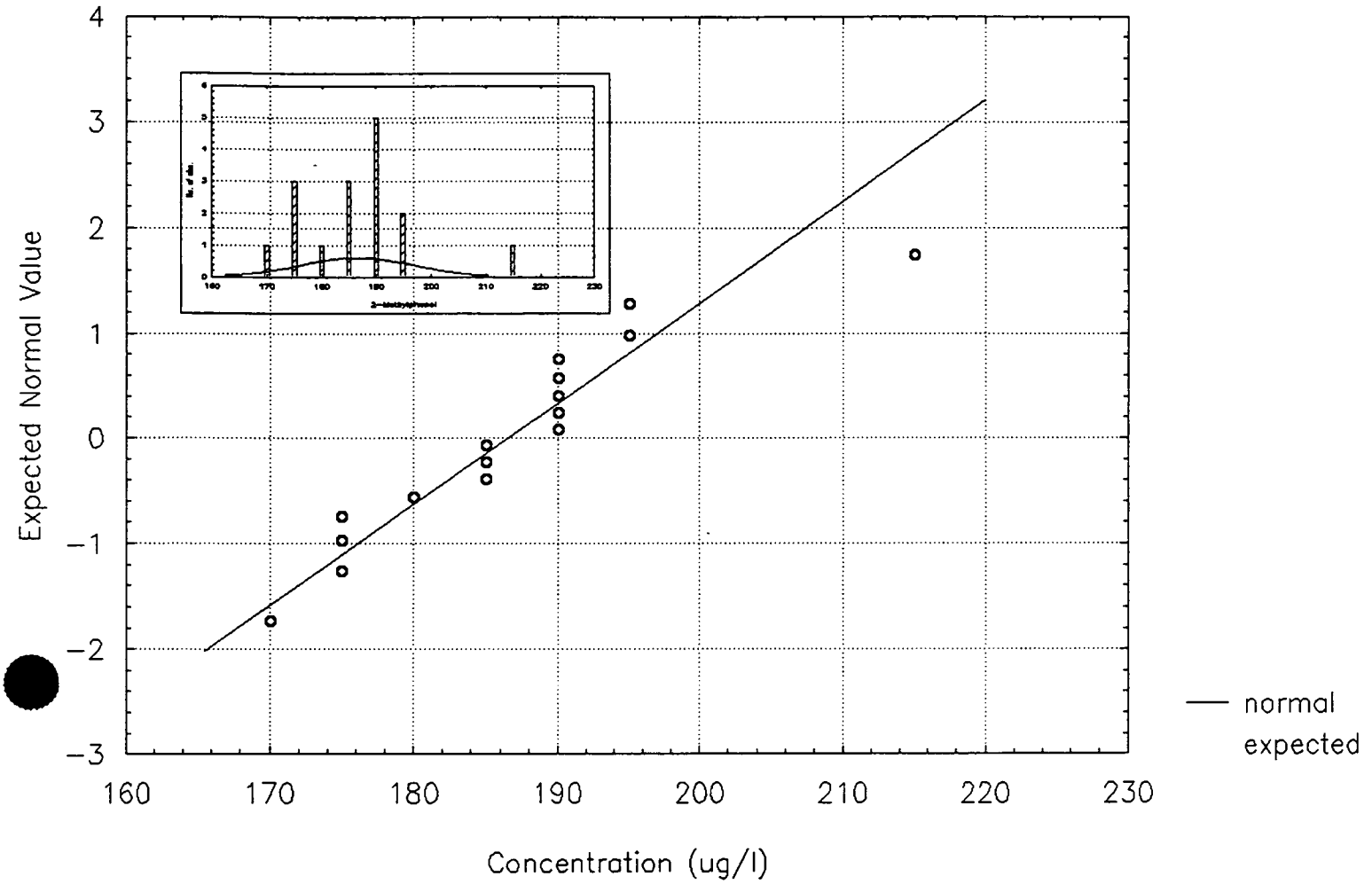


Normal Probablility Plot for
log Base 10 of
Phenol
in Background Surface Soils

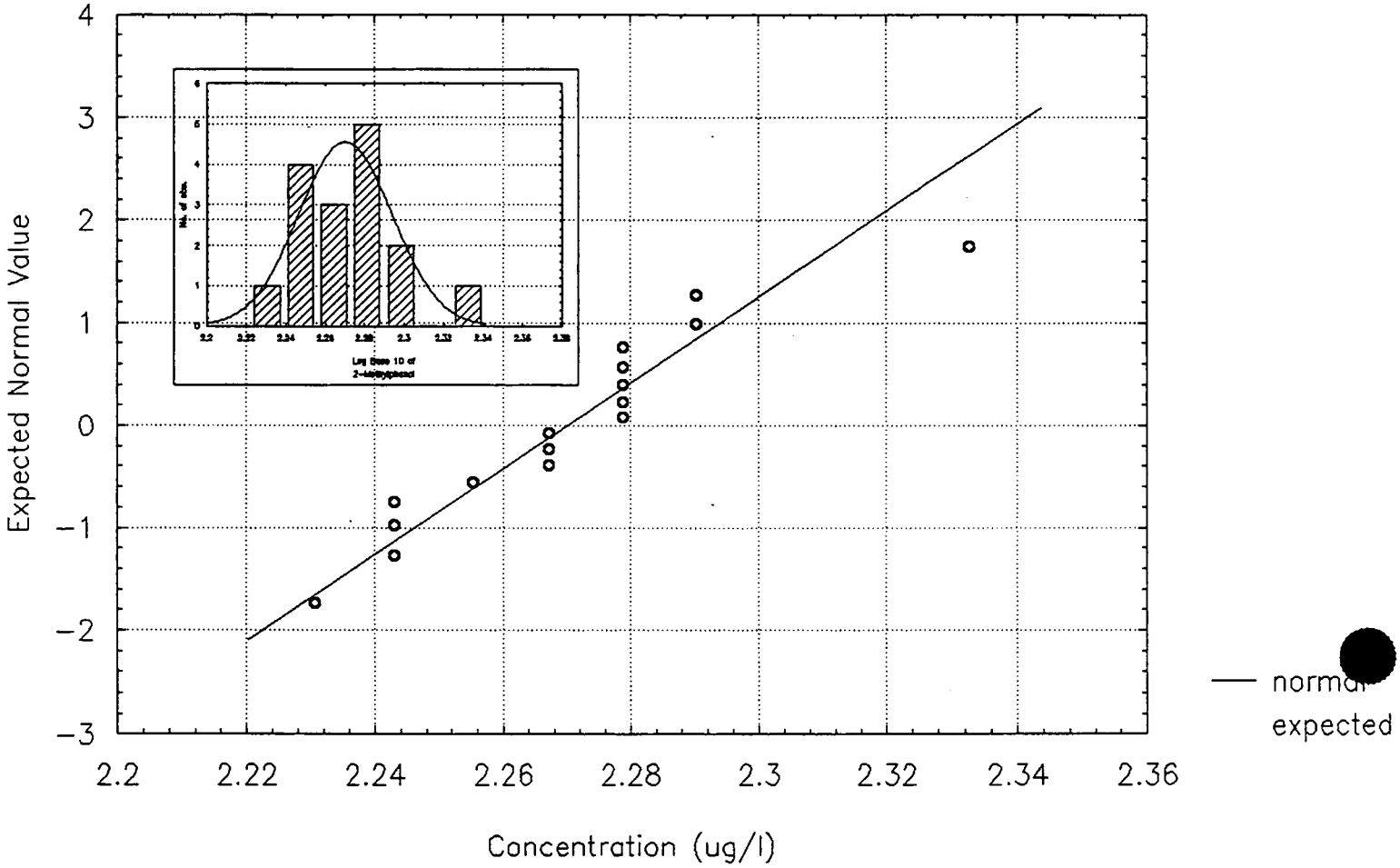


000483

Normal Probablility Plot for
2-Metylphenol
in Background Surface Soils

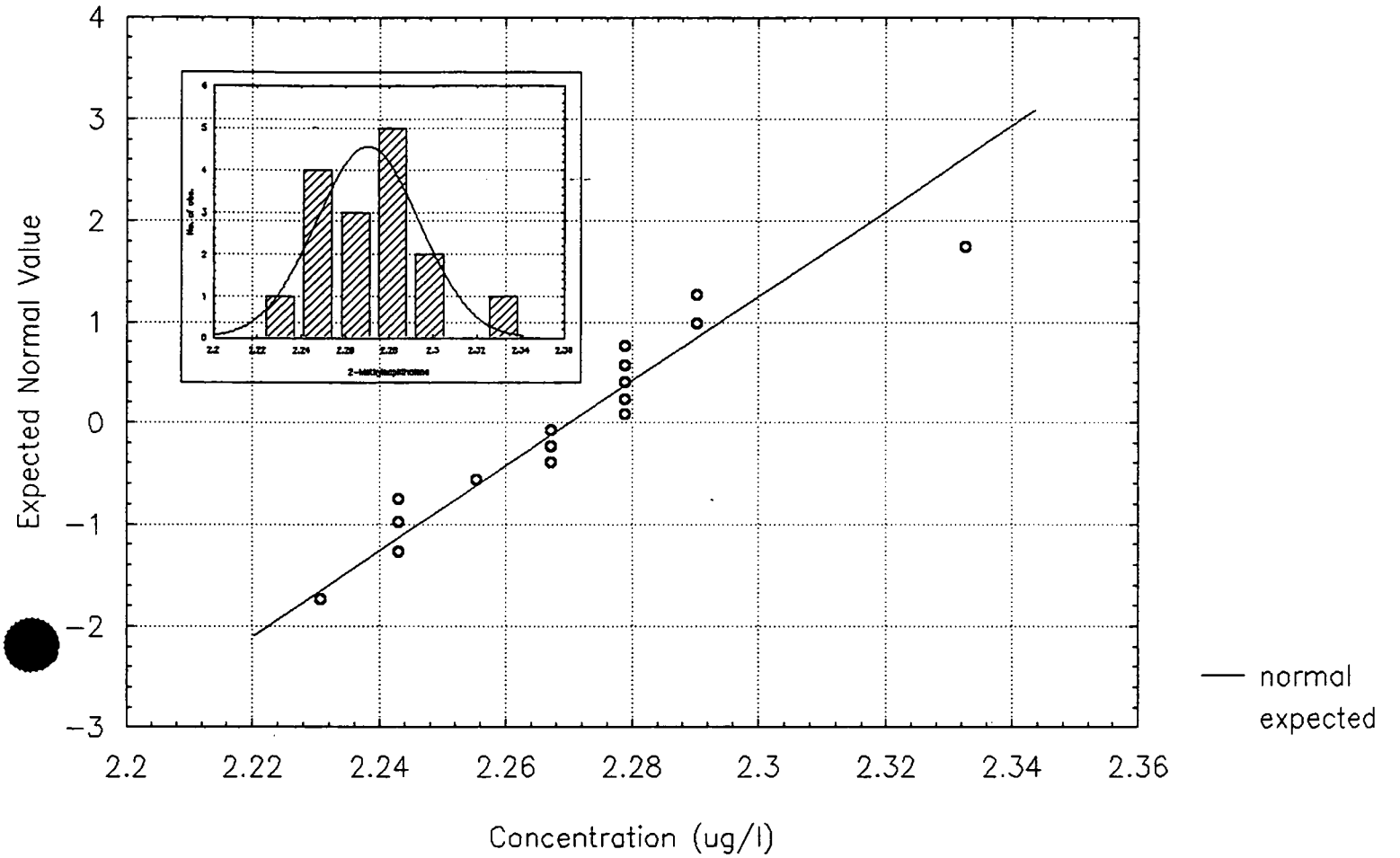


Normal Probablility Plot for
log Base 10 of
2-Methylphenol
in background Surface Soils

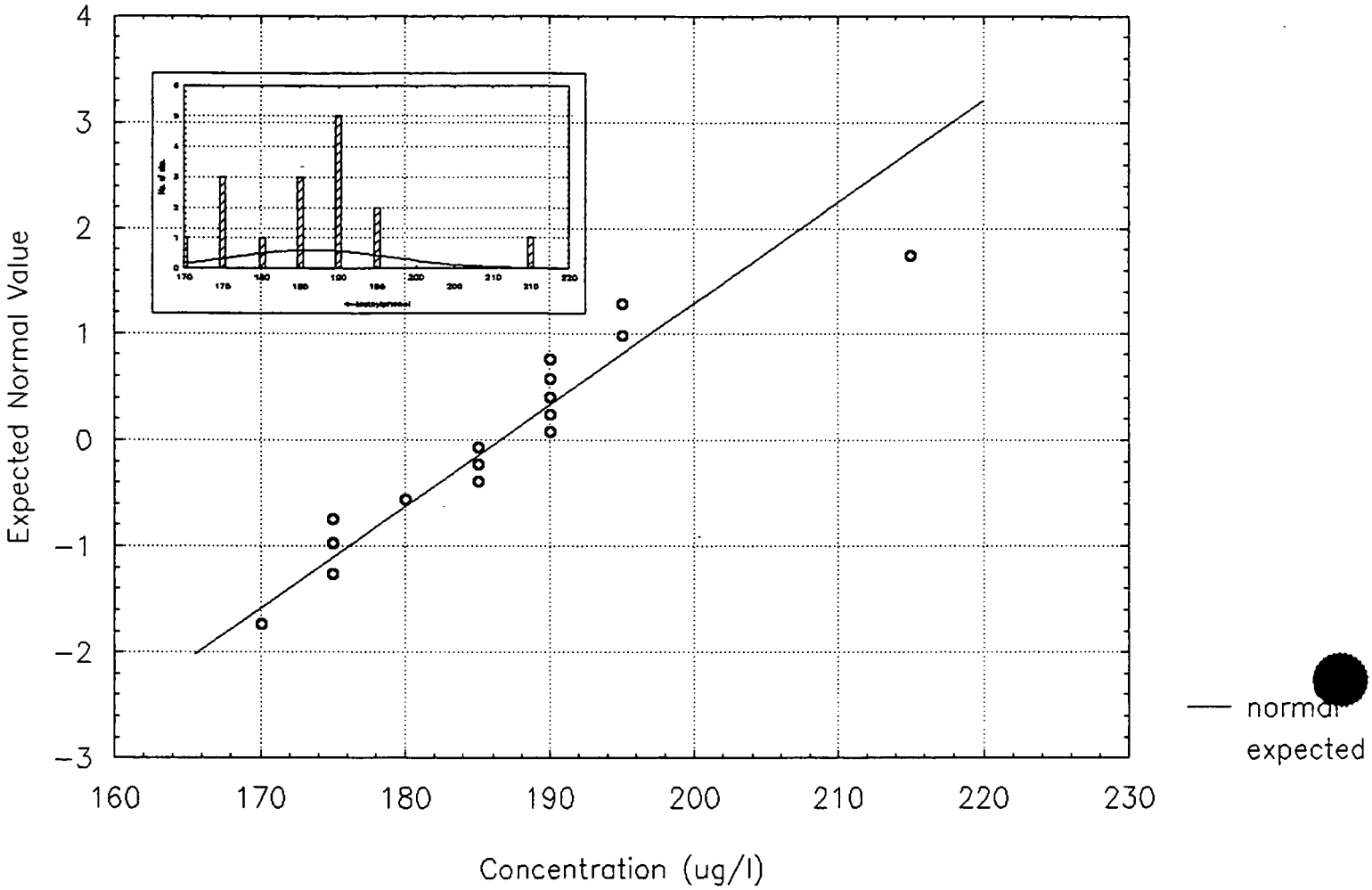


000485

Normal Probablility Plot for
Log Base 10 of
2-Methylnaphthalene
in Background Soil Samples

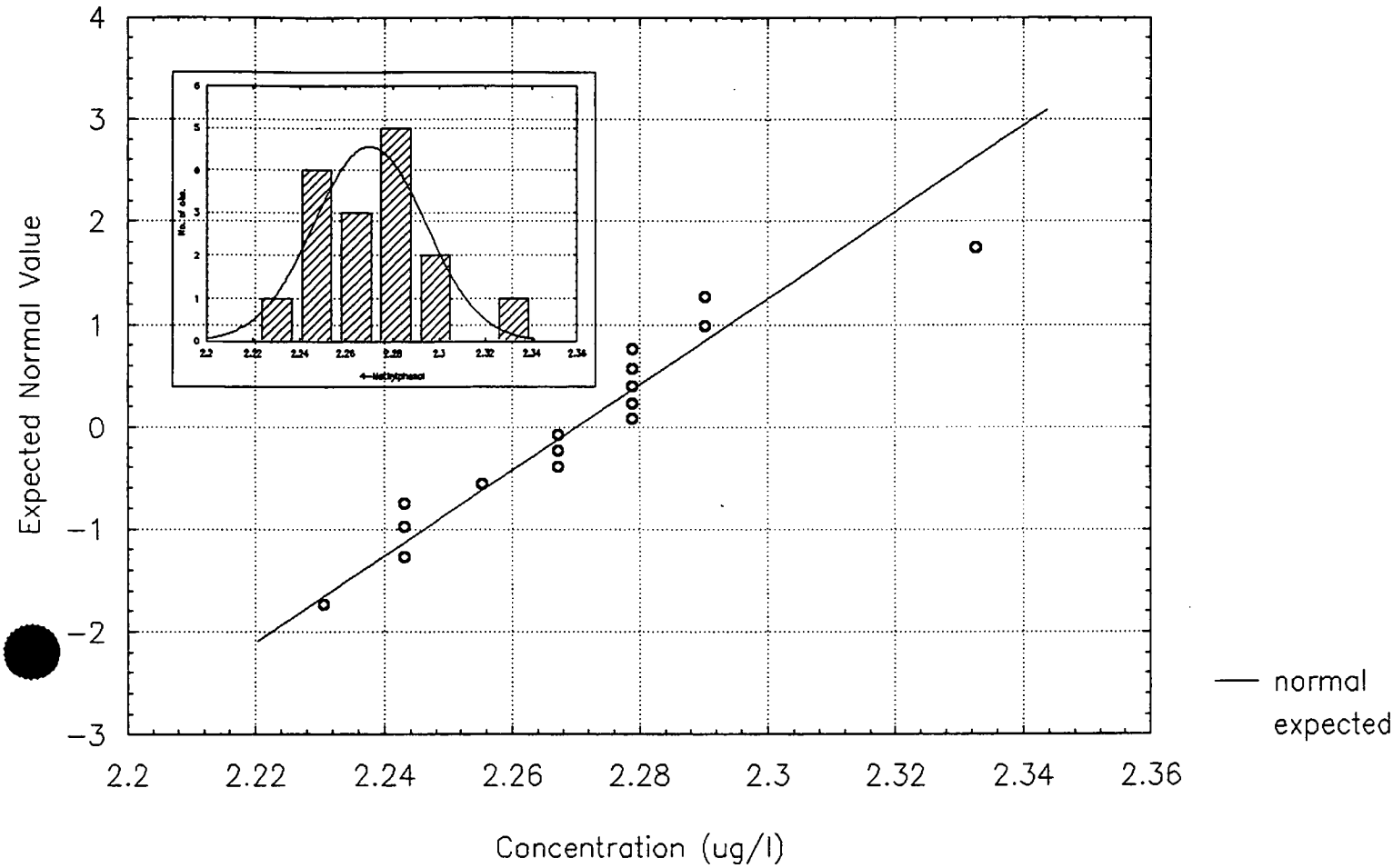


Normal Probability Plot for
4-Methylphenol
in Background Soil Samples

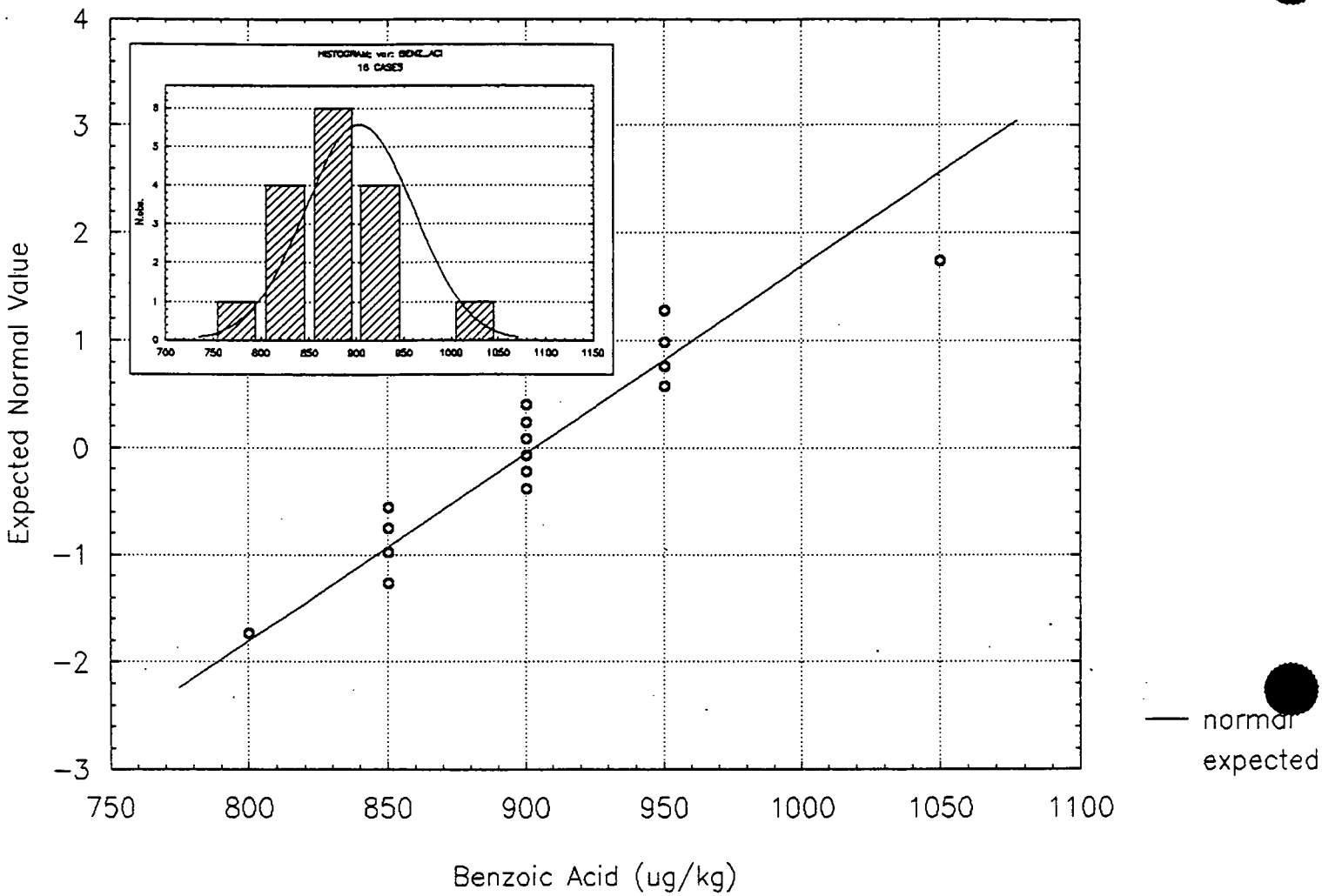


000487

Normal Probablility Plot for
Log Base 10 of
4-Methylphenol
in Background Soil Samples

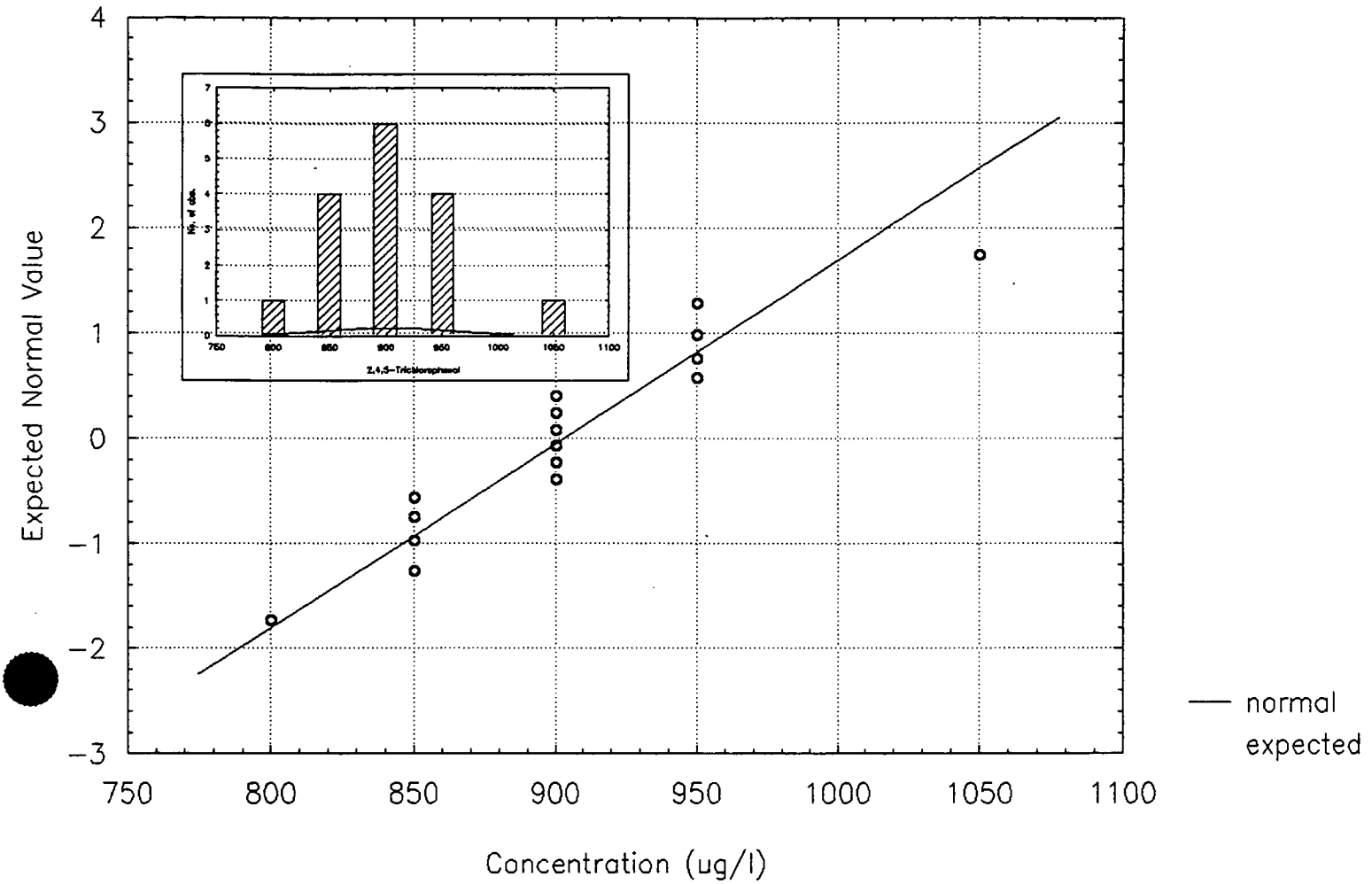


Normal Probablility Plot for Benzoic Acid
in Background Surface Soils

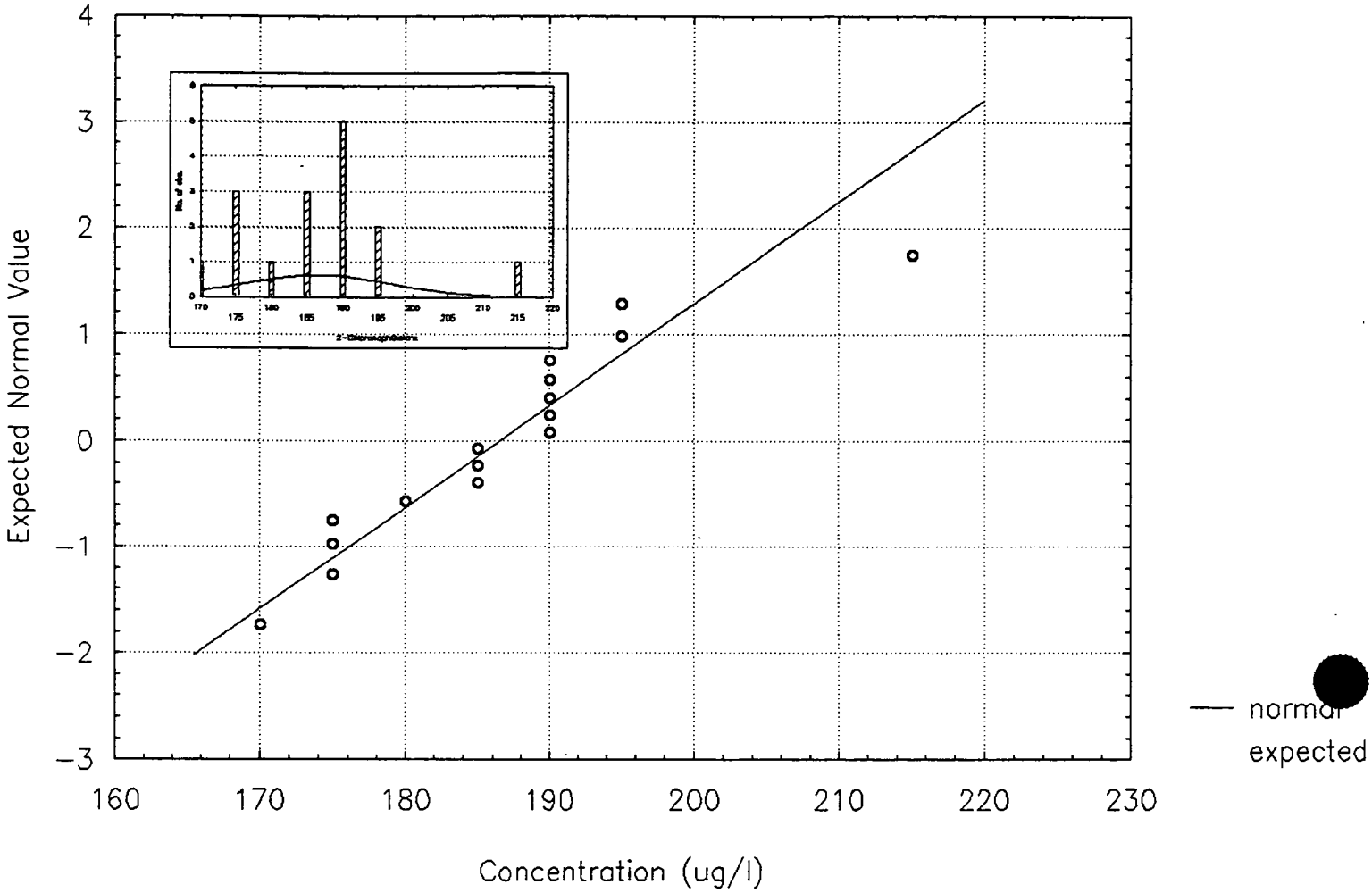


000489

Normal Probablility Plot for
2,4,5-Trichlorophenol
in Background Surface Soils

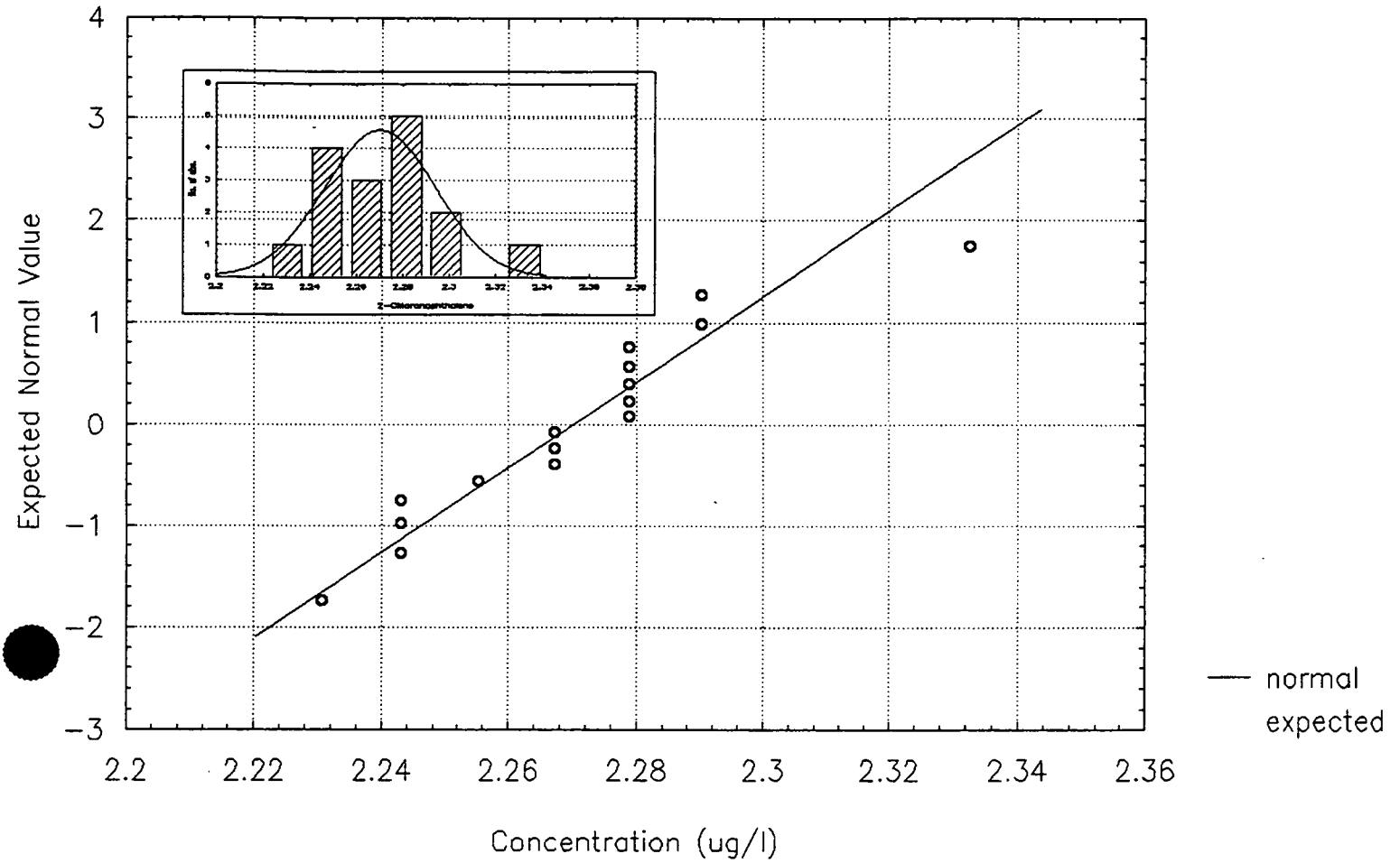


Normal Probability Plot for
2-Cholronaphthalene
in Background Soil Samples

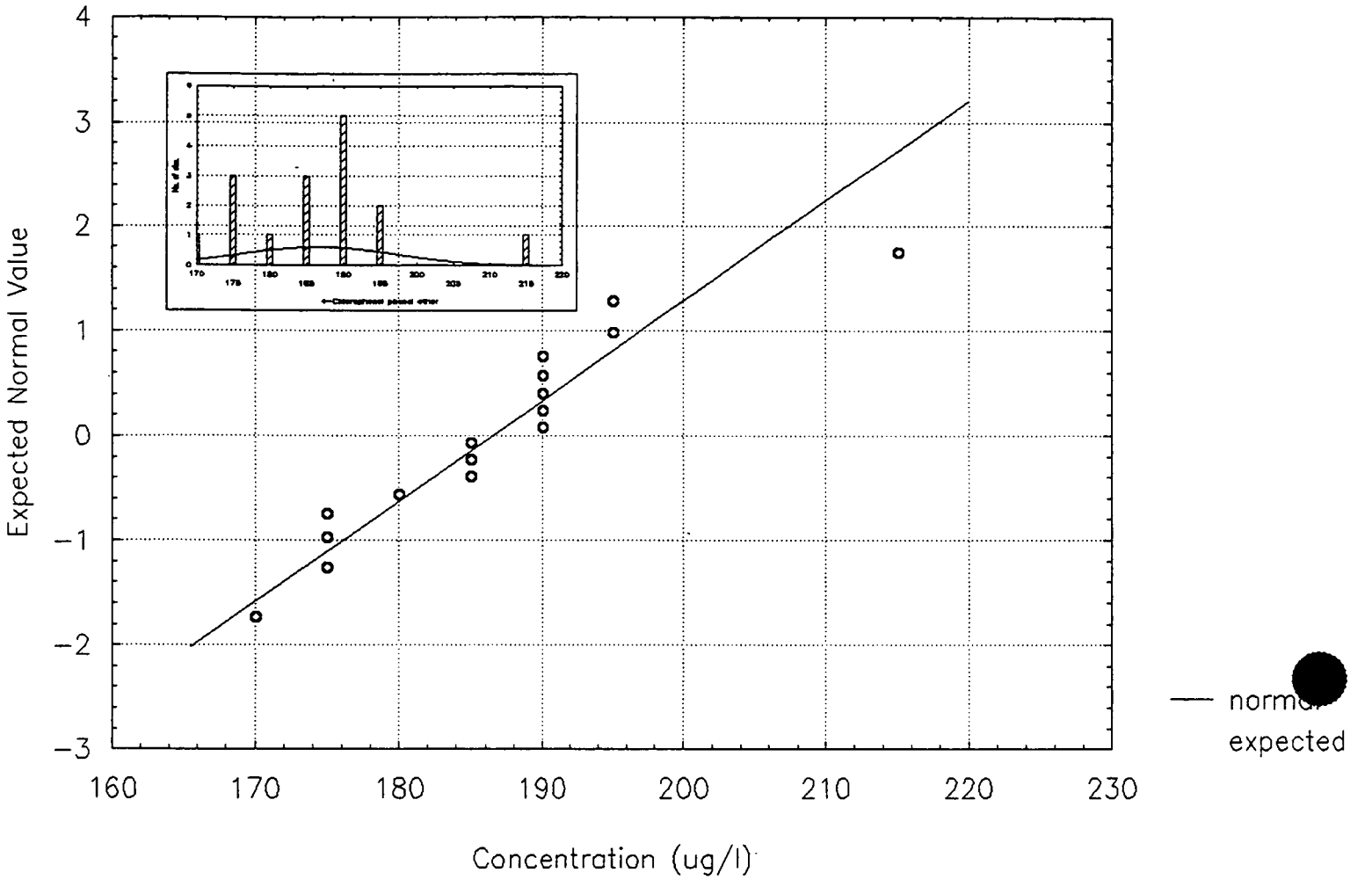


000491

Normal Probablility Plot for
Log Base 10 of
2-Chloronaphthalene
in Background Soil Samples

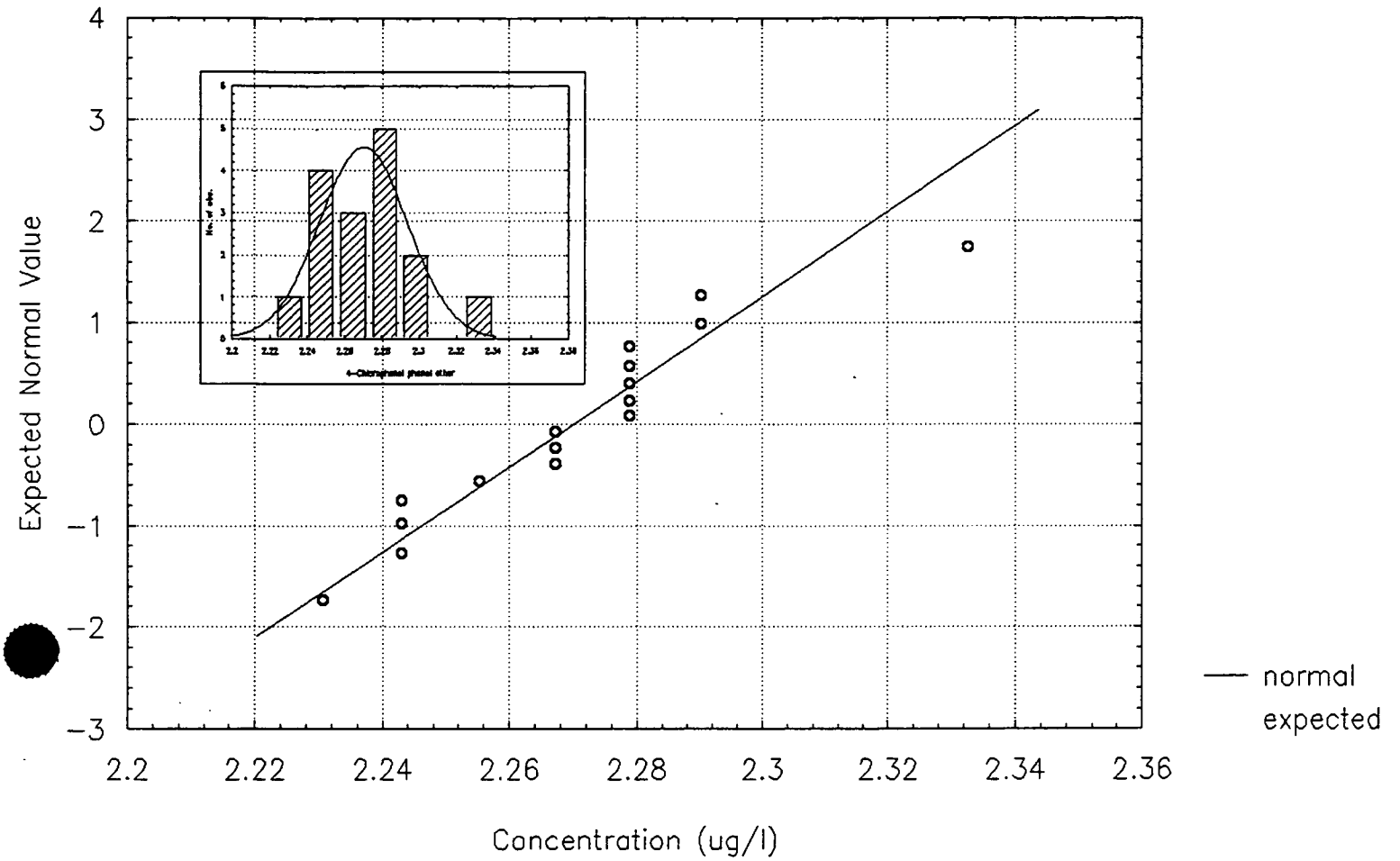


Normal Probability Plot for
4–Chorophenyl phenyl ether
in Background Soil Samples

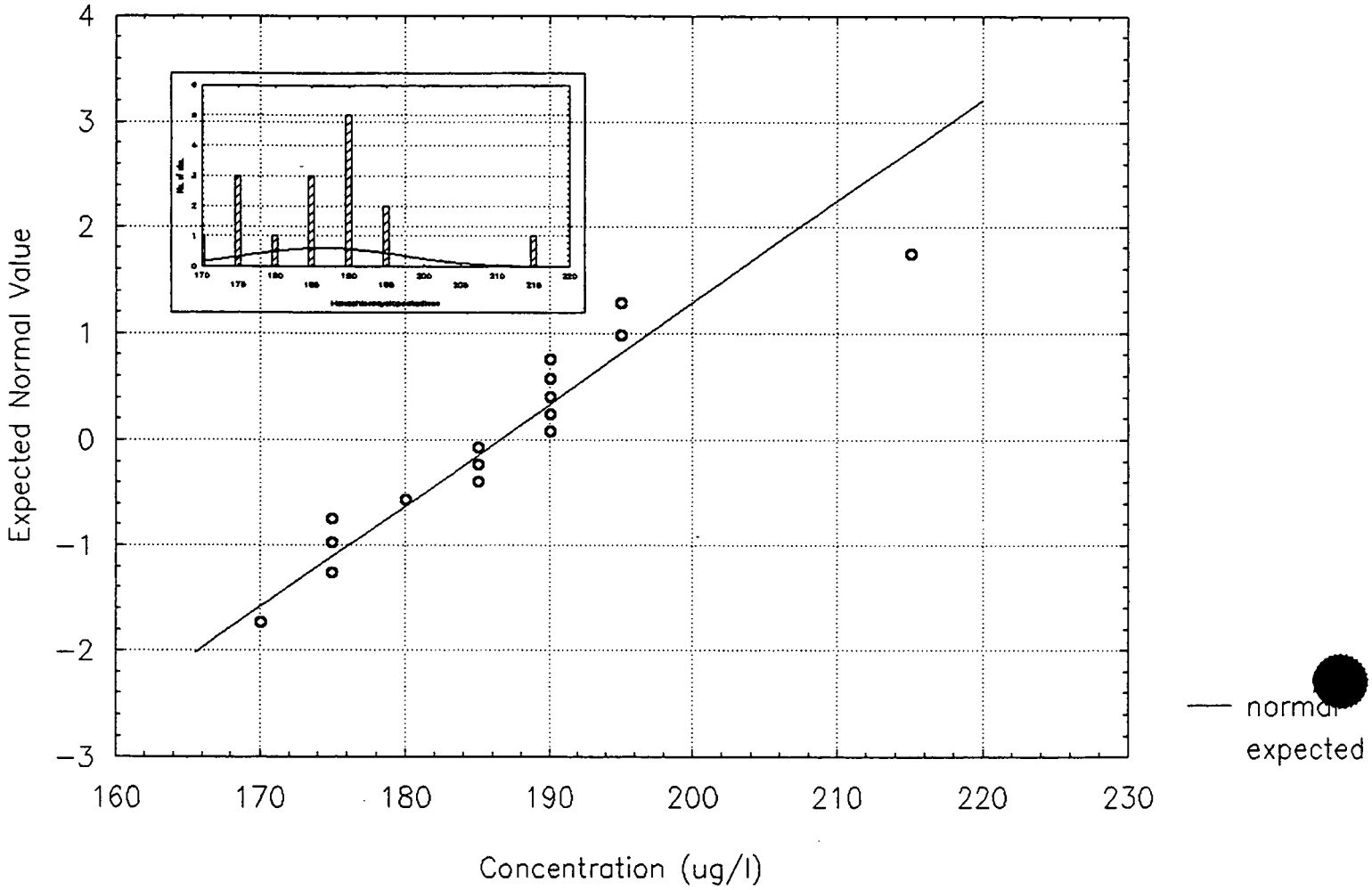


000493

Normal Probablility Plot for
Log Base 10 of
4-Chlorophenyl phenyl ether
in Background Soil Samples

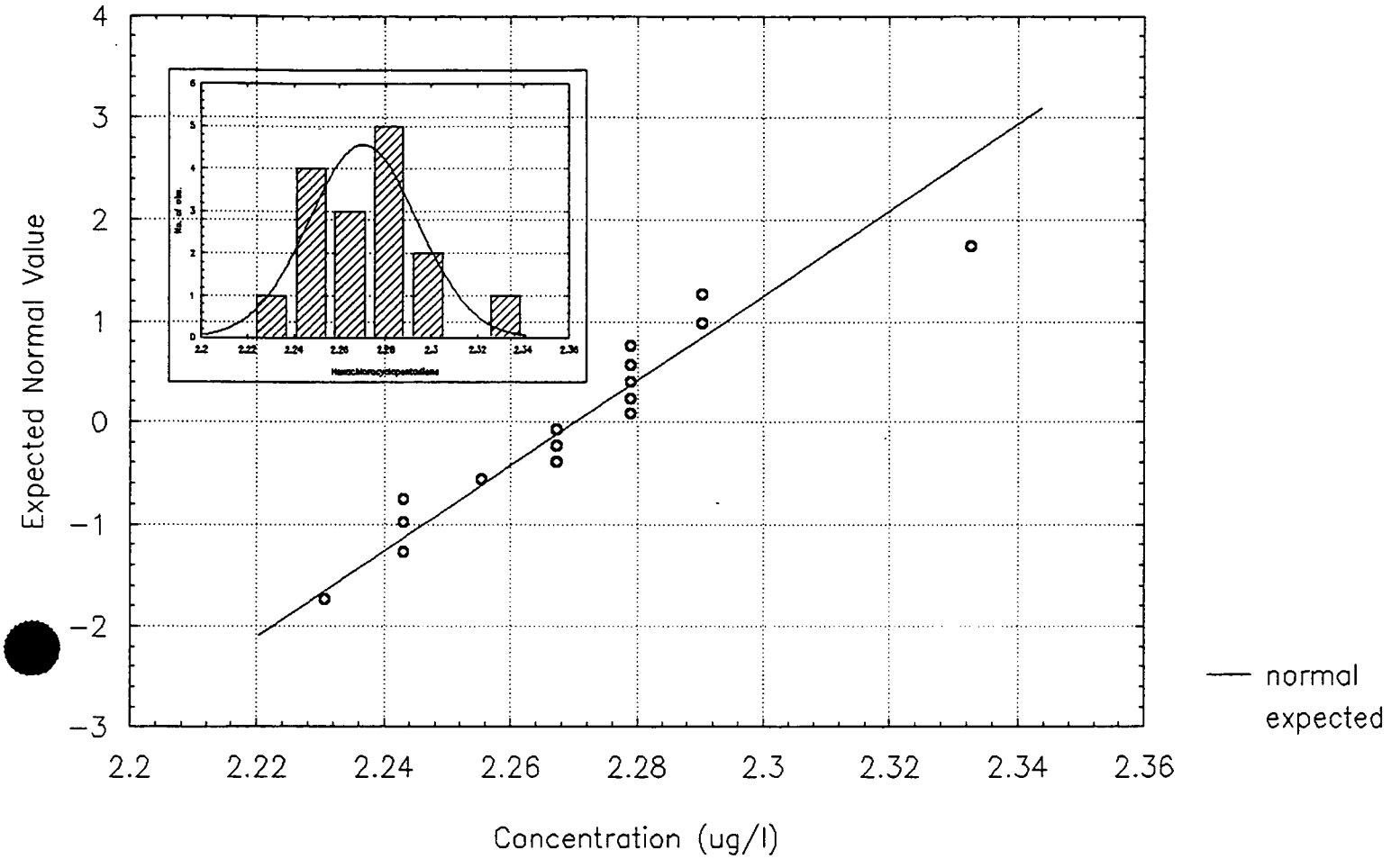


Normal Probability Plot for
Hexachlorocyclopentadiene
in Background Soil Samples

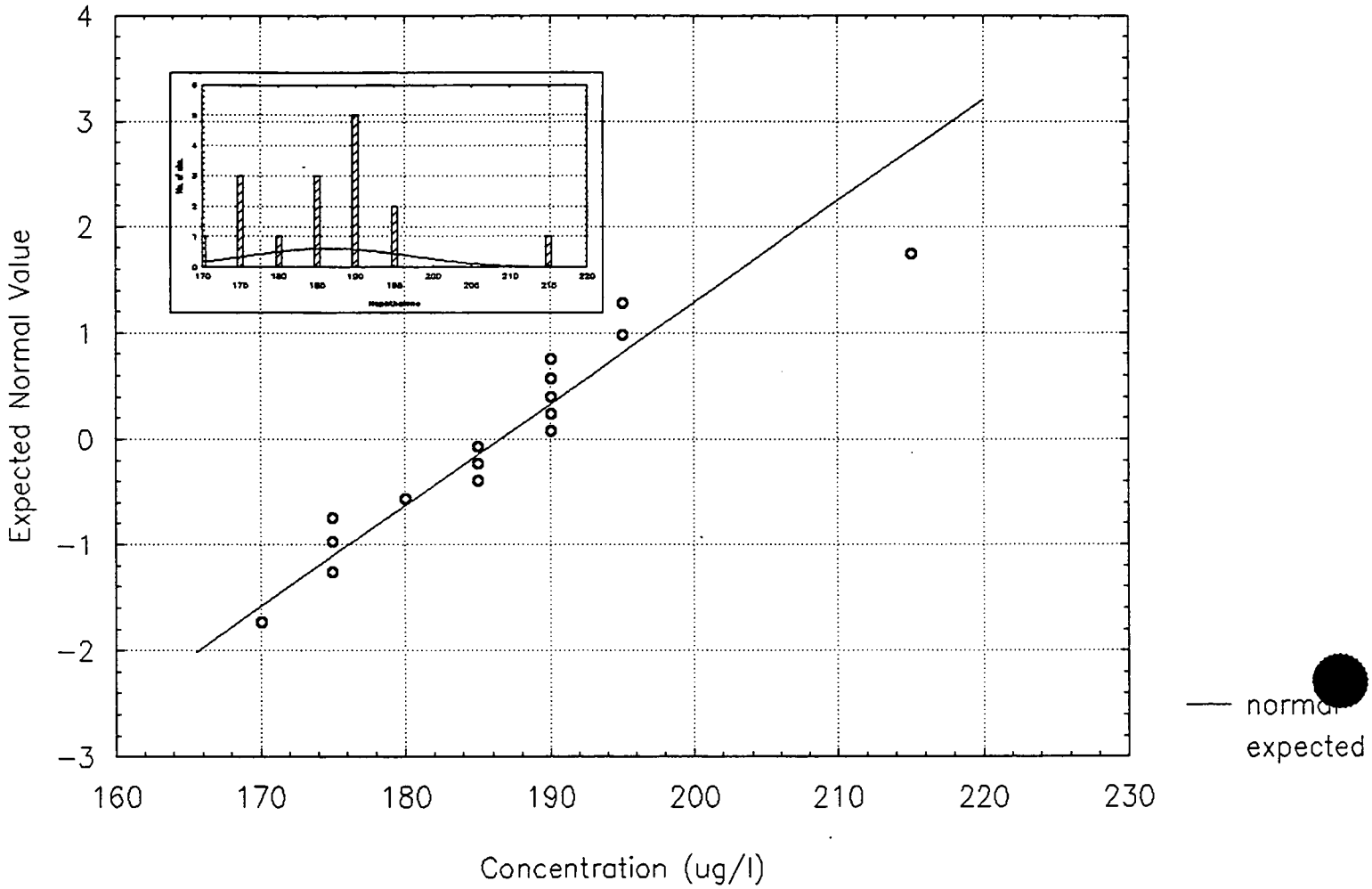


000495

Normal Probablility Plot for
Log Base 10 of
Hexachlorocyclopentadiene
in Background Soil Samples

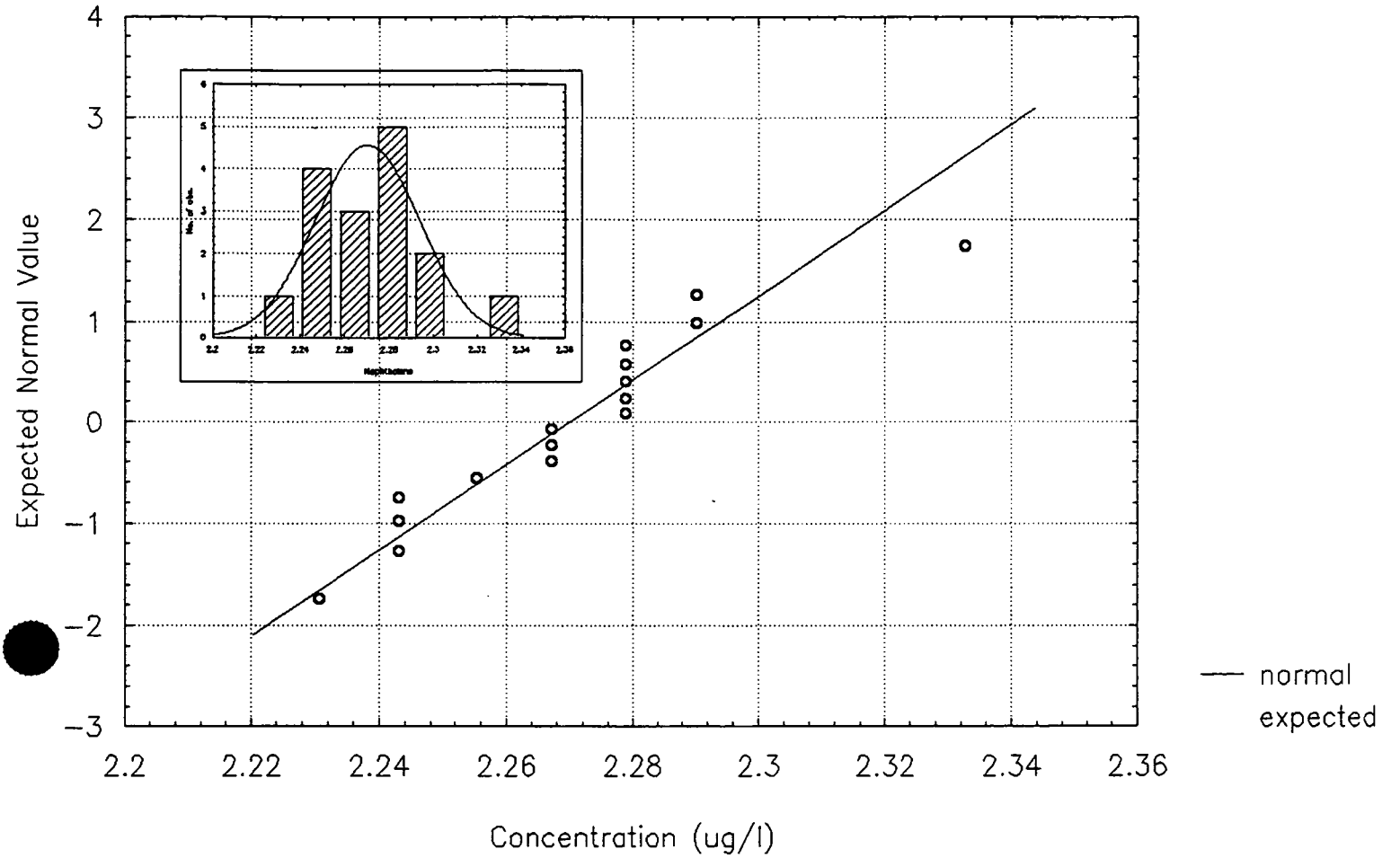


Normal Probability Plot for
Naphthalene
in Background Soil Samples

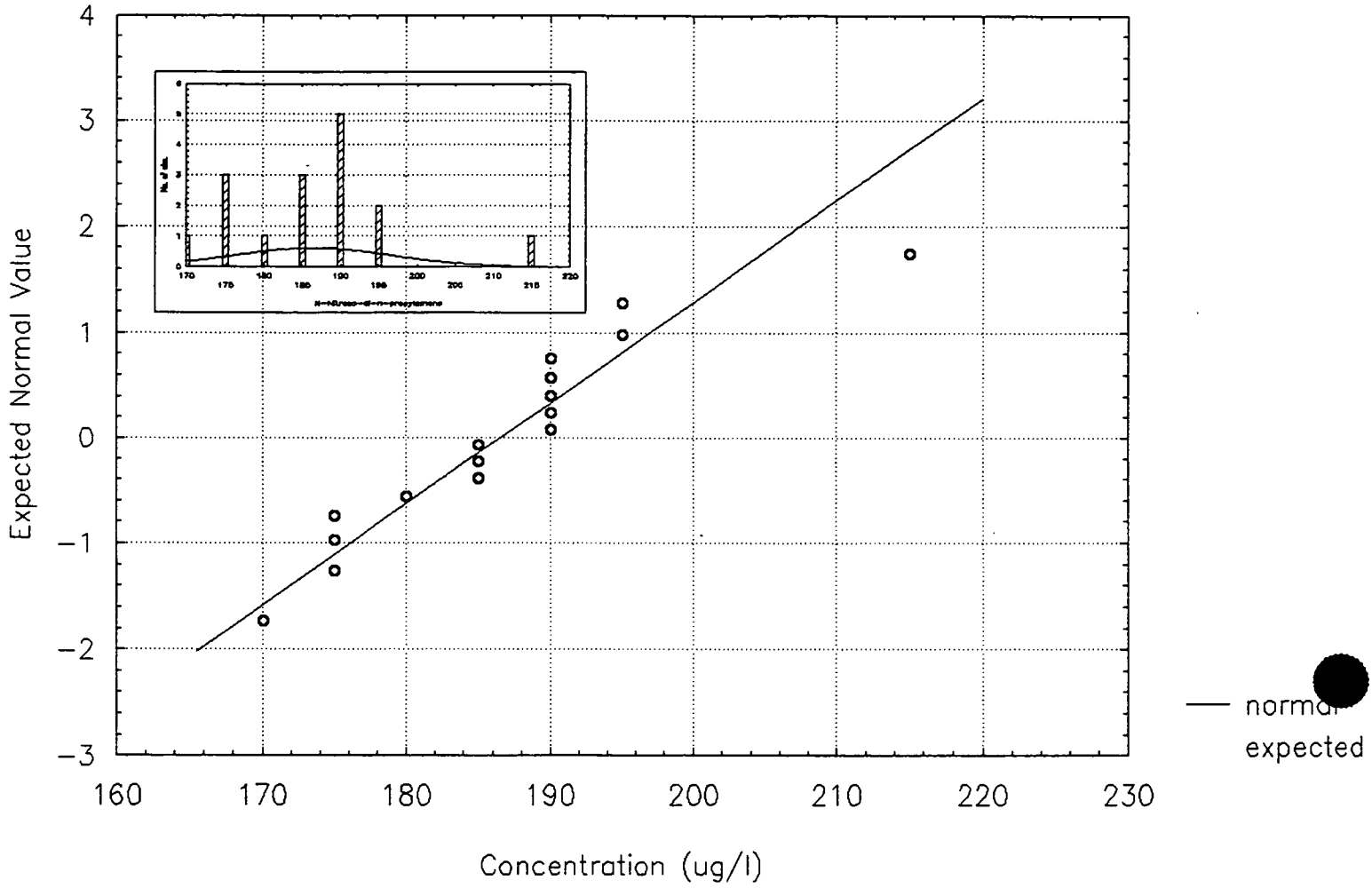


000497

Normal Probablility Plot for
Log Base 10 of
Naphthalene
in Background Soil Samples

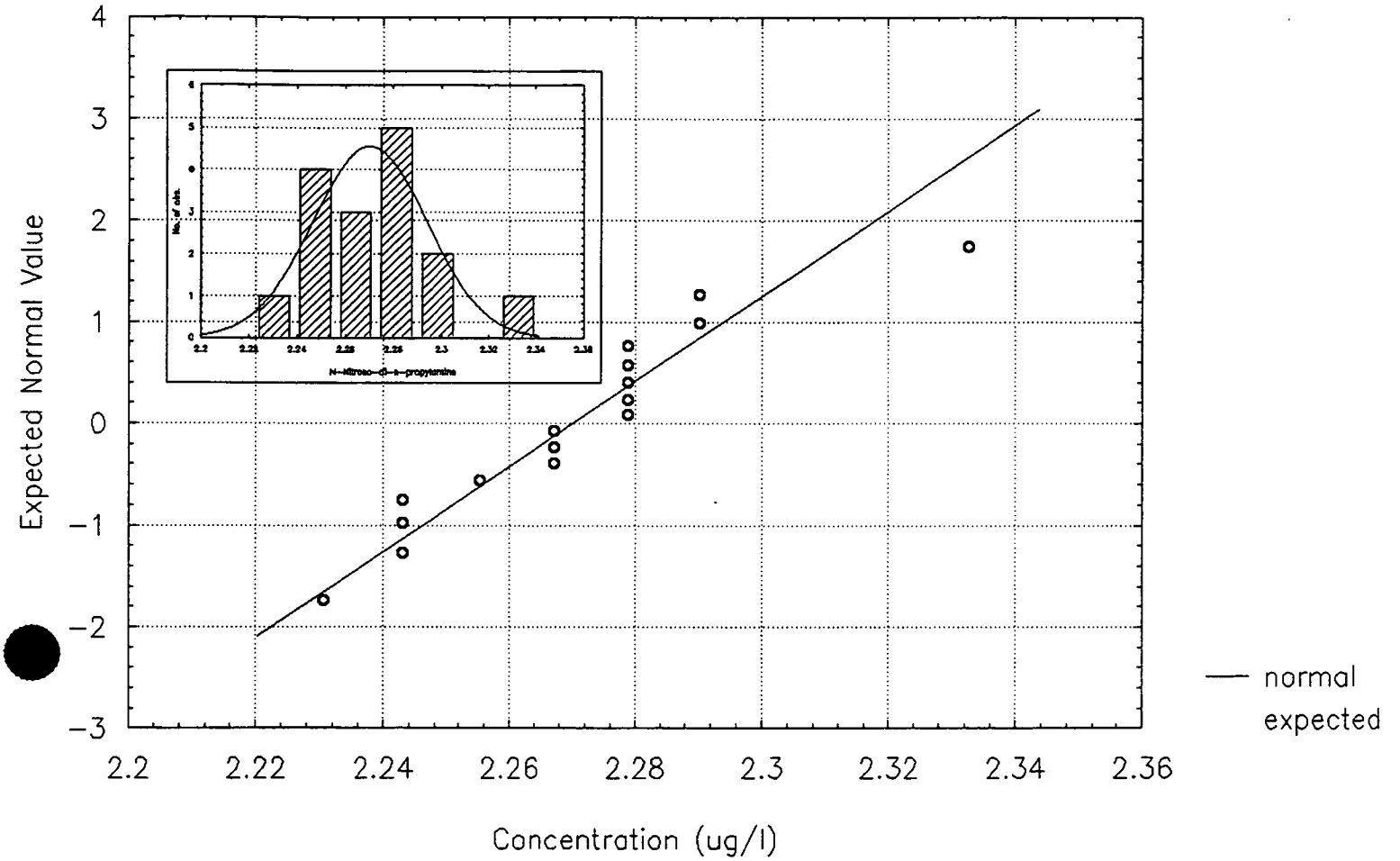


Normal Probability Plot for
N-Nitroso-di-n-propylamine
in Background Soil Samples

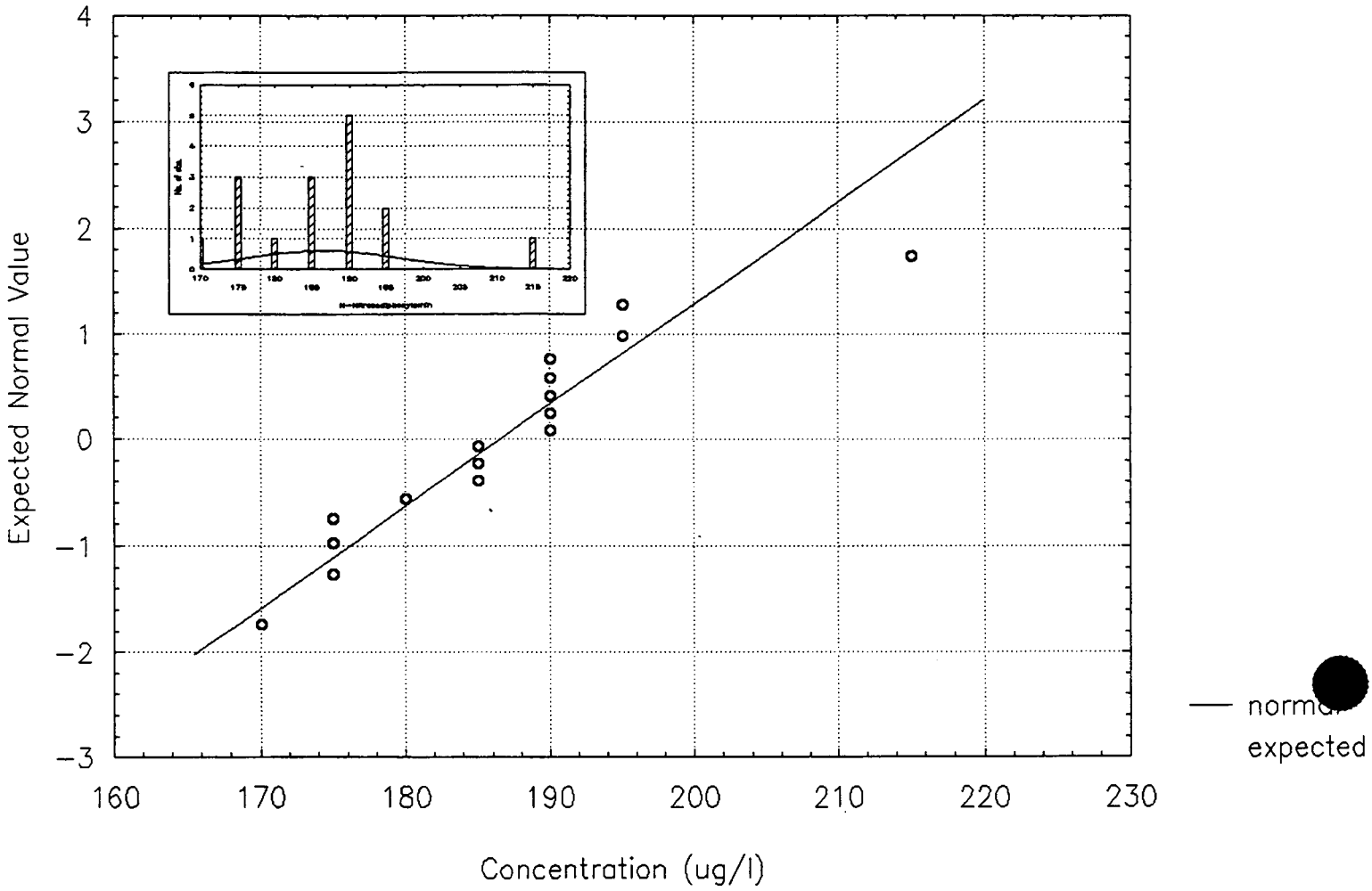


000499

Normal Probablility Plot for
Log Base 10 of
N-Nitroso-di-n-propylamine
in Background Soil Samples

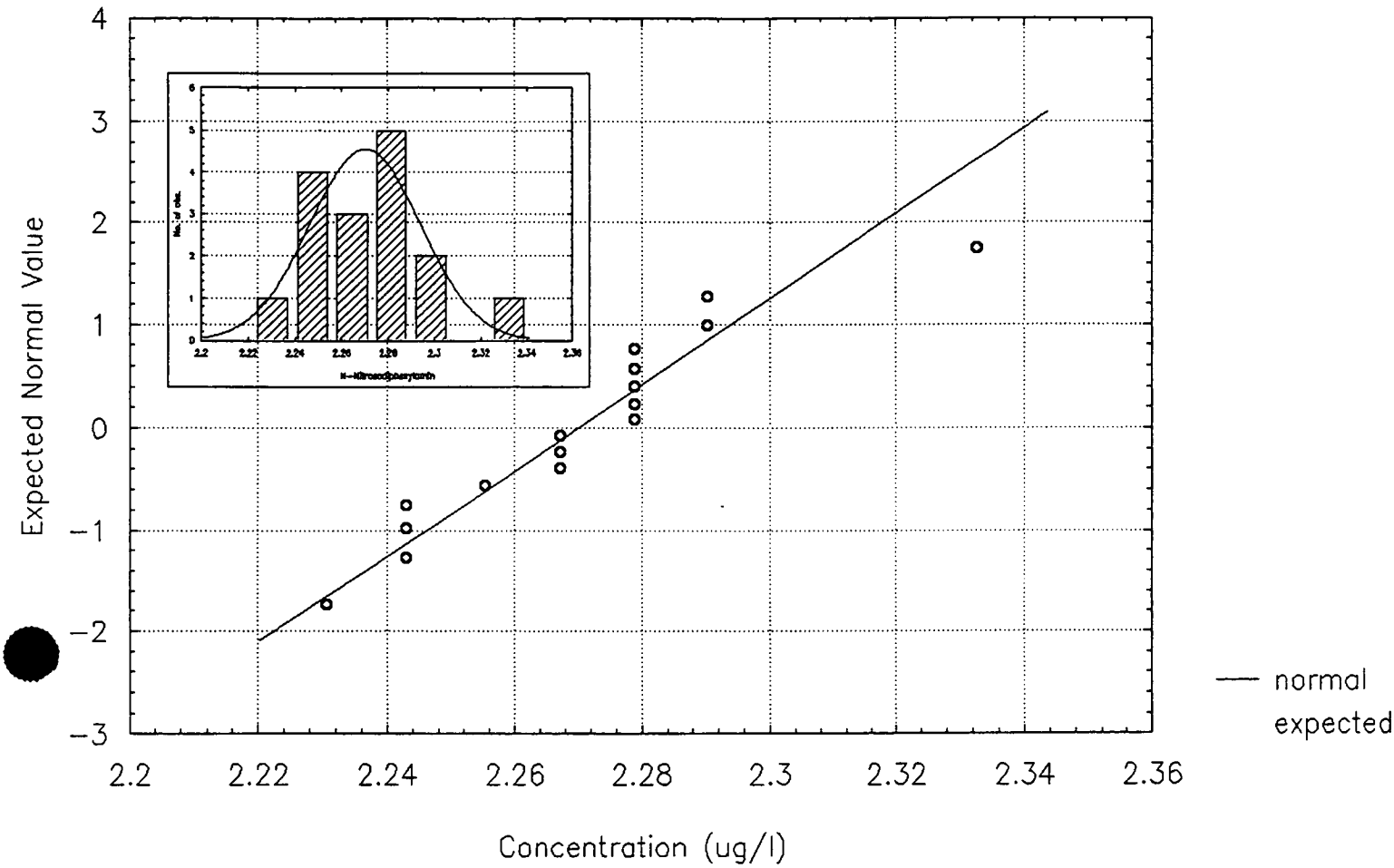


Normal Probability Plot for
N-Nitrosodiphenylamin
in Background Soil Samples



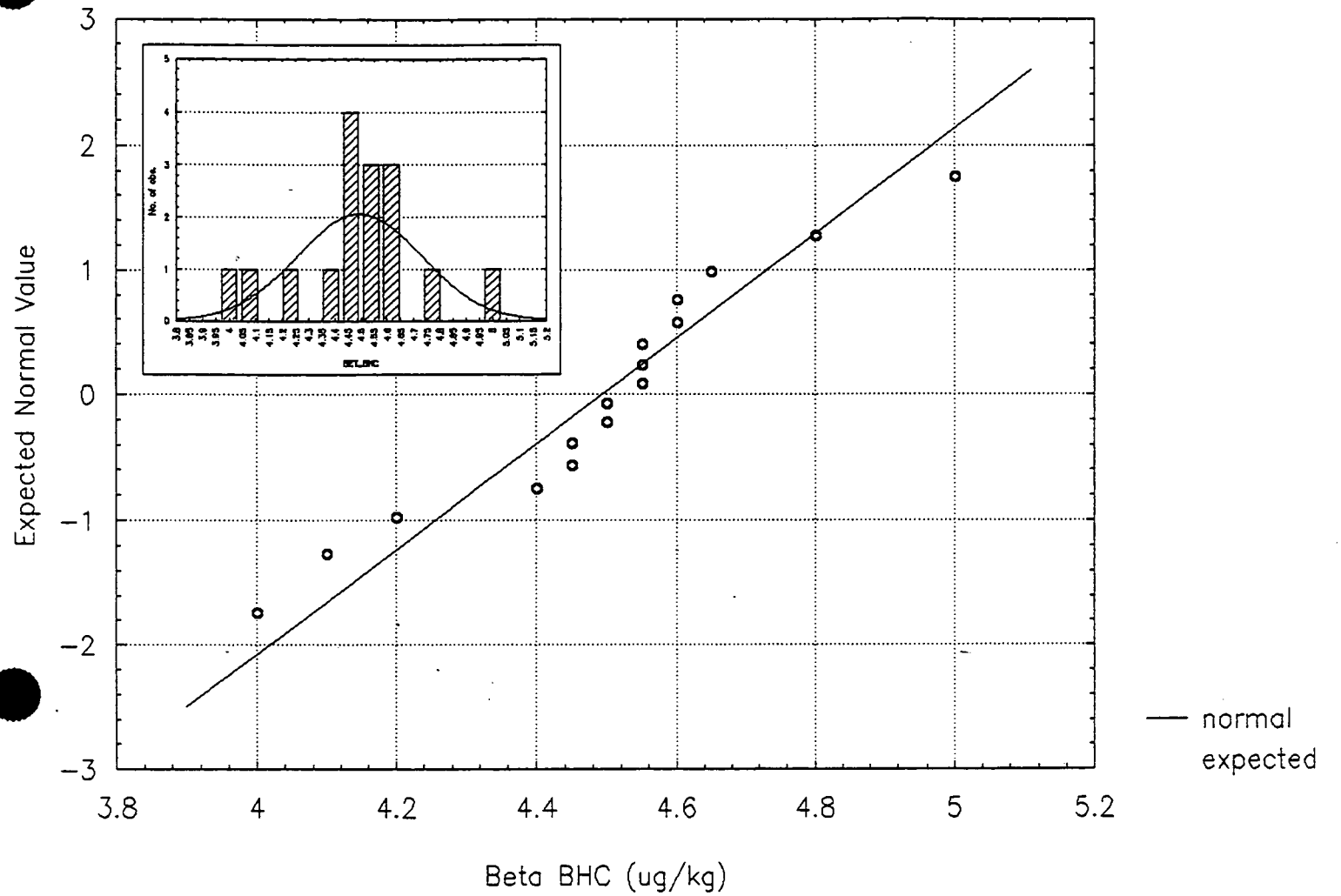
000501

Normal Probablility Plot for
Log Base 10 of
N-Nitrosodiphenylamin
in Background Soil Samples

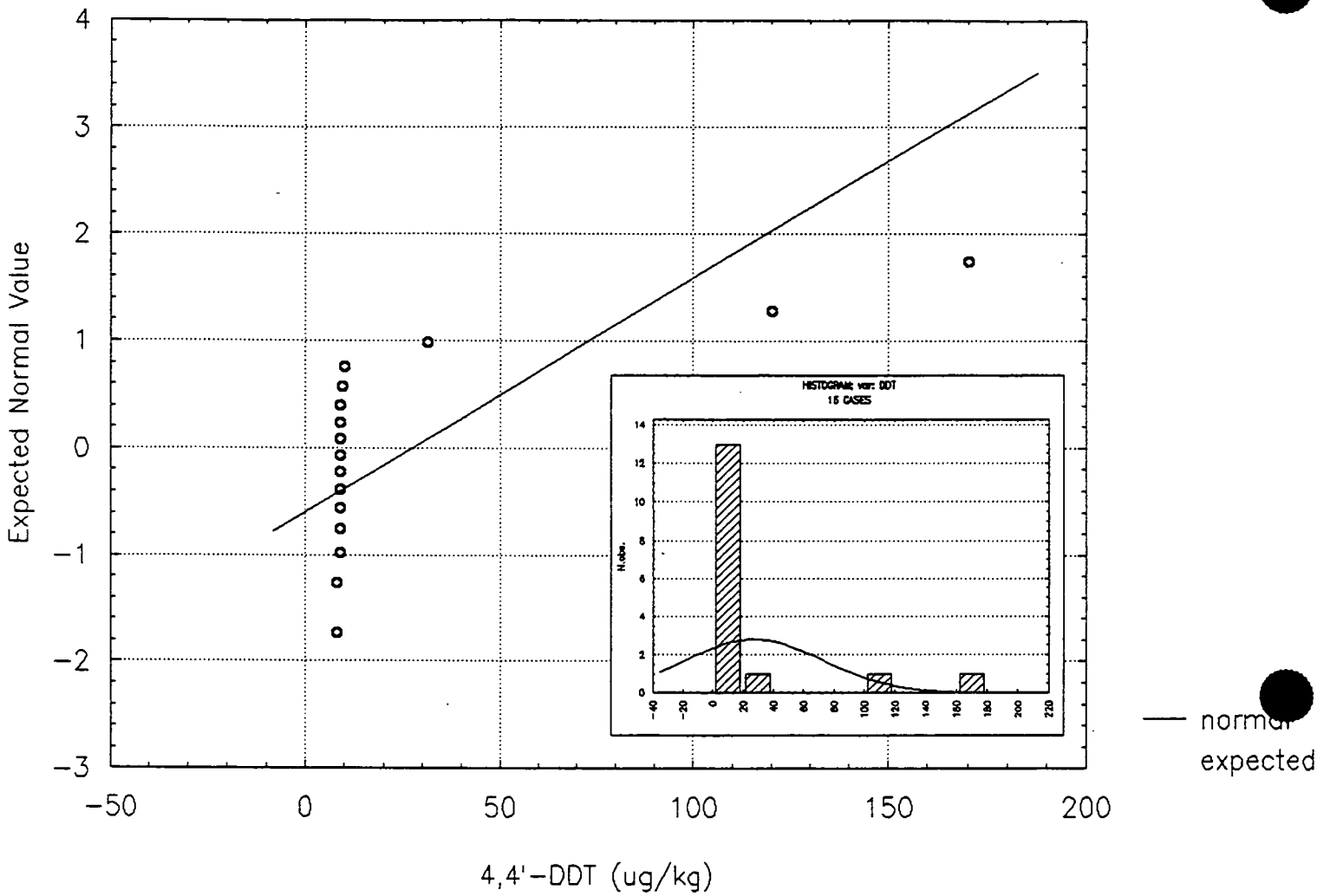


PESTICIDES

Normal Probablility Plot for Beta-BHC
in Background Surface Soils

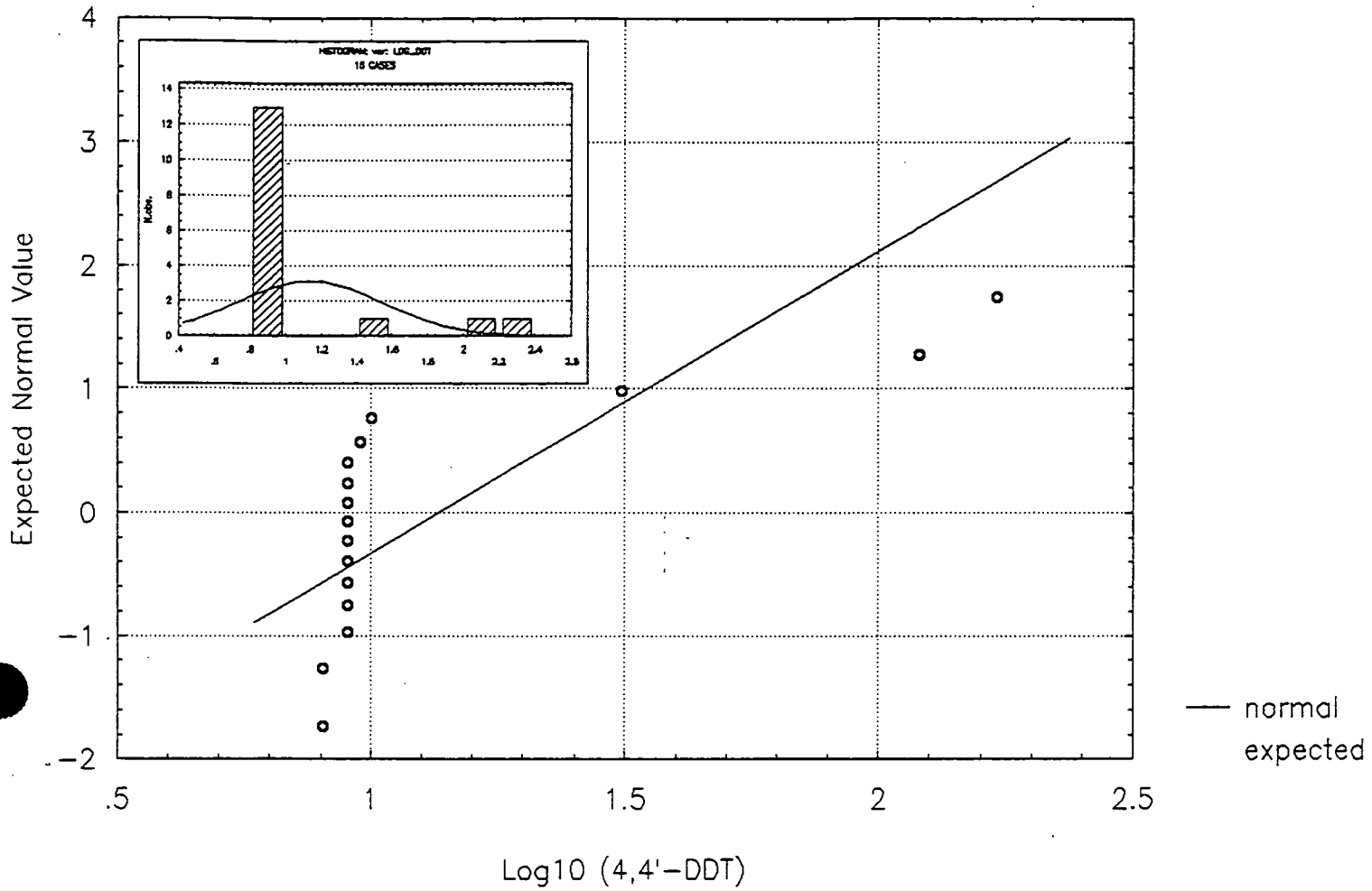


Normal Probablility Plot for 4,4-DDT
in Background Surface Soil

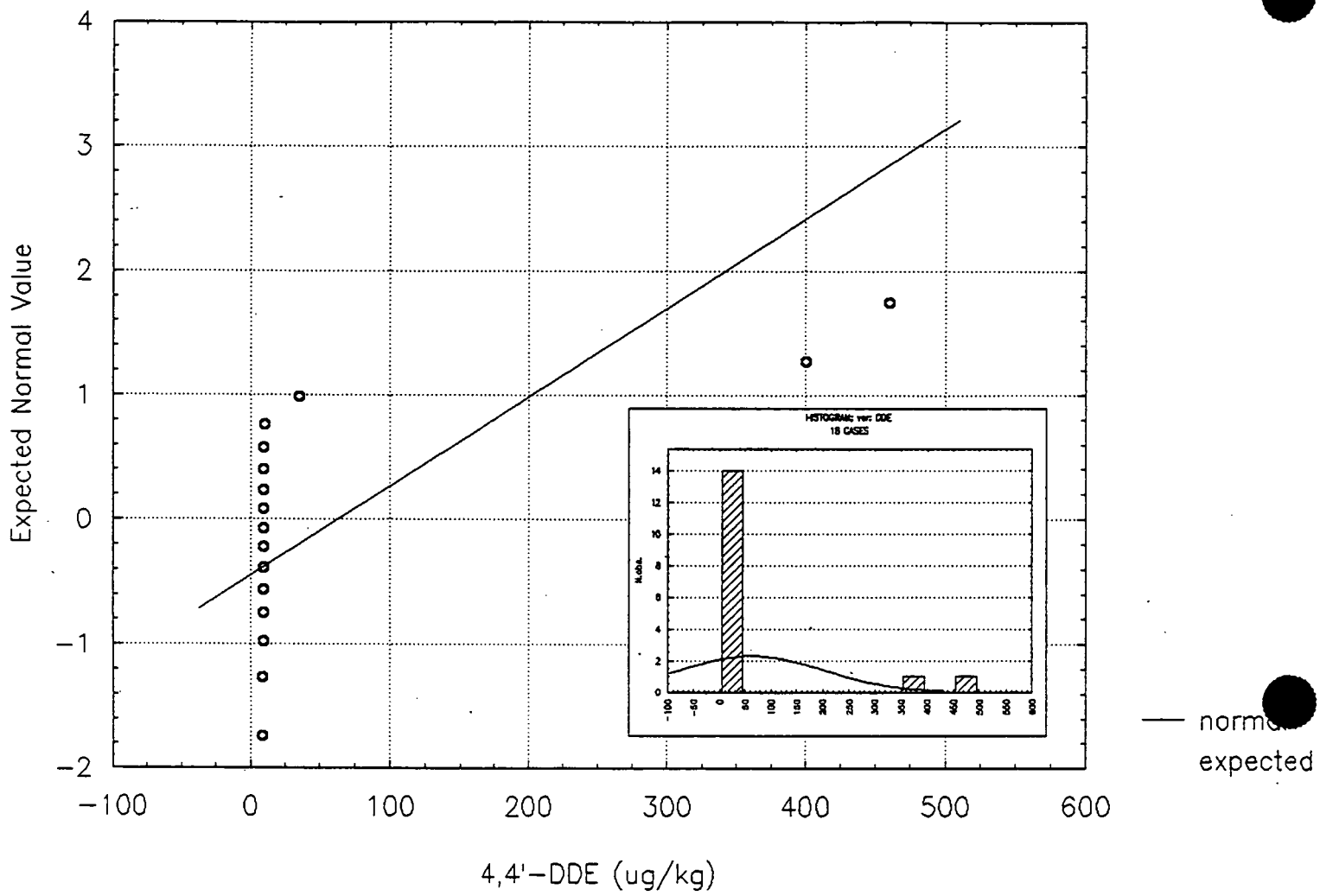


000505

Normal Probablility Plot for the Log Base
10 Transform of 4,4'-DDT in
Background Surface Soil

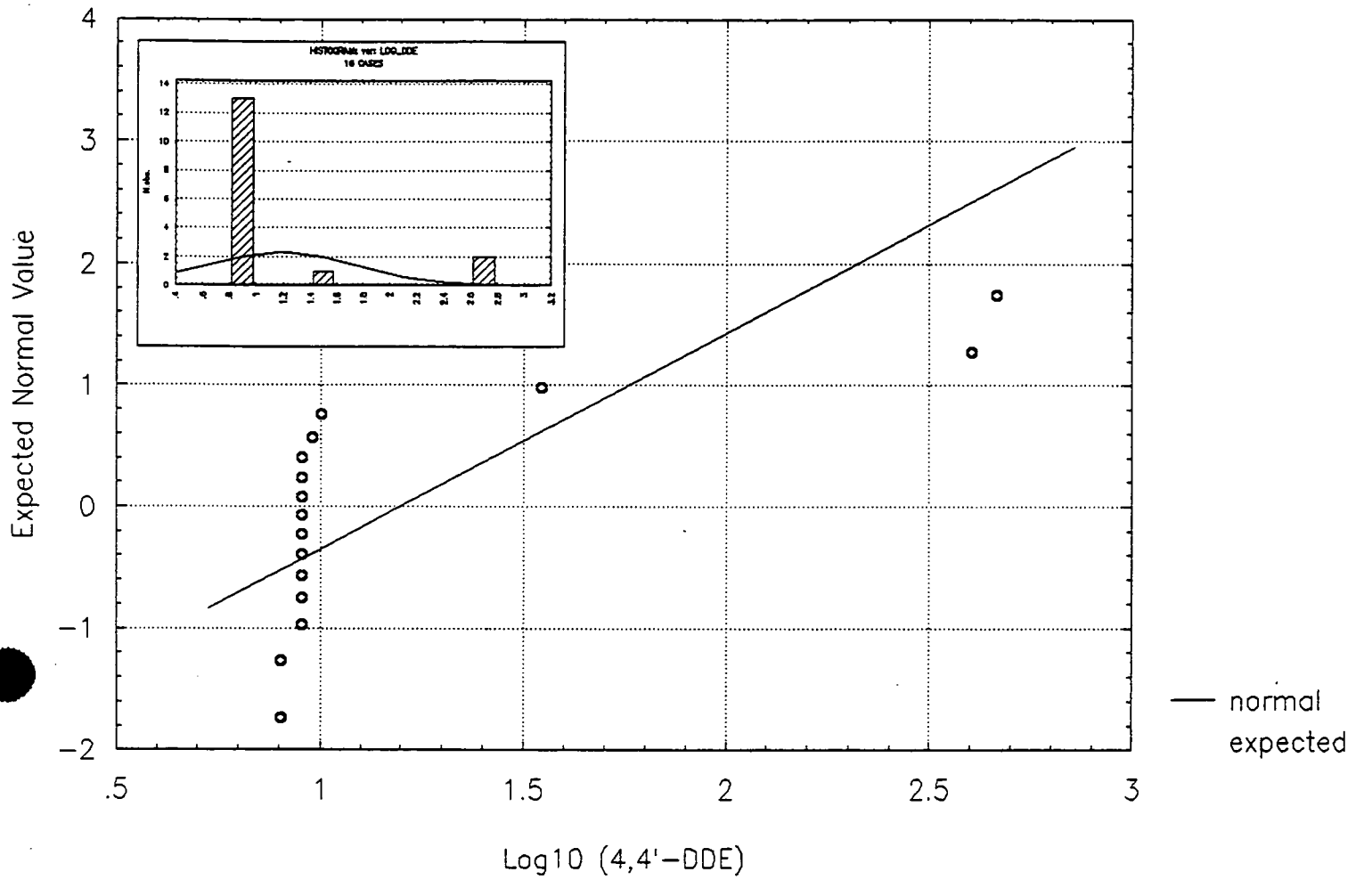


Normal Probablility Plot for 4,4'-DDE
in Background Surface Soil

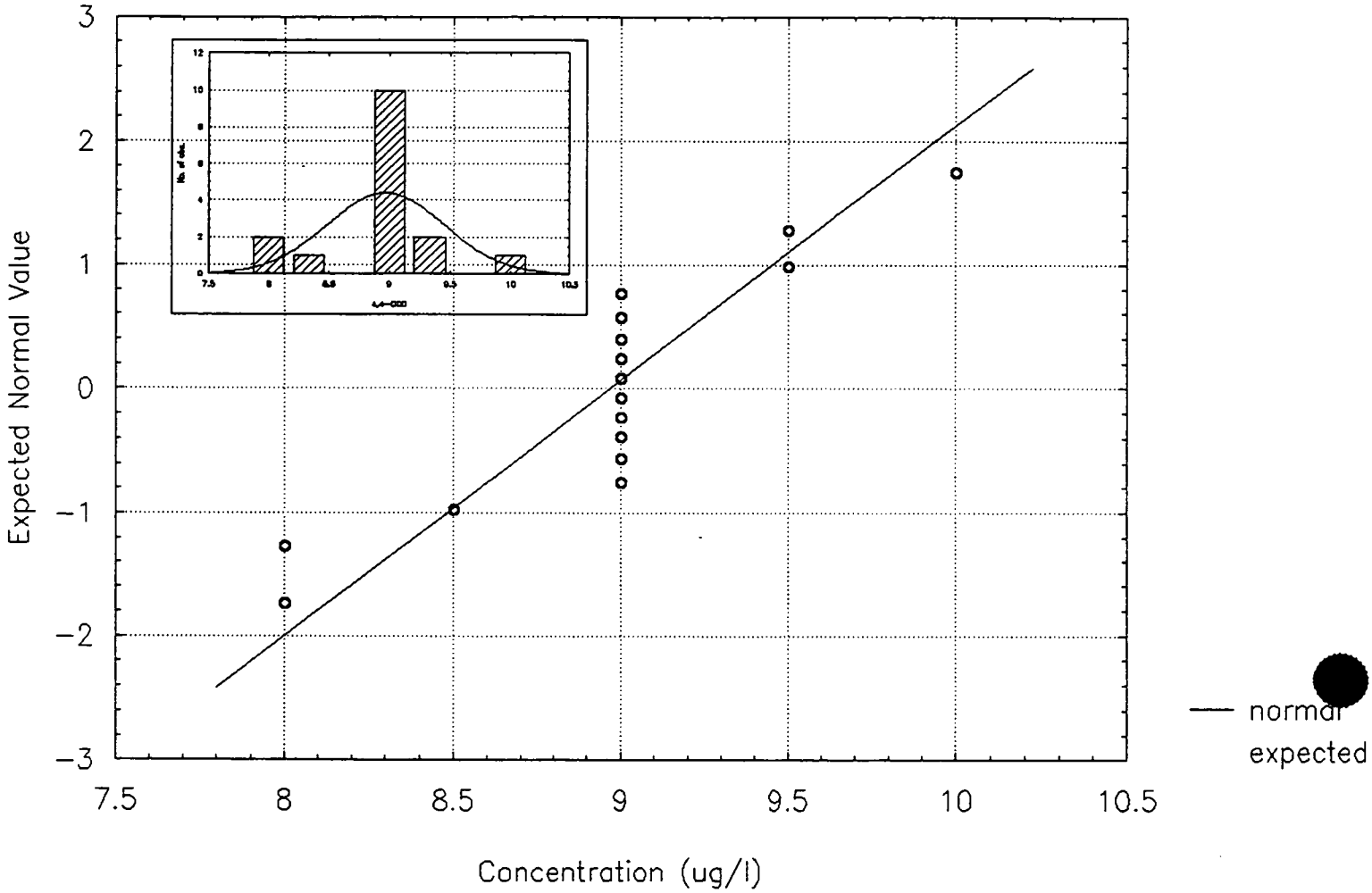


000507

Normal Probablility Plot for the Log
Base 10 Transform of 4,4'-DDE in
Background Surface Soil

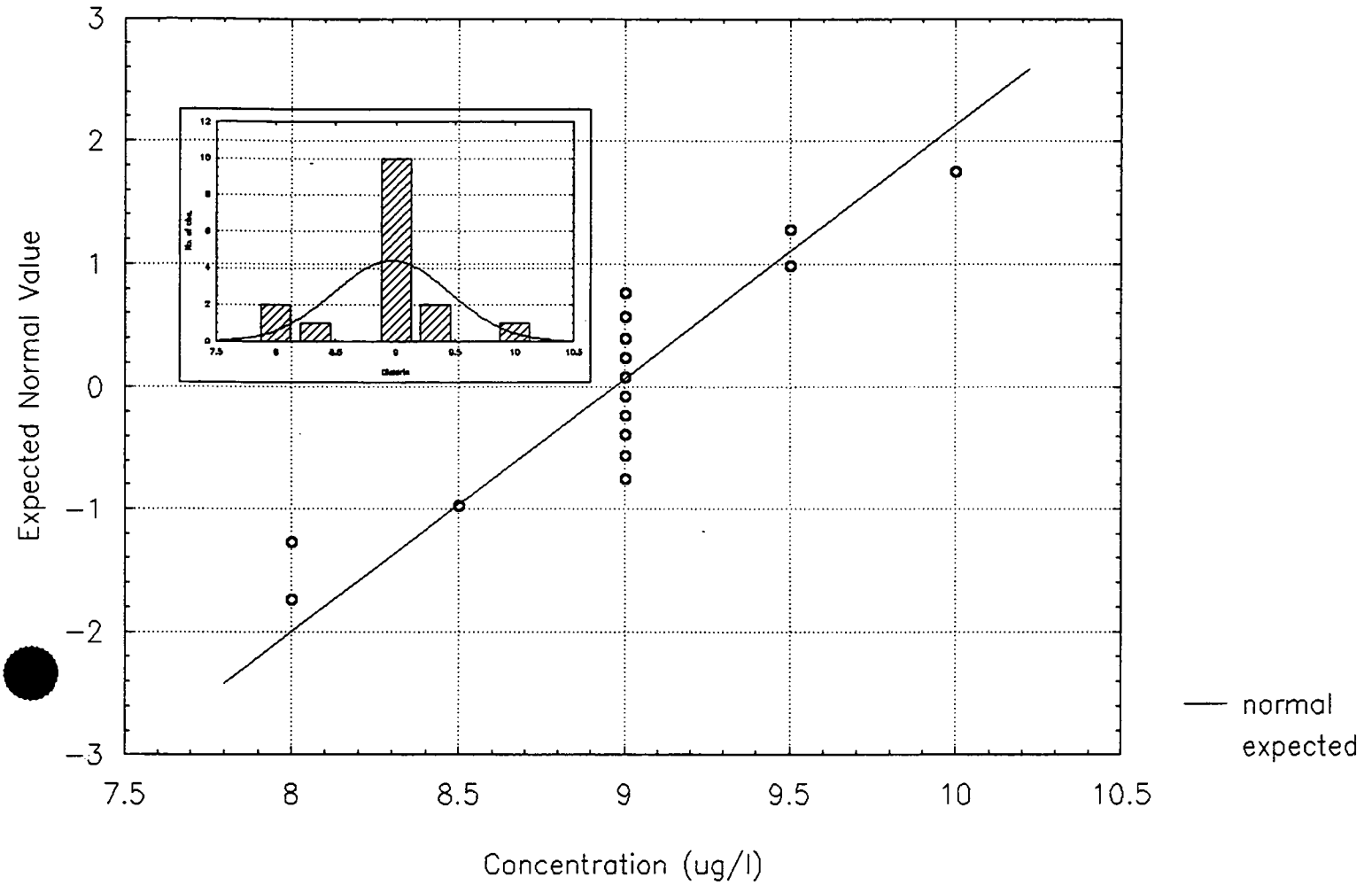


Normal Probablility Plot for
4,4'-DDD
in Background Surface Soils

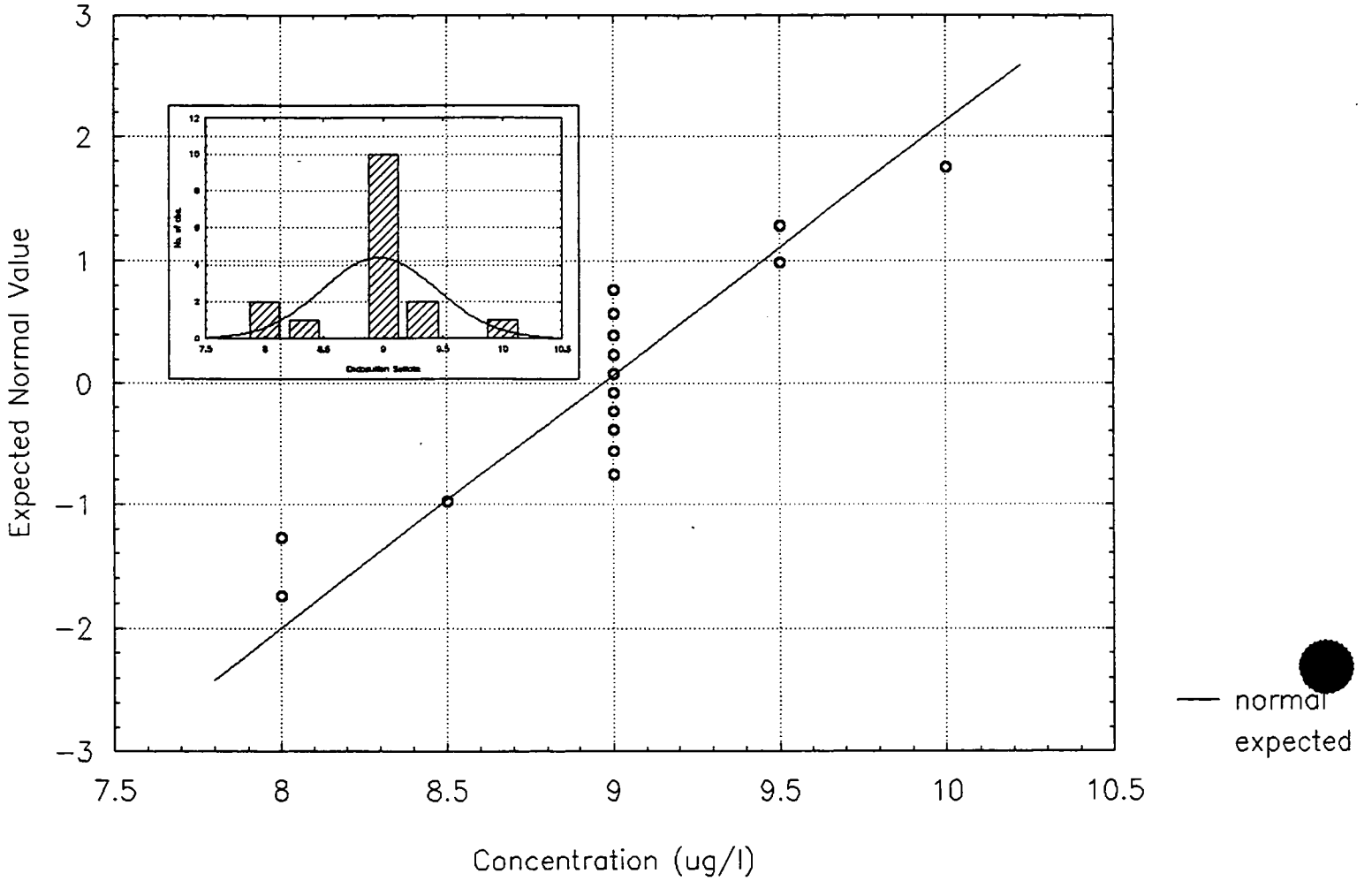


000509

Normal Probablility Plot for
Dieldrin
in Background Surface Soils

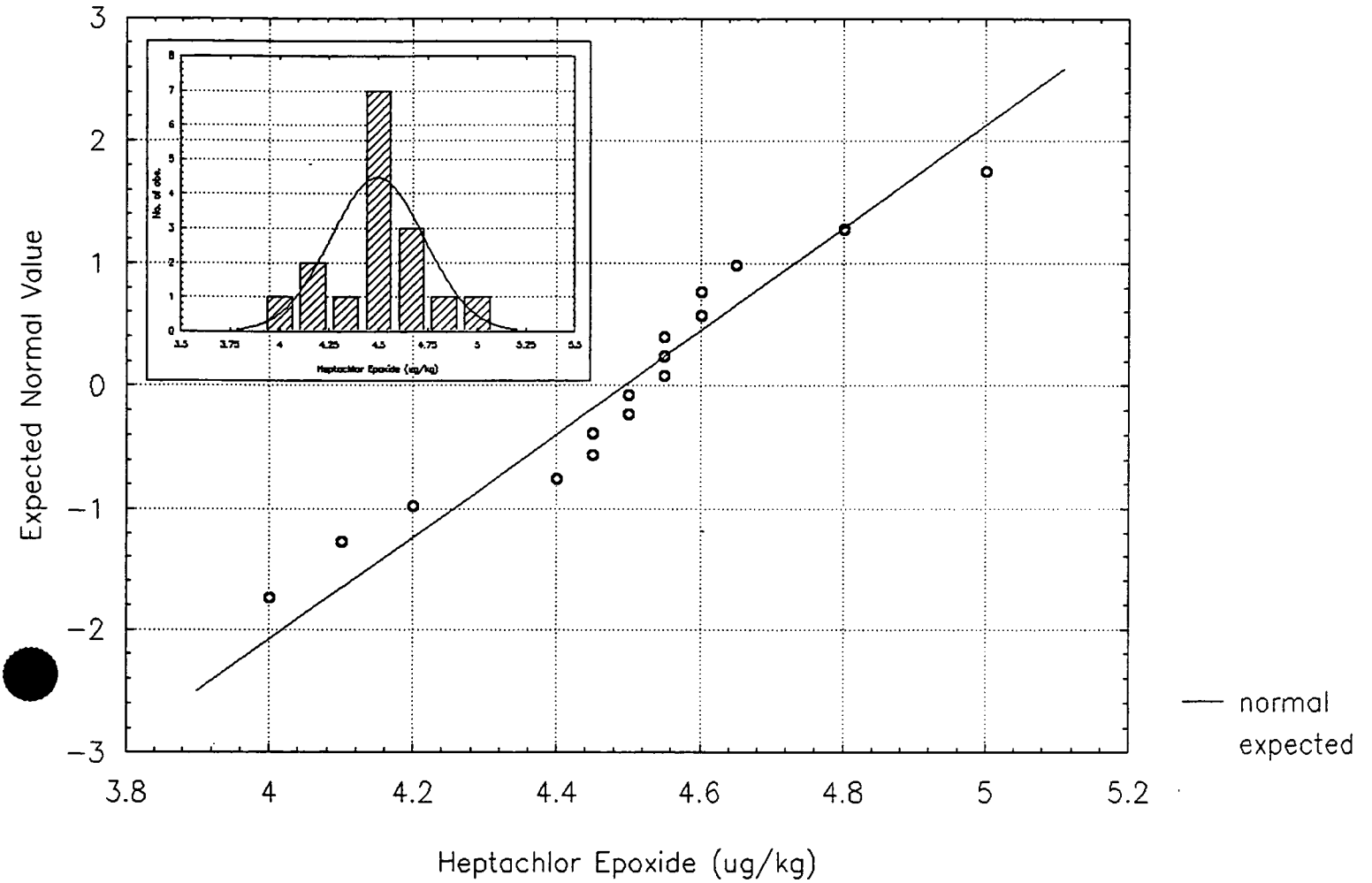


Normal Probablility Plot for
Endosulfan Sulfate
in Background Surface Soils

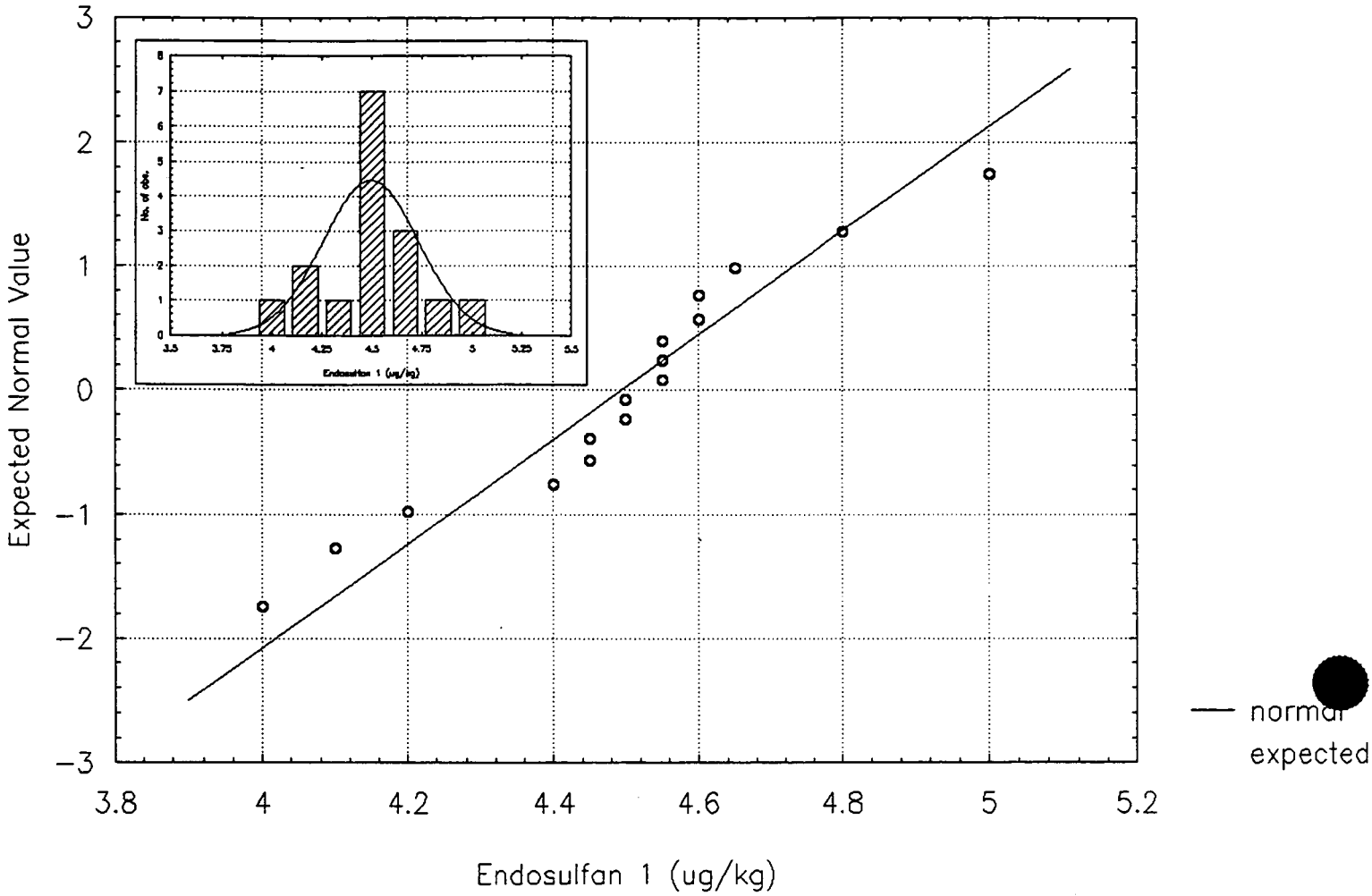


000511

Normal Probablility Plot for
Heptachlor Epoxide for Background
Surface Soil Samples

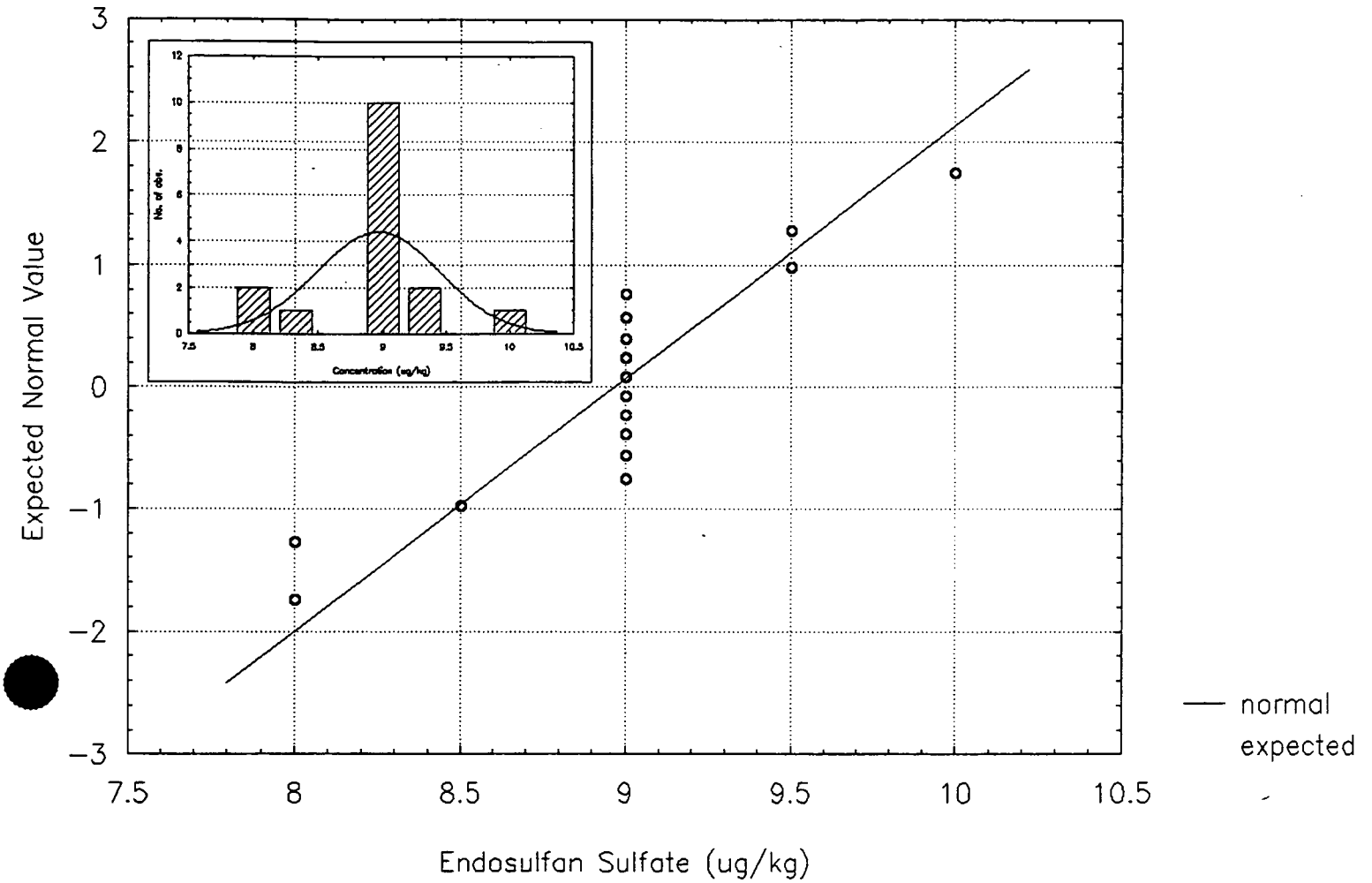


Normal Probablility Plot for
Endosulfan 1 for Background
Surface Soil Samples

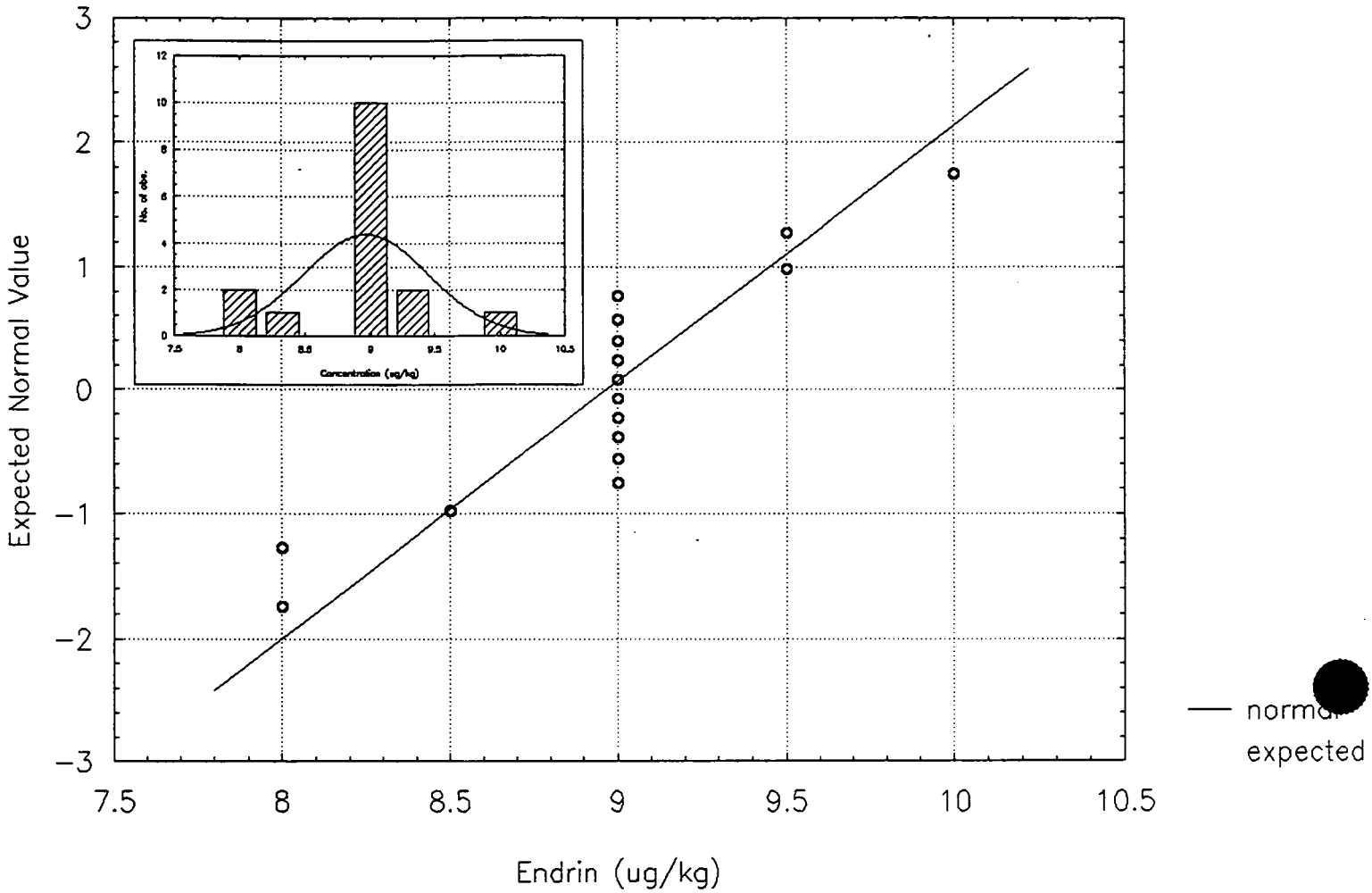


000513

Normal Probablility Plot
for Endosulfan Sulfate in
Background Surface Soils

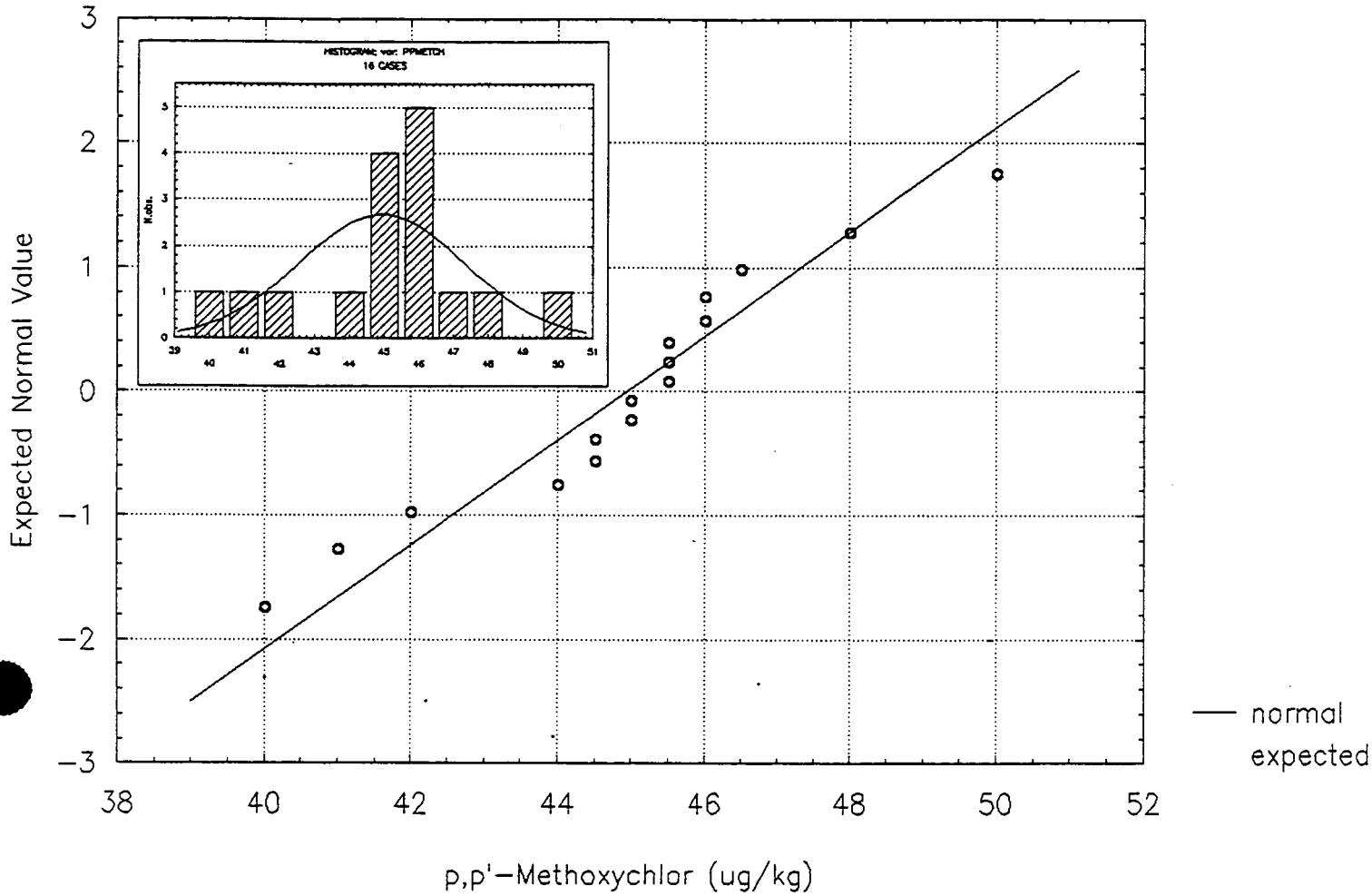


Normal Probablility Plot
for Endrin in Background Surface
Soil

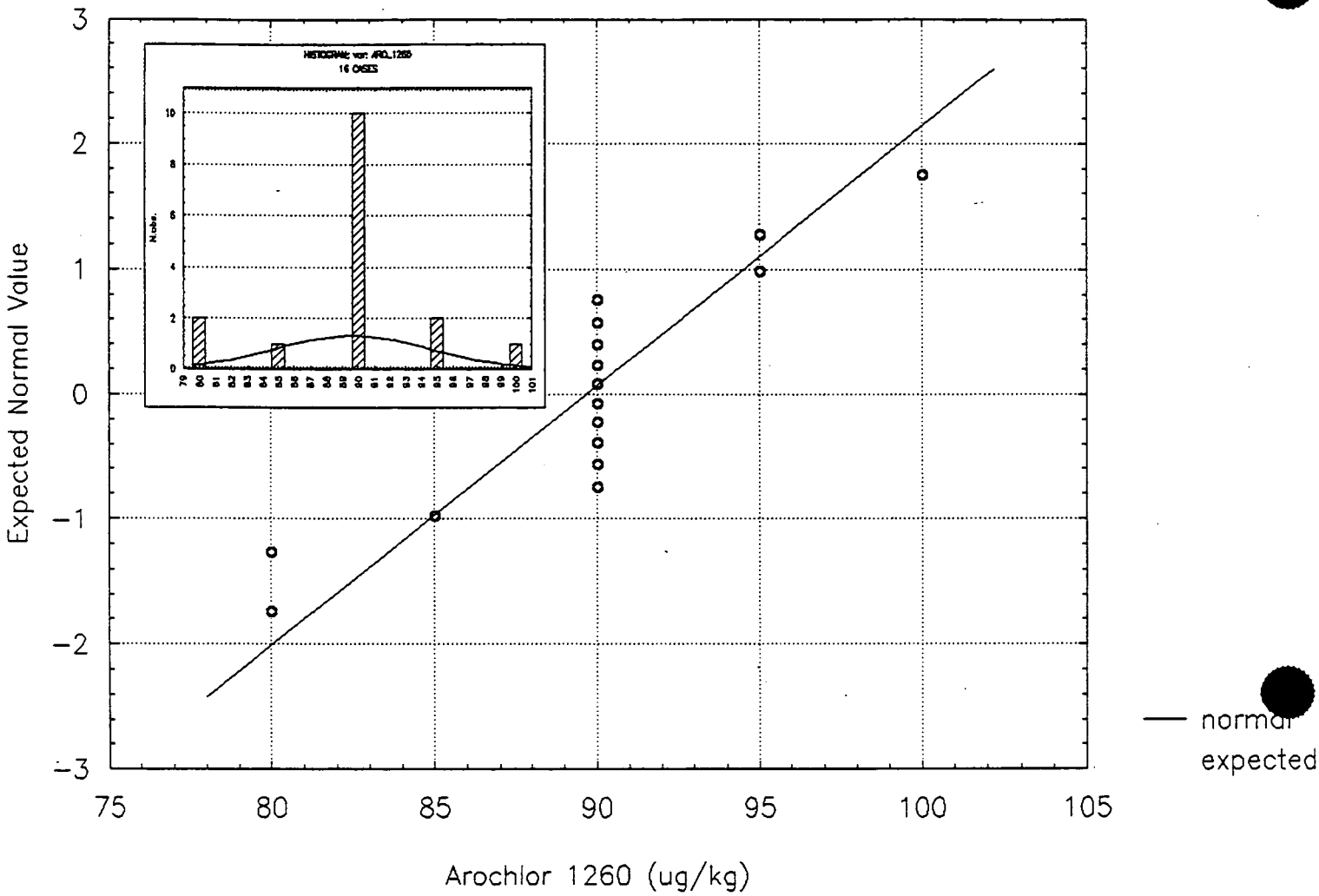


000515

Normal Probablility Plot for
p,p'-Methoxychlor in Background
Surface Soils

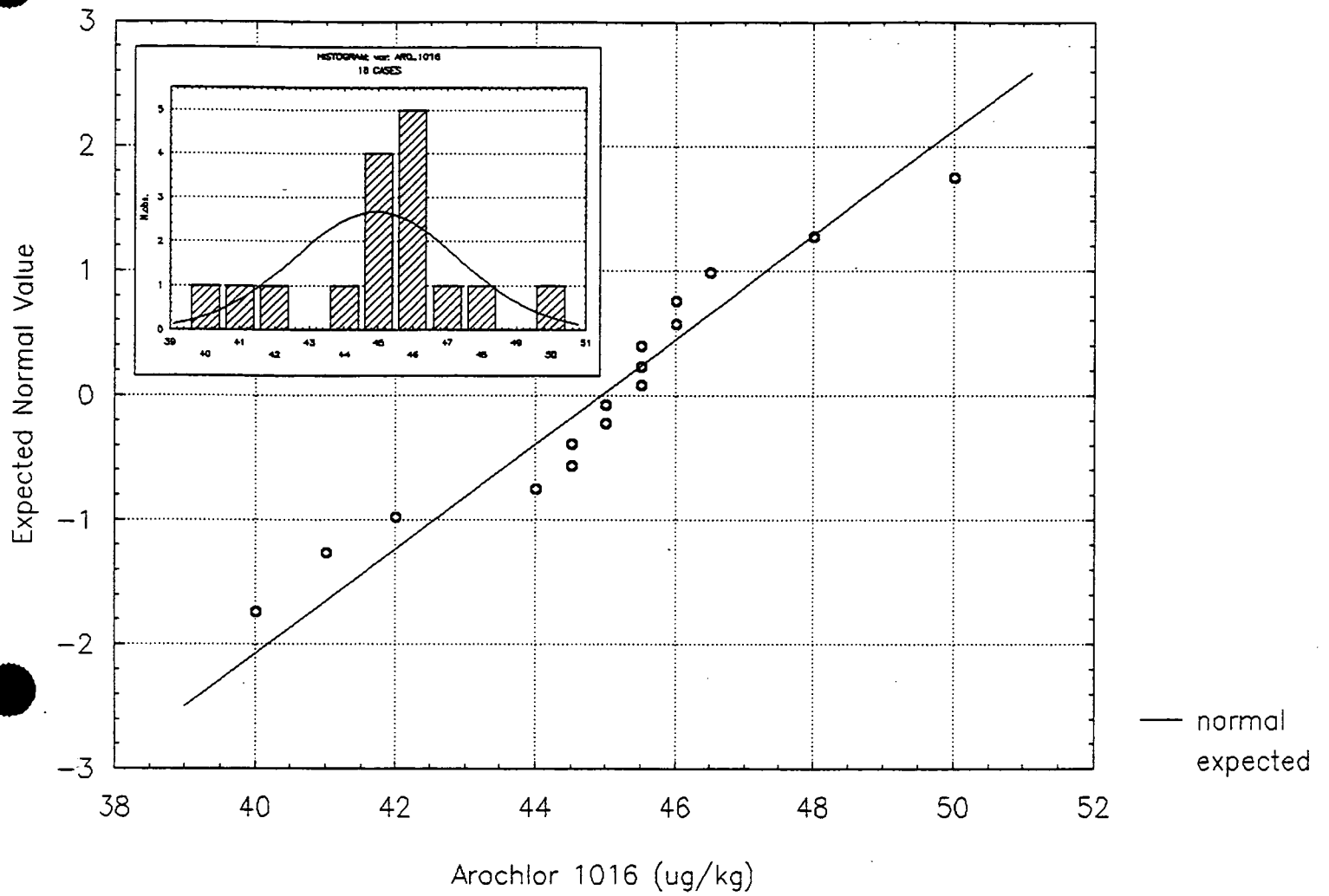


Normal Probablility Plot for PCB
Arochlor 1260 in Background Surface Soils

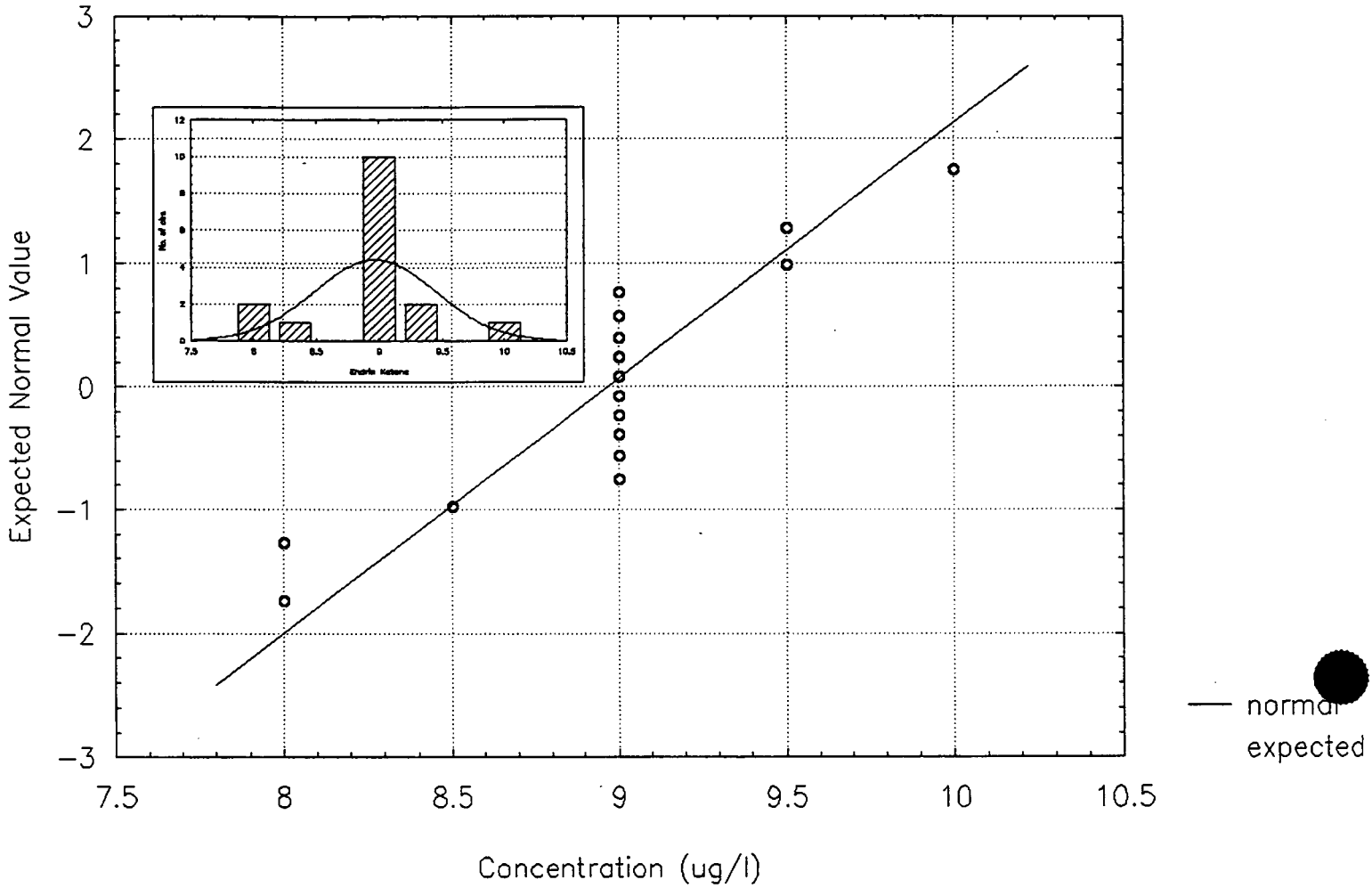


000517

Normal Probablility Plot for PCB
Arochlor 1016 in Backgroun Surface Soils



Normal Probablility Plot for
Endrin Ketone
in Background Surface Soils



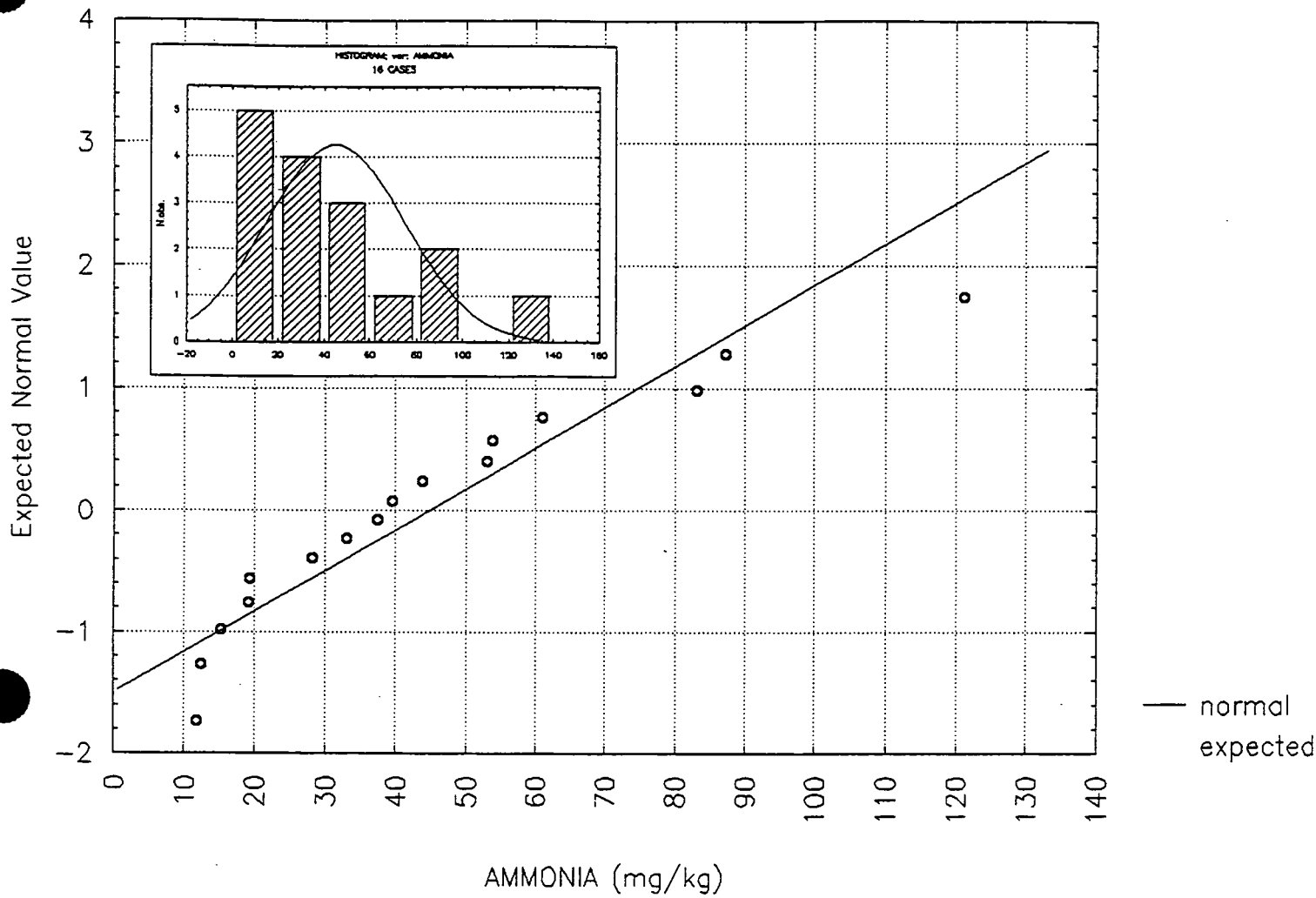
000519

007359

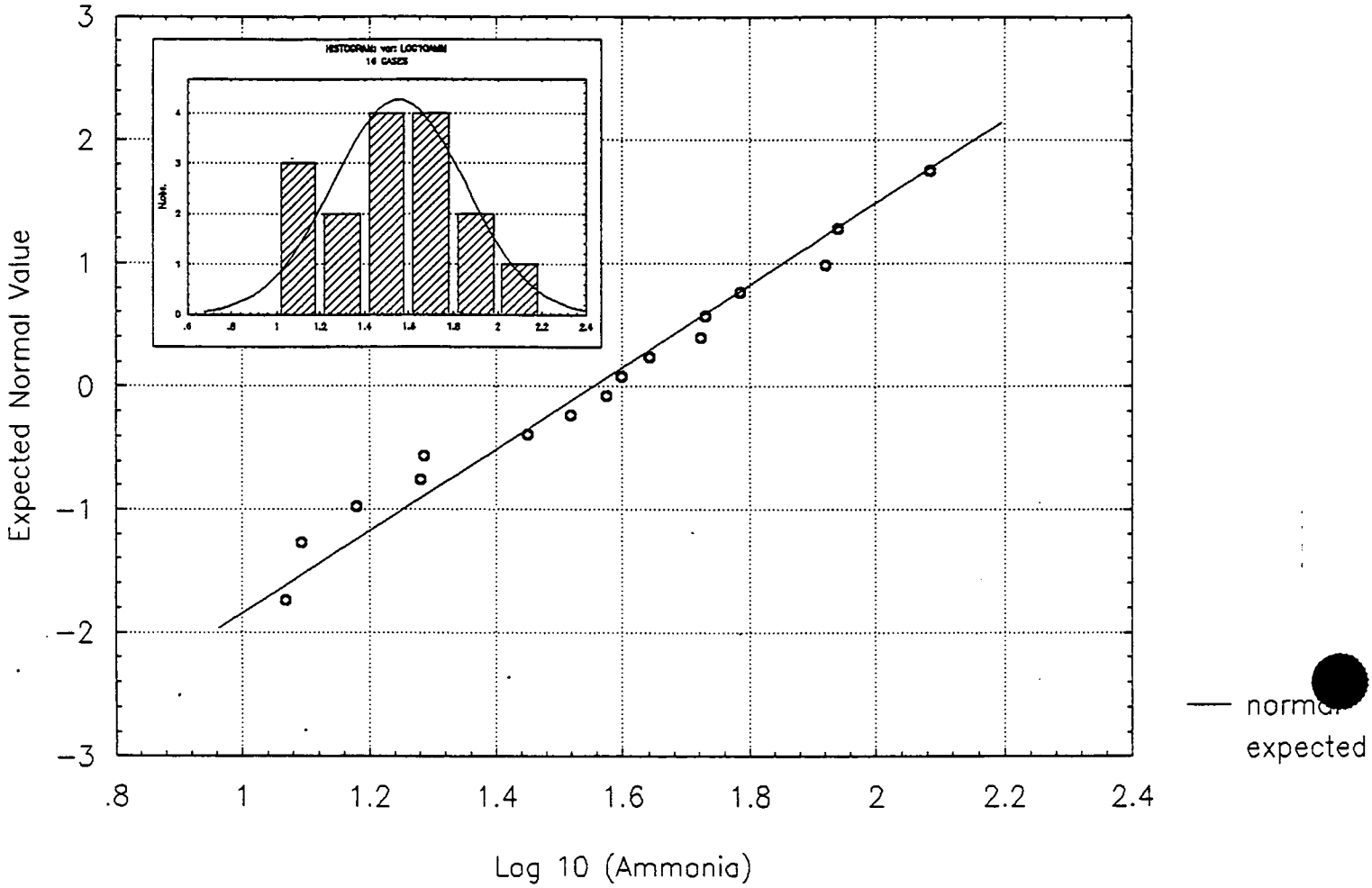
GENERAL PARAMETERS

000520

Normal Probablility Plot for Ammonia
in Background Surface Soils

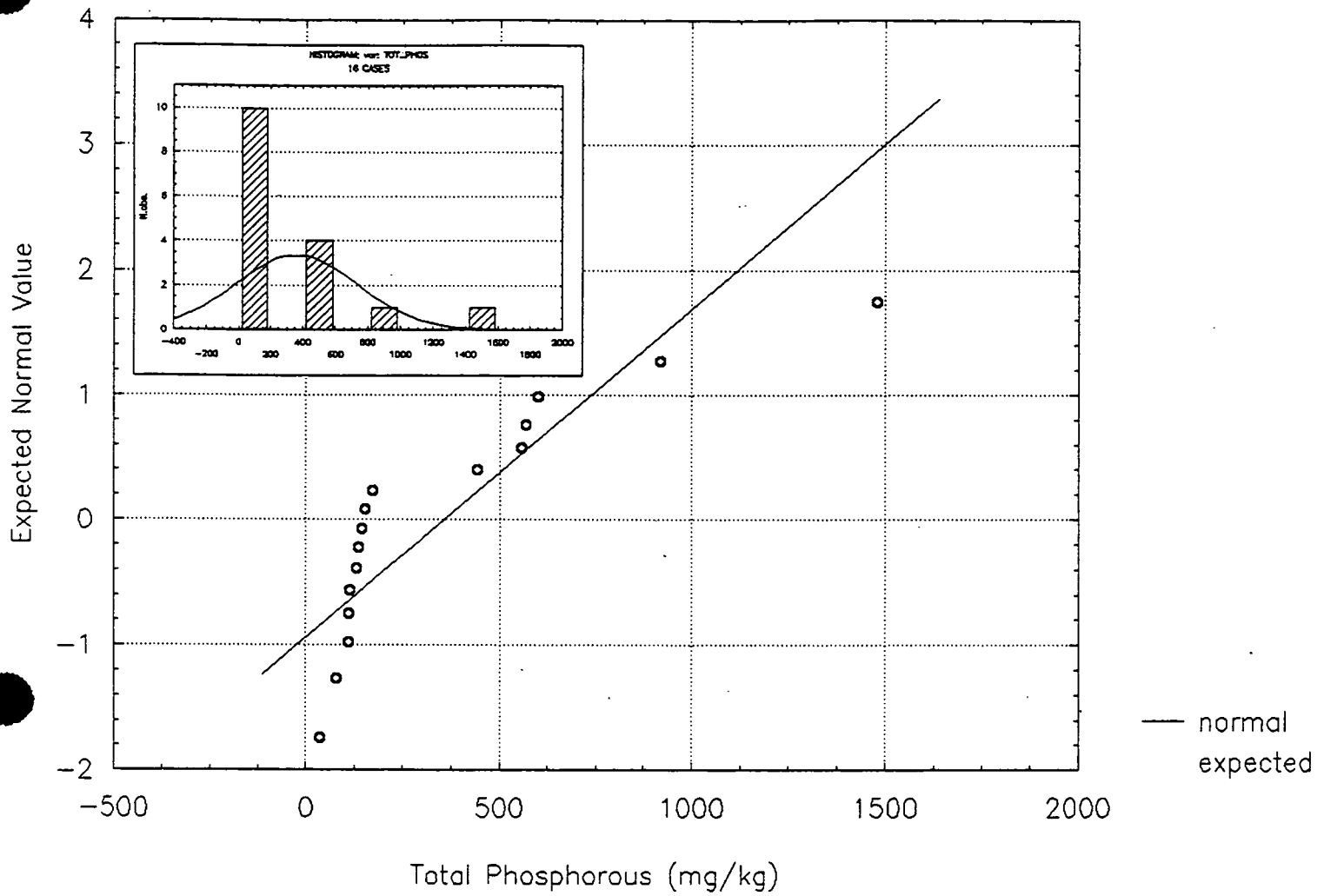


Normal Probablility Plot for the
Log Base 10 Transform of Ammonia
in Background Surface Soils

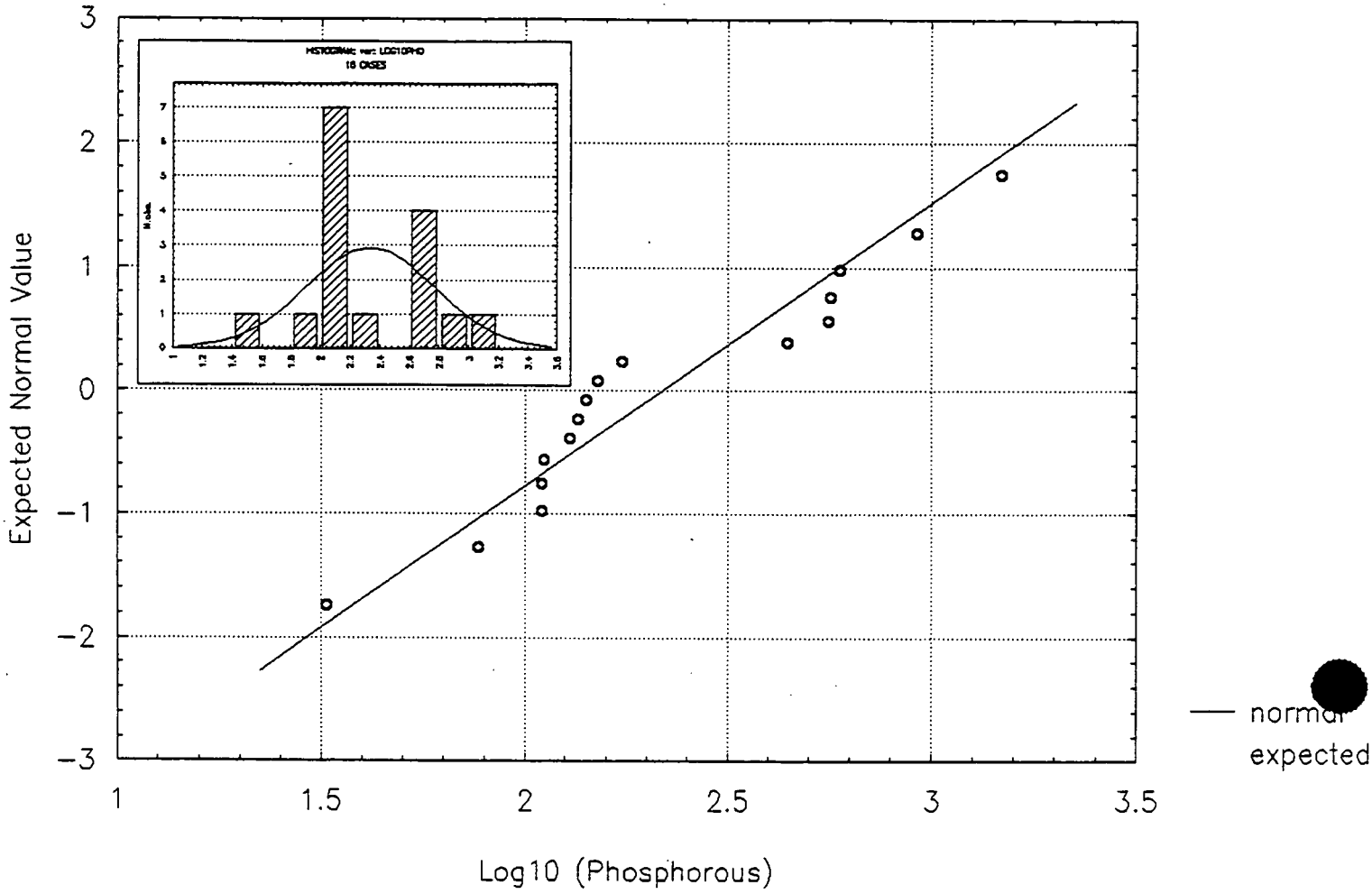


000522

Normal Probablility Plot for Total
Phosphorous in Background Surface Soils

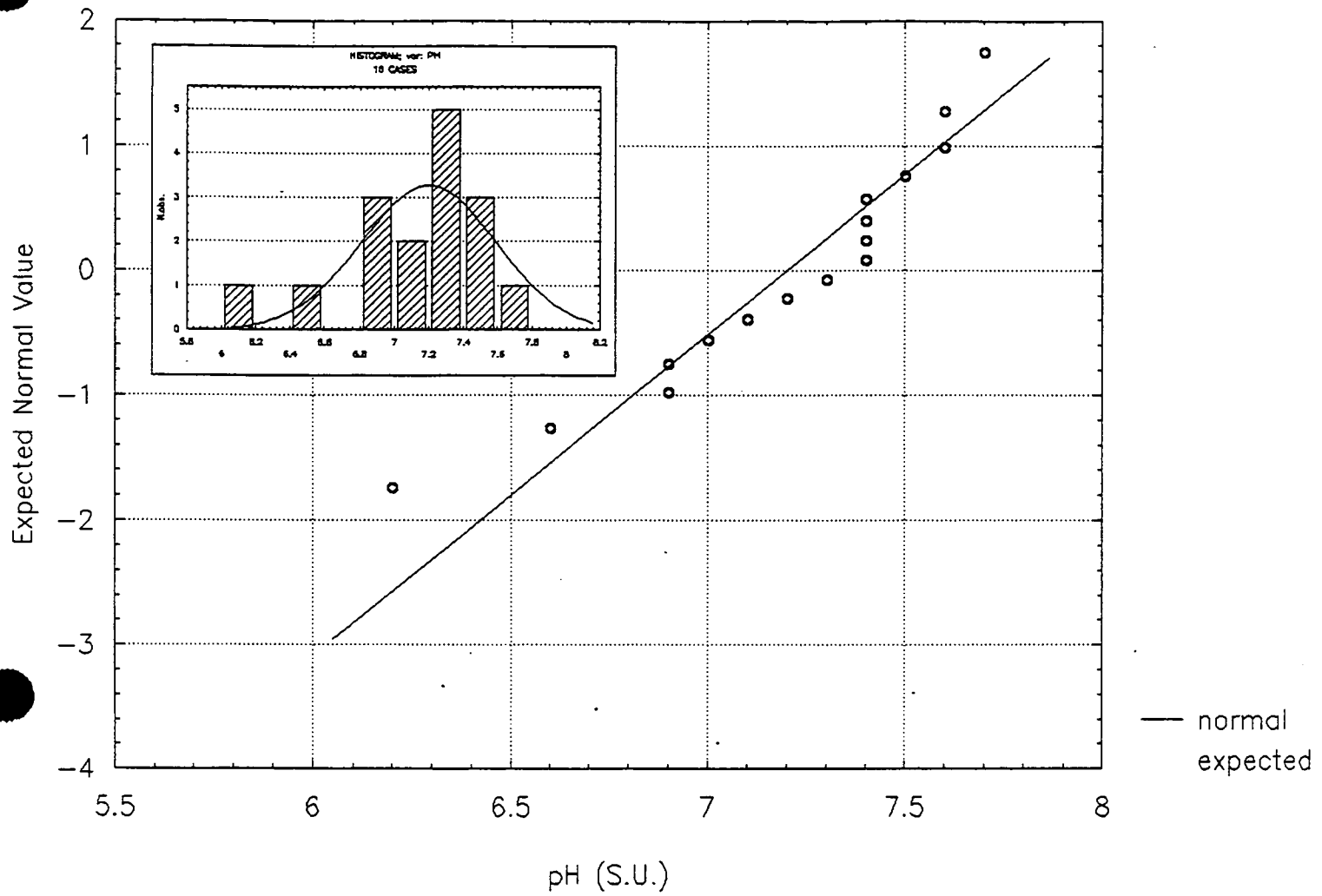


Normal Probablility Plot for the
Log Base 10 Transform of Total
Phosphorous in Background Surface Soils

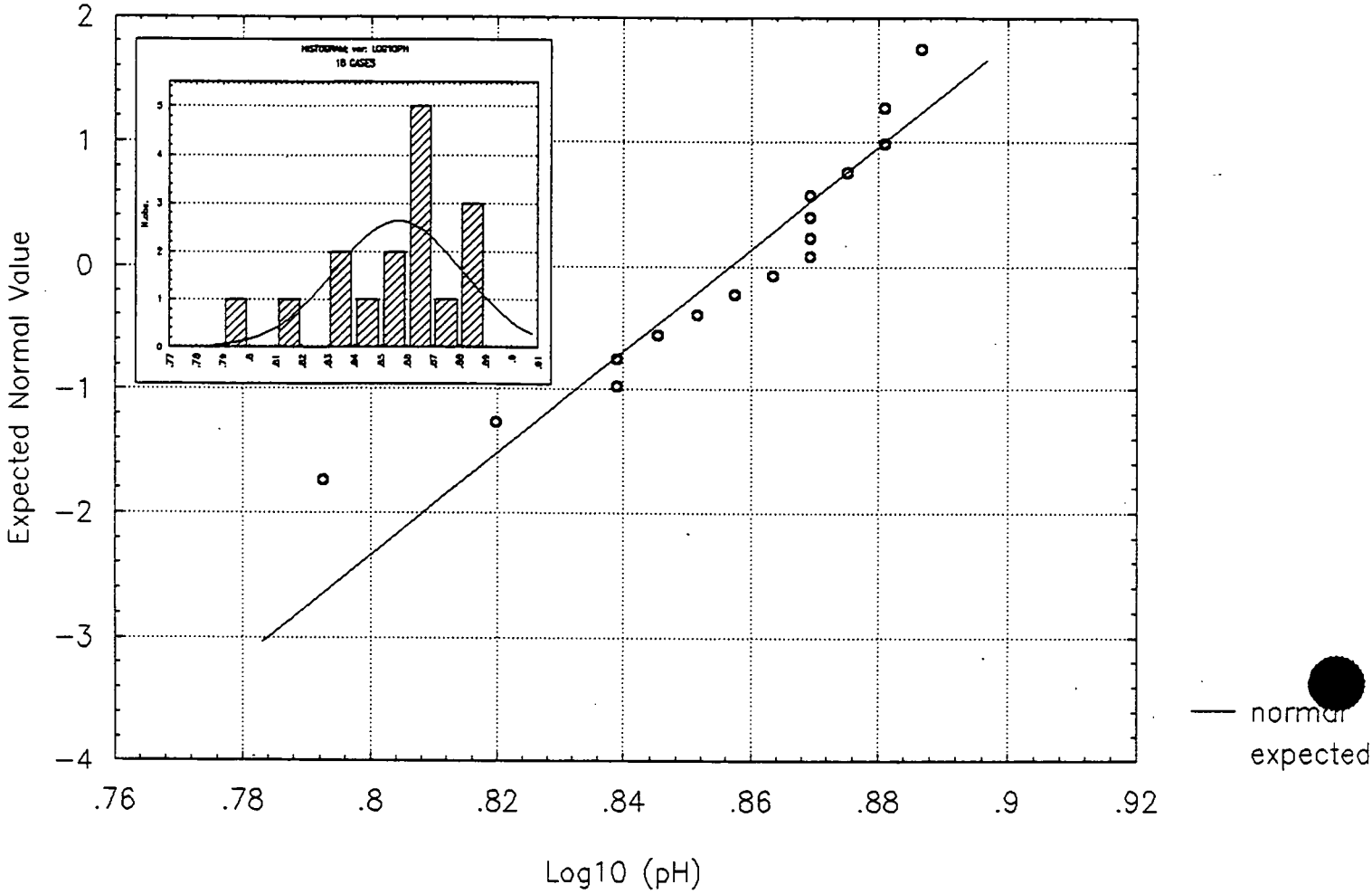


000524

Normal Probablility Plot for pH in
the Background Surface Soils

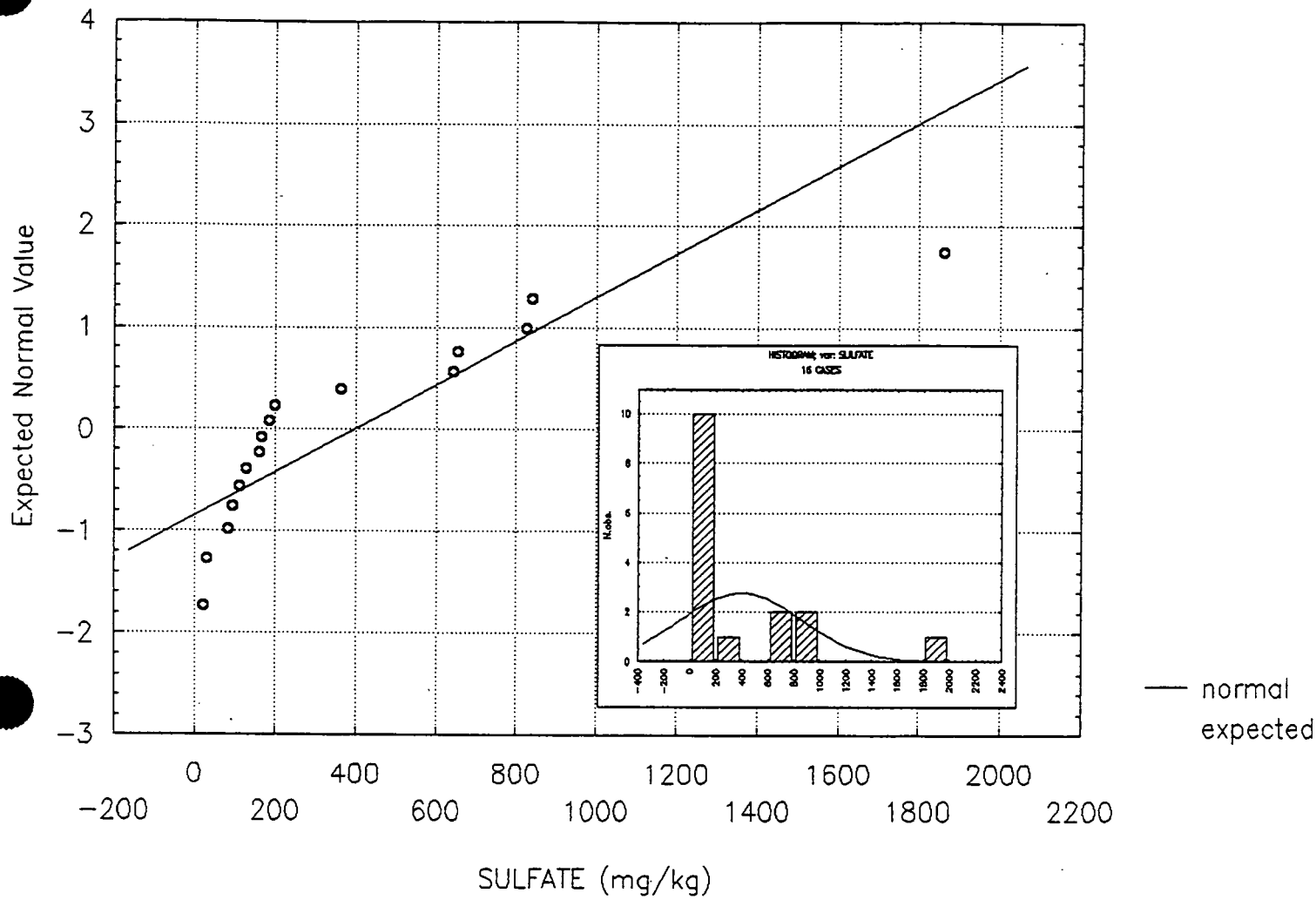


Normal Probablility Plot for the
Log Base 10 Transform of pH in
Background Surface Soils

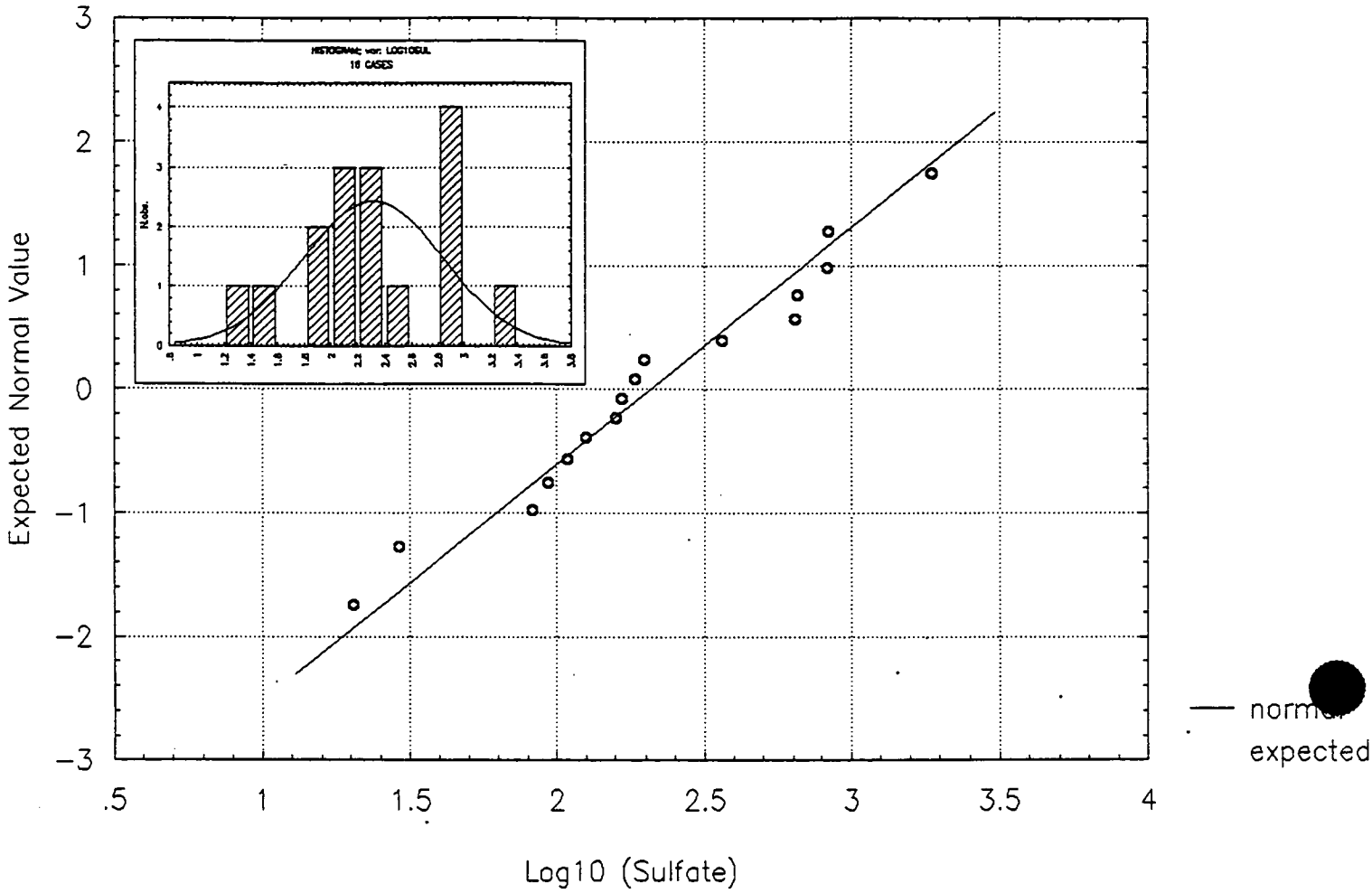


000526

Normal Probablility Plot for Sulfate
in Background Surface Soils



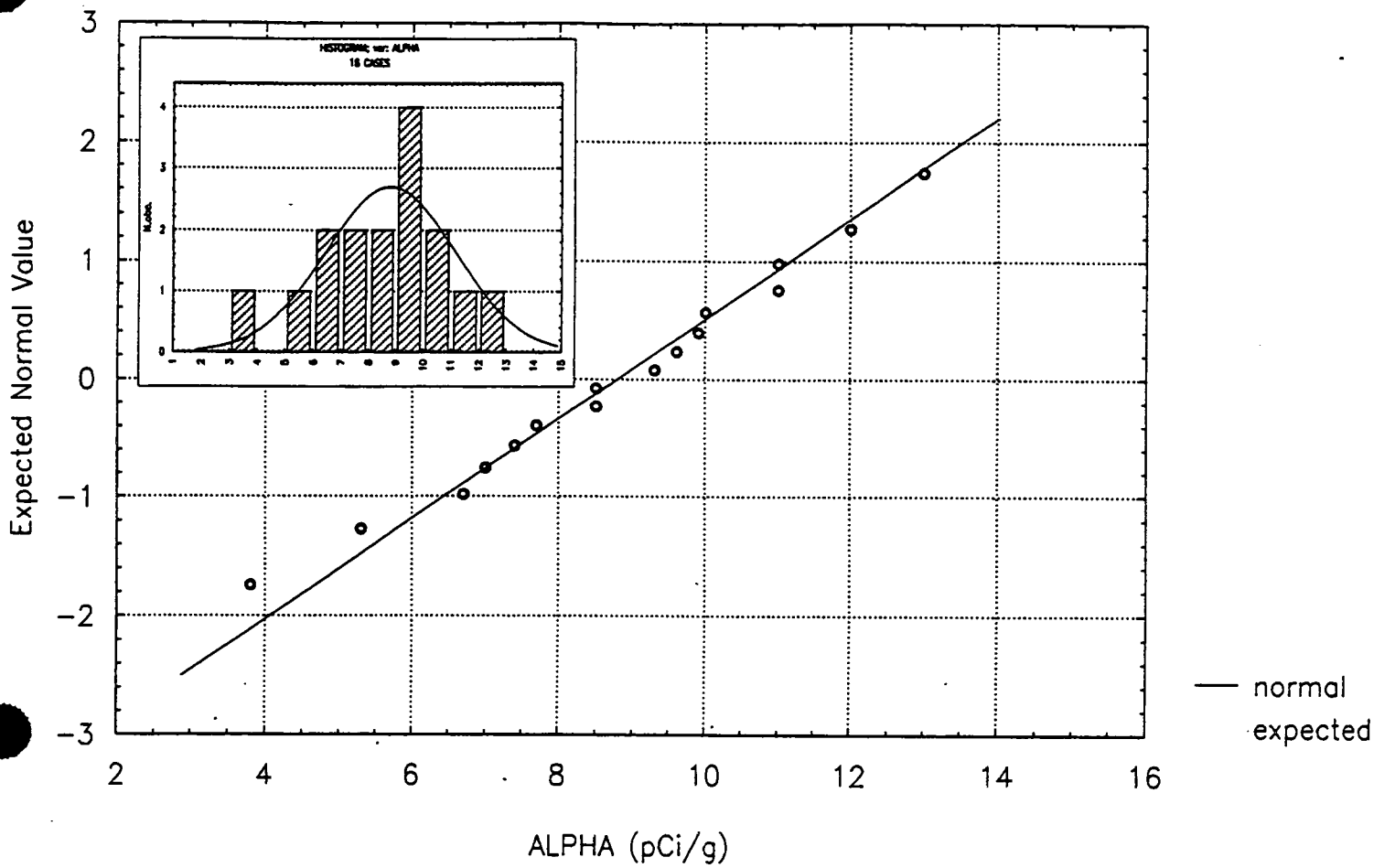
Normal Probablility Plot for the
Log Base 10 Transform of Sulfate
in Background Surface Soils



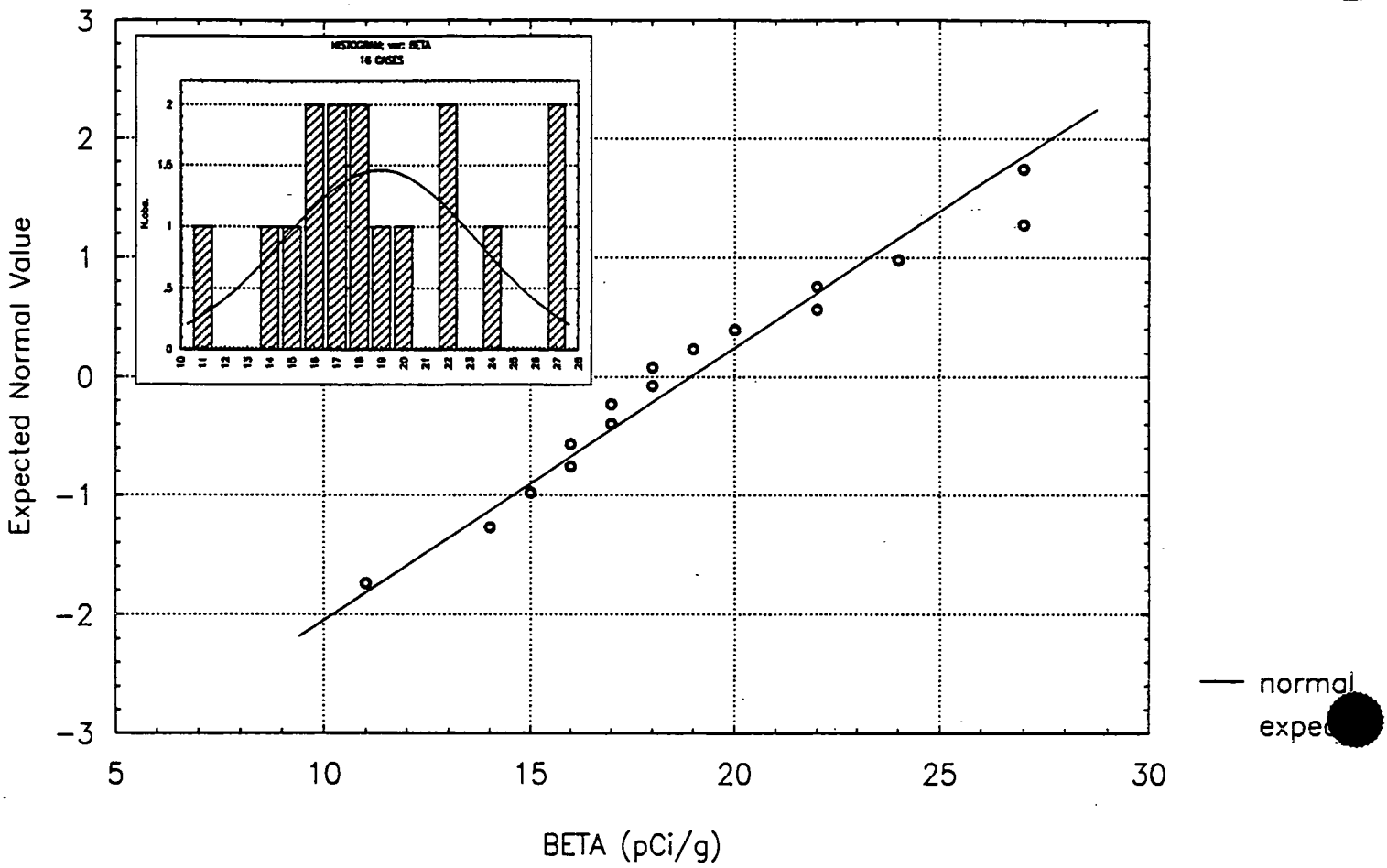
000528

RADIOLOGICAL PARAMETERS

Normal Probablility Plot
for Alpha Particles in Surface Soil

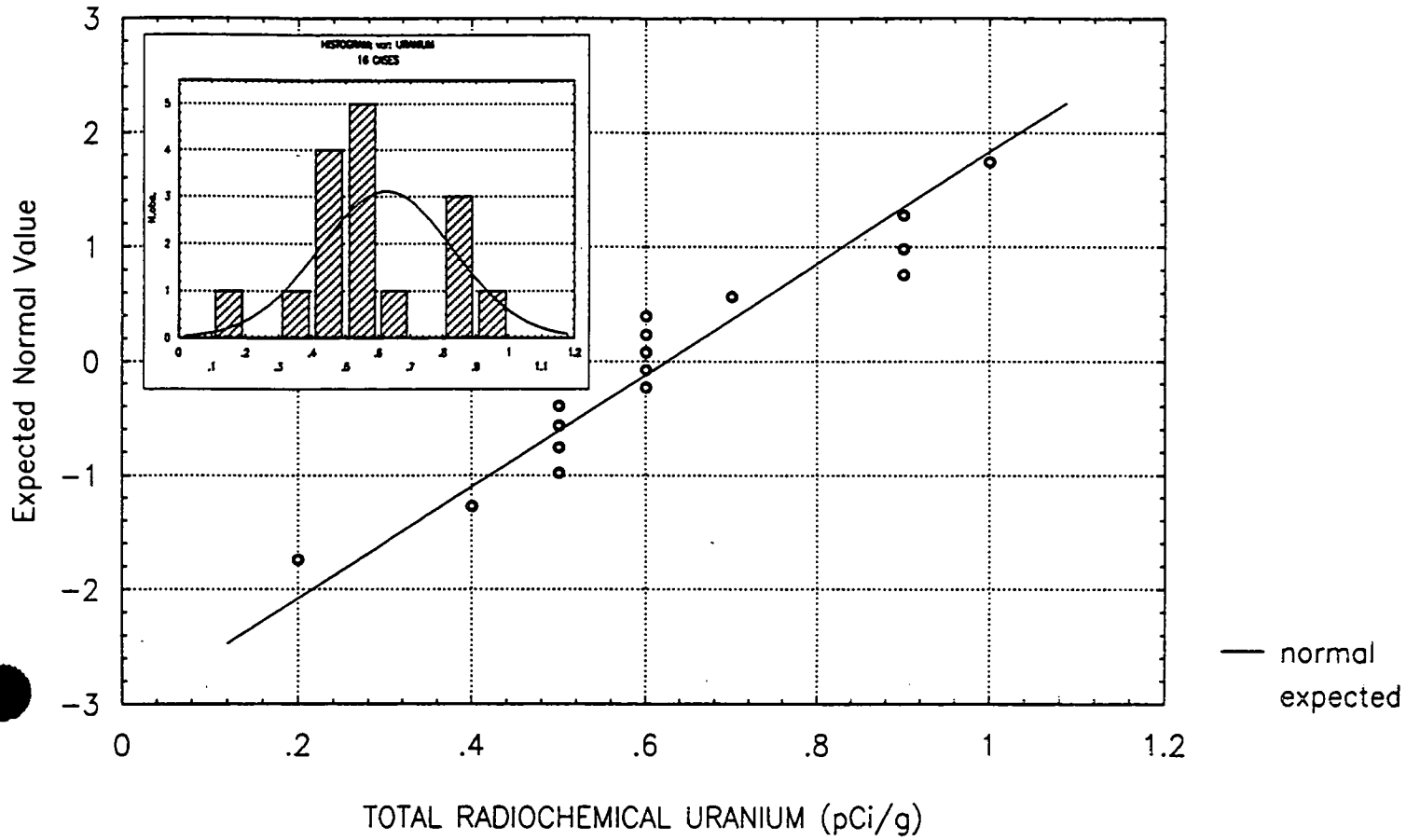


Normal Probablility Plot
for Beta Particles in Surface Soils

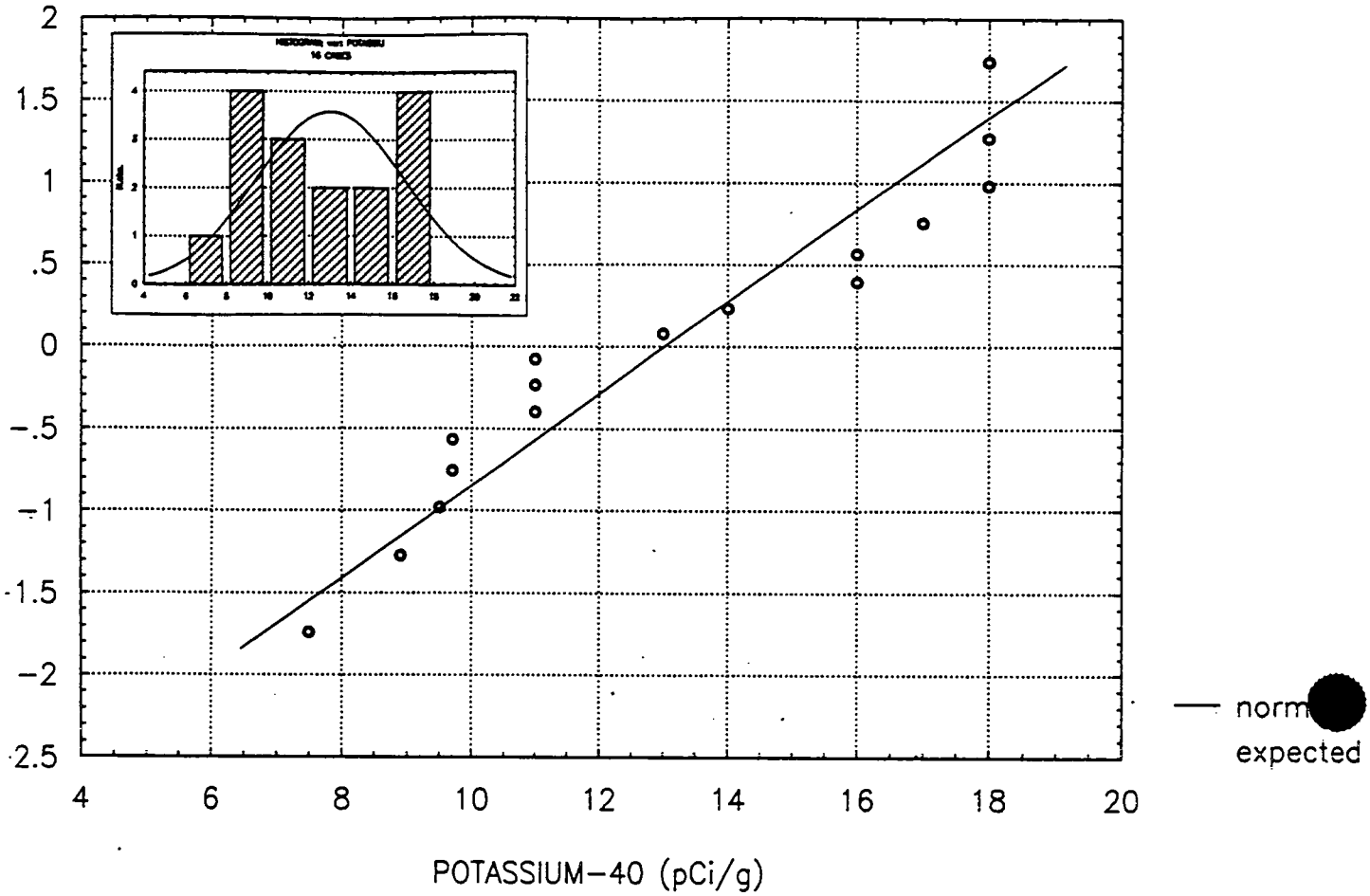


000531

Normal Probablility Plot
for Total (Radiochemical) Uranium
in Background Surface Soils



Normal Probablility Plot
for Potassium-40 in Surface Soils



000533

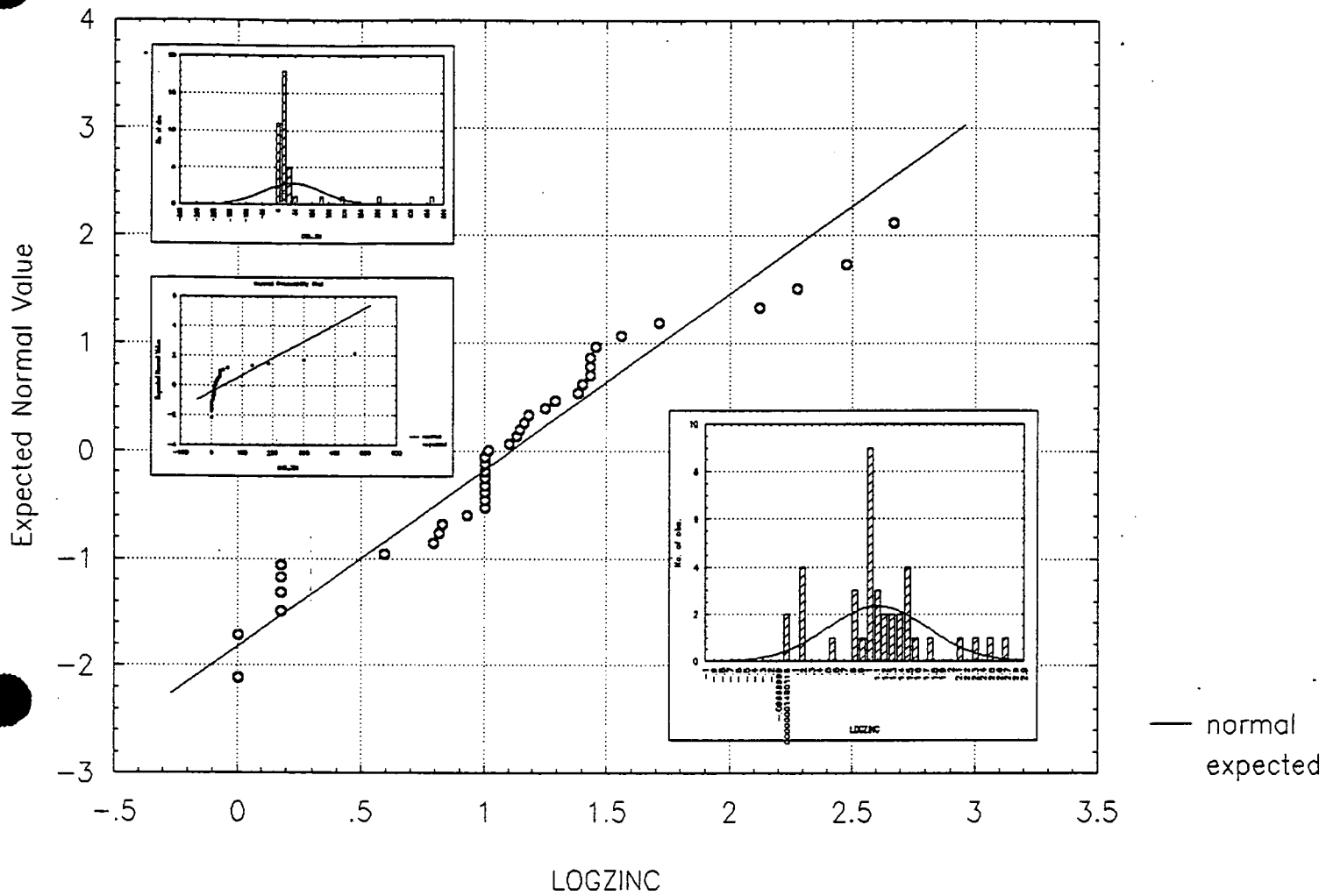
APPENDIX F

STATISTICAL EVALUATION SUMMARY - GROUNDWATER

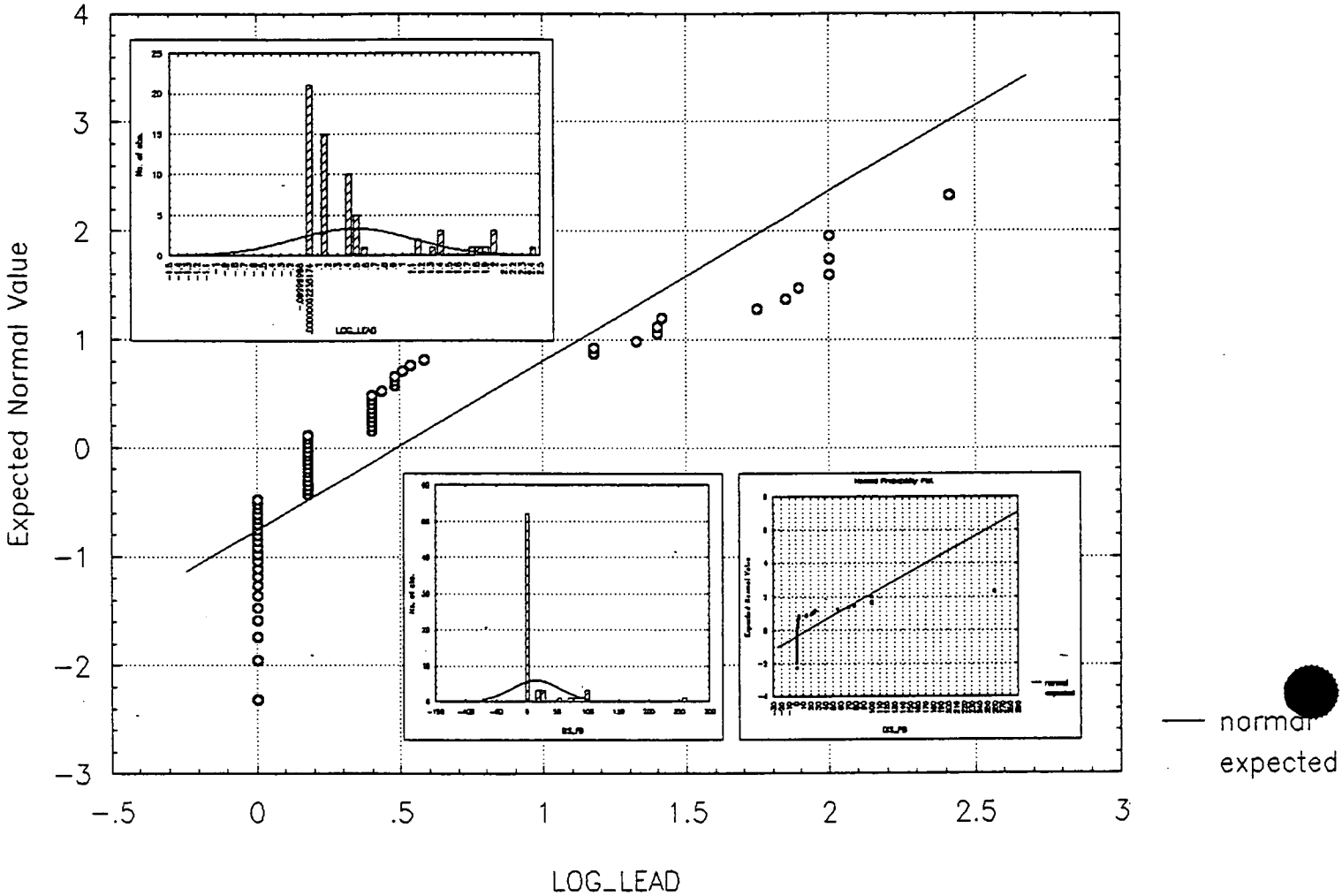
DISSOLVED METALS

EVALUATION OF SELECT CHEMICALS USING ENTIRE BACKGROUND DATA SET

Normal Probablility Plot for Dissolved Zinc
in Background Groundwater (Original Data Set)

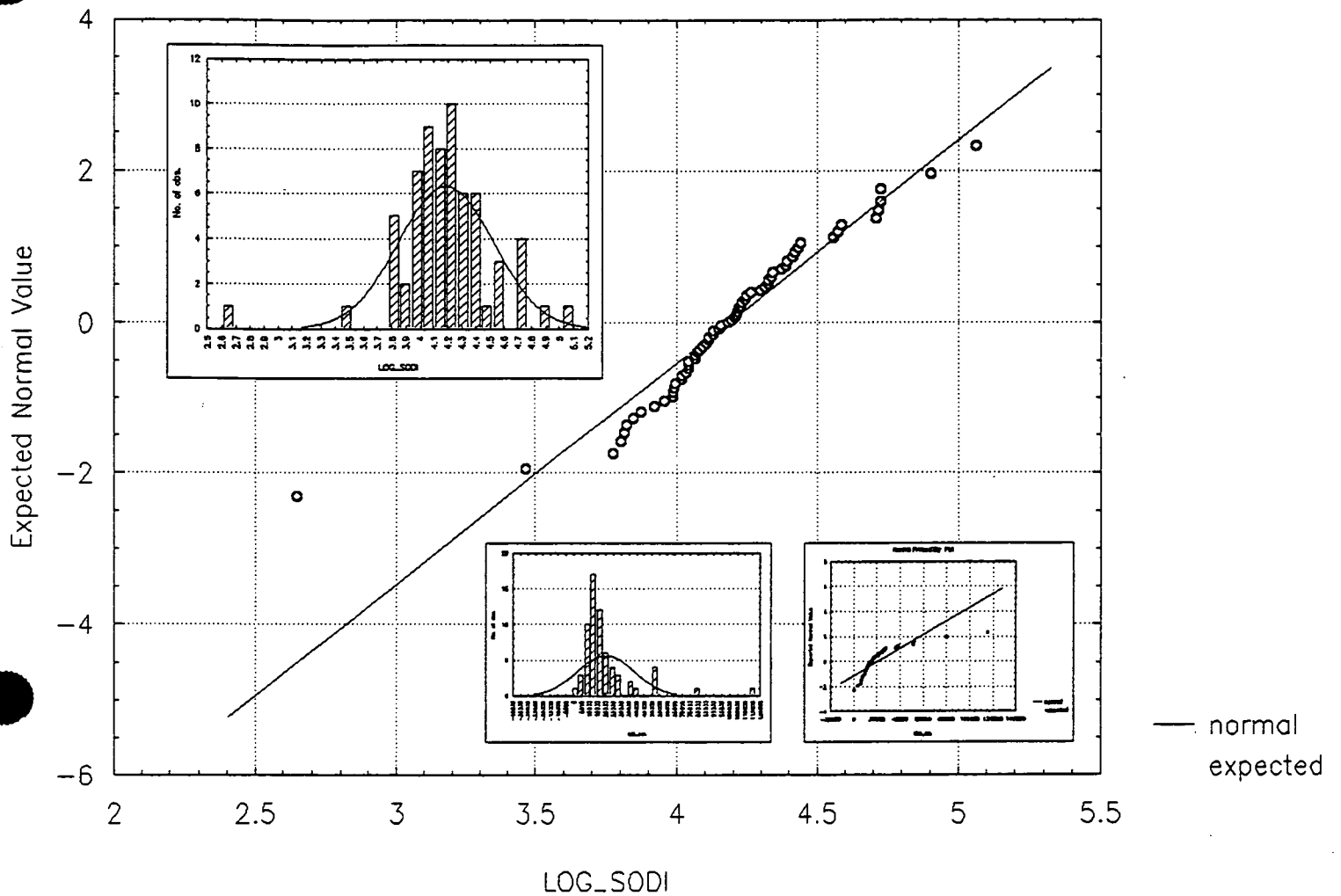


Normal Probablility Plot for Dissolved Lead
in Background Groundwater (Original Data Set)

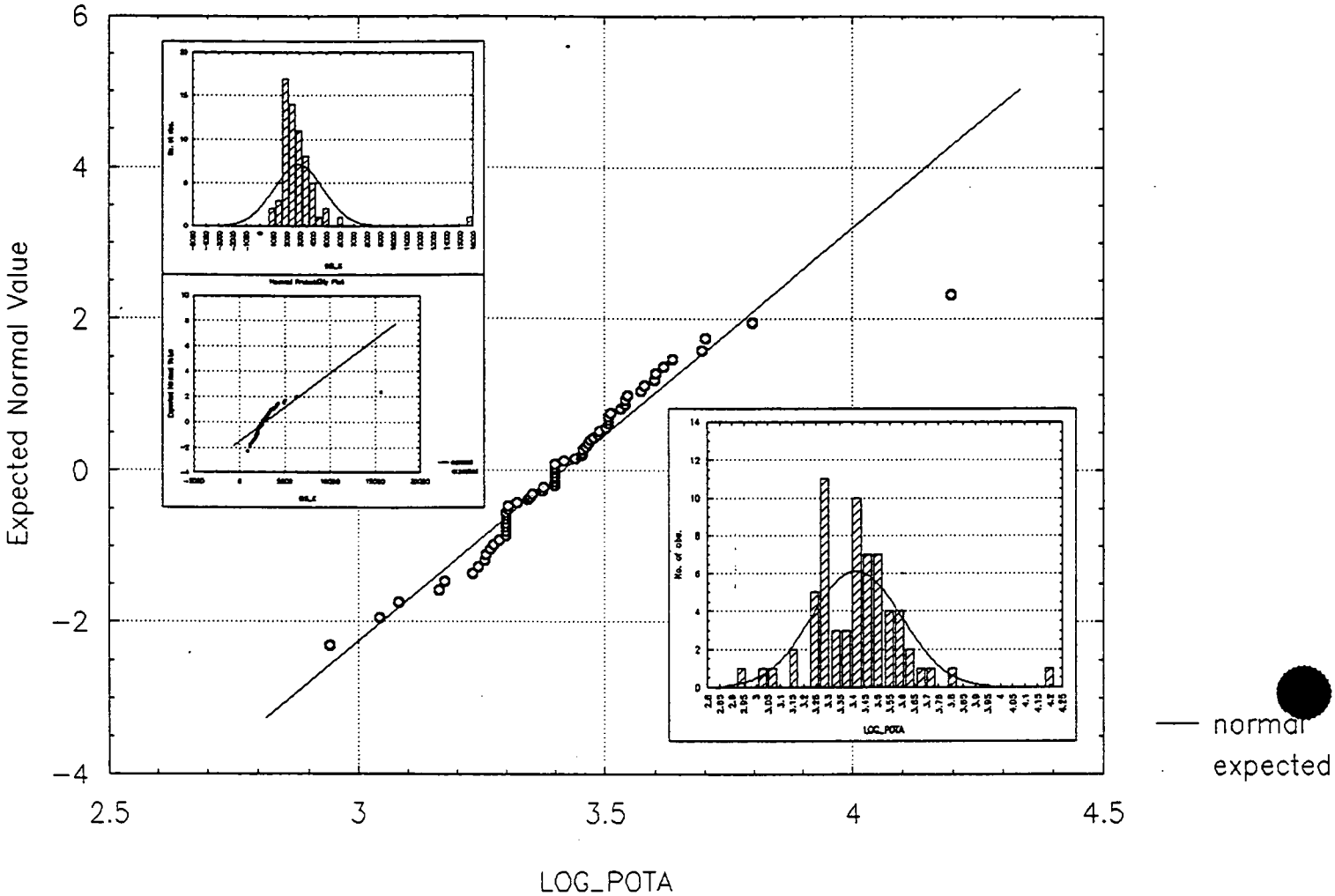


000558

Normal Probablility Plot for Dissolved Sodium
in Background Groundwater (Original Data Set)



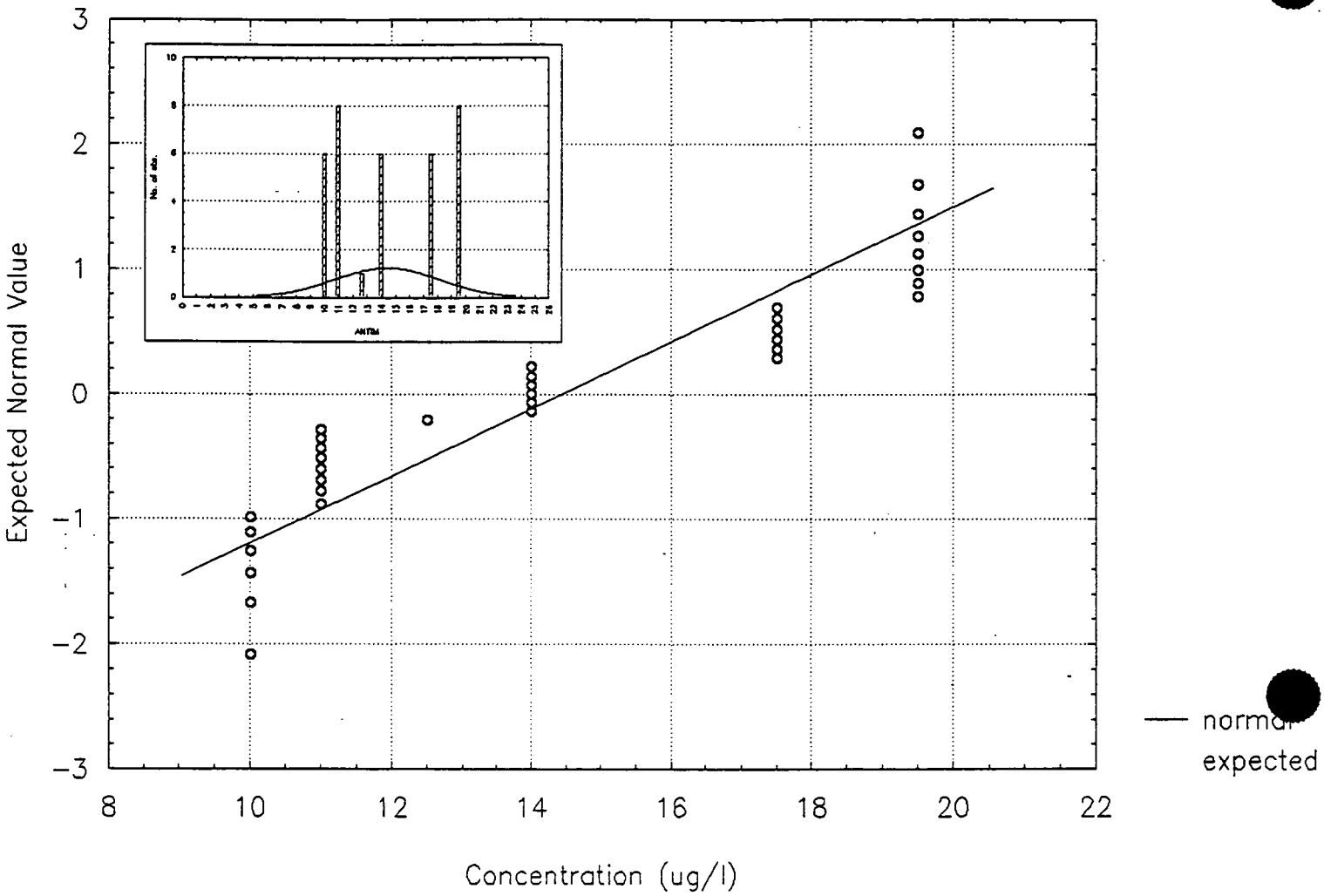
Normal Probablility Plot for Dissolved Potassium
in Background Groundwater (Original Data Set)



000540

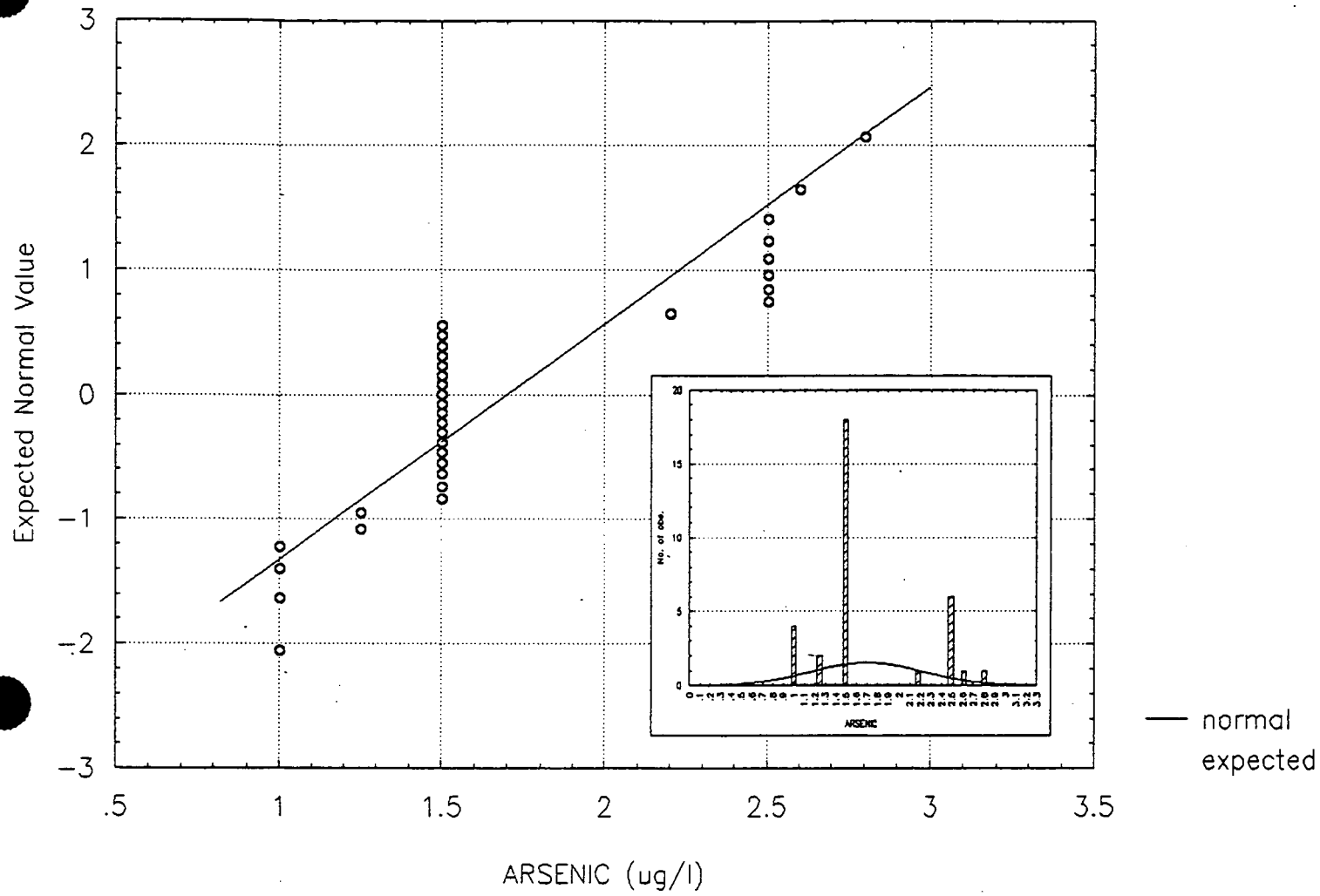
STATISTICAL EVALUATION USING REDUCED DATA SET [ESTES (ROUND 4), DOE #2095 AND A&W2 (ROUND 3) REMOVED]

Normal Probablility Plot for Dissolved Antimony
in Background Groundwater (Reduced Data Set)

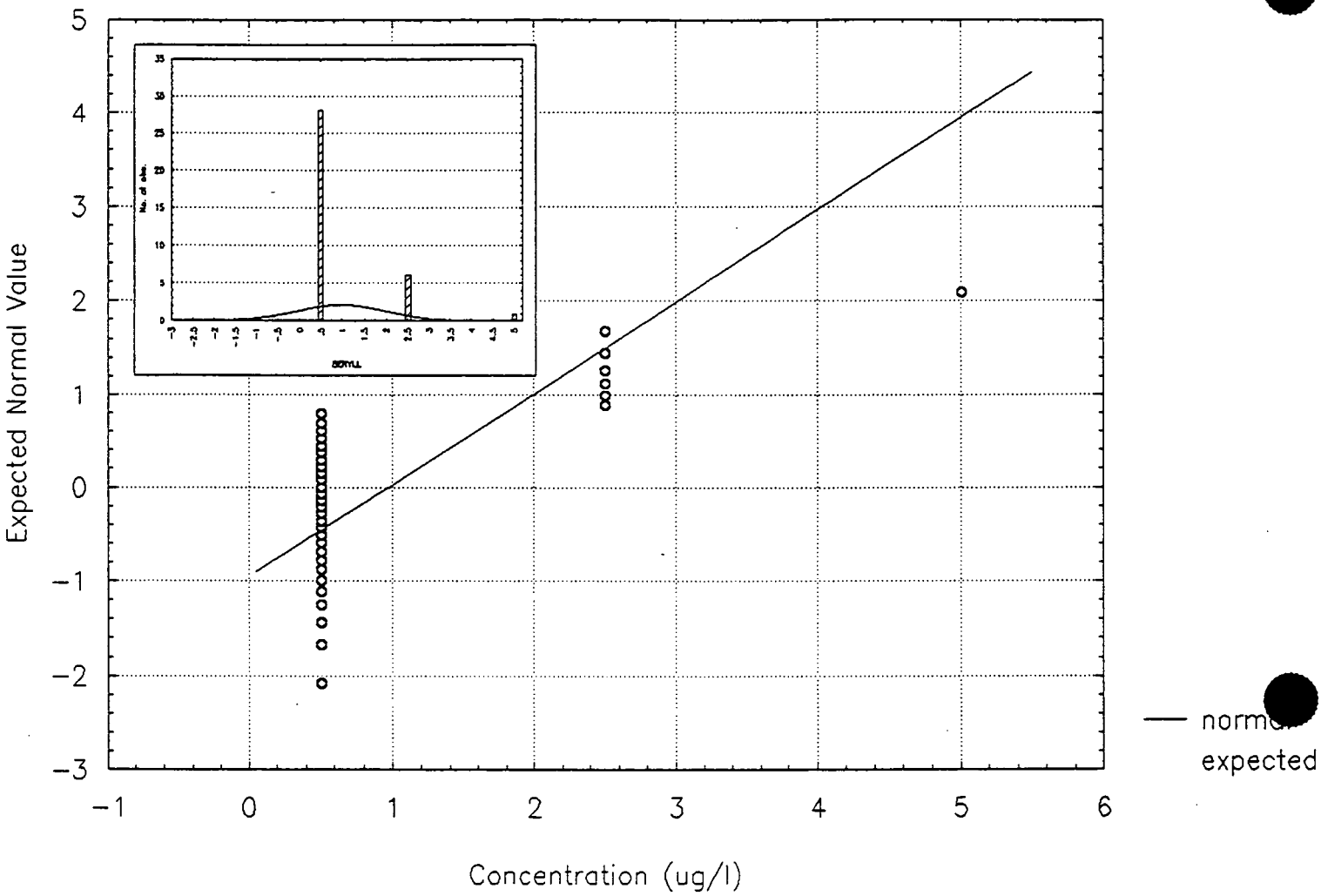


000542

Normal Probablility Plot for Dissolved Arsenic
in Background Groundwater (Reduced Data Set)

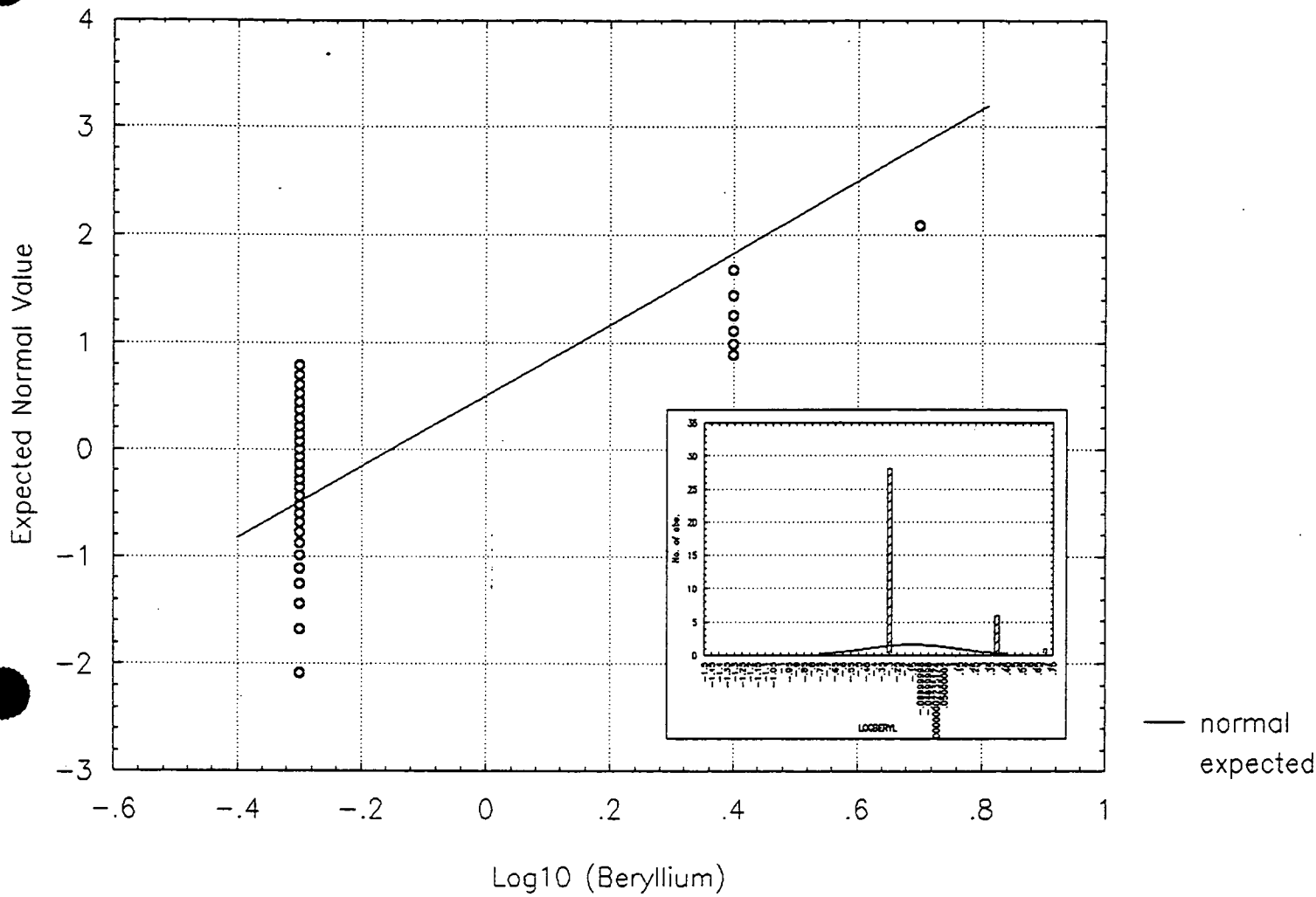


Normal Probablility Plot for Dissolved Beryllium
in Background Groundwater (Reduced Data Set)

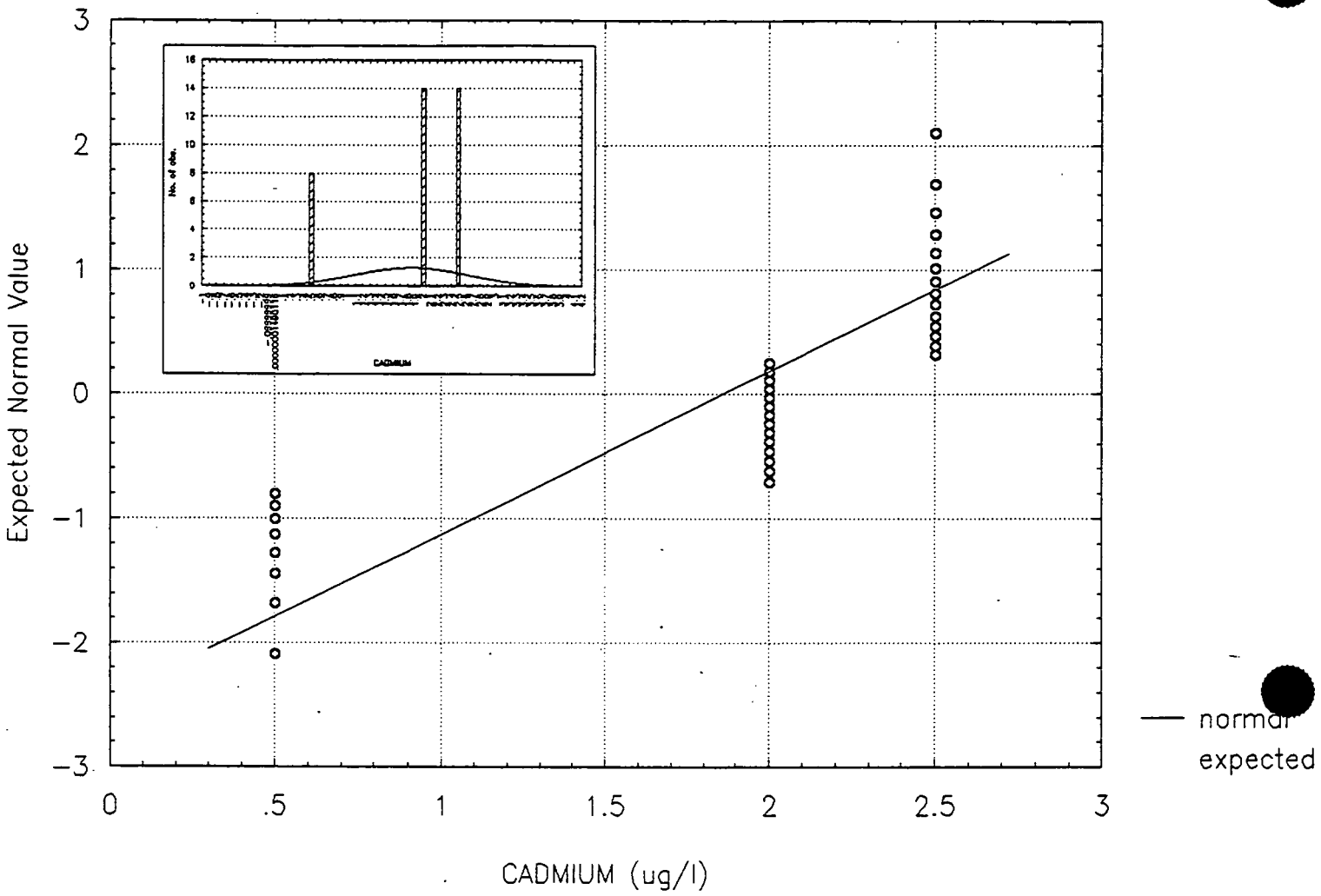


000544

Normal Probablility Plot for the Log Base 10
Transform of Beryllium in Background Groundwater

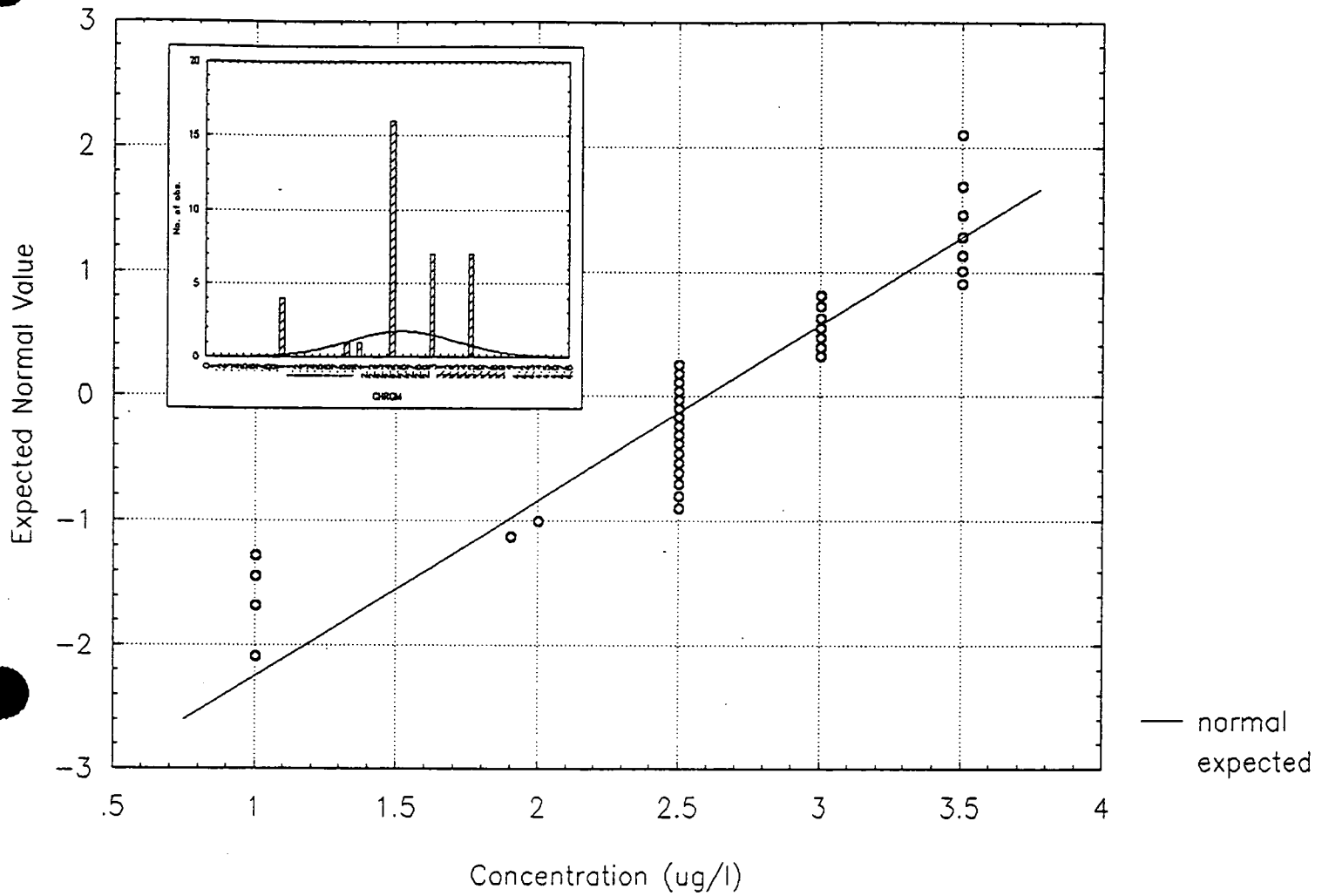


Normal Probablility Plot for Dissolved Cadmium
in Background Groundwater (Reduced Data Set)

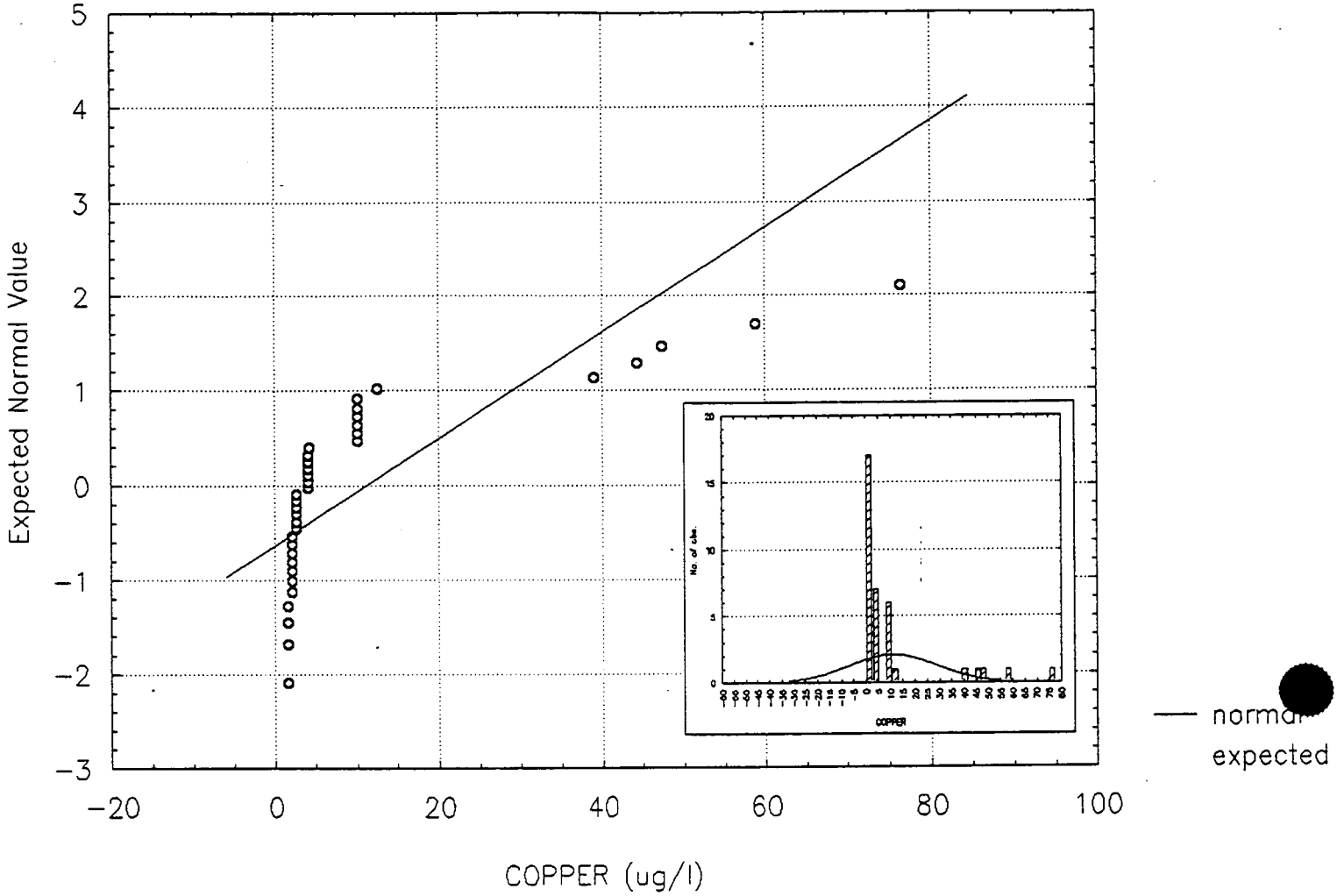


000546

Normal Probablility Plot for Dissolved Chromium
in Background Groundwater (Reduced Data Set)

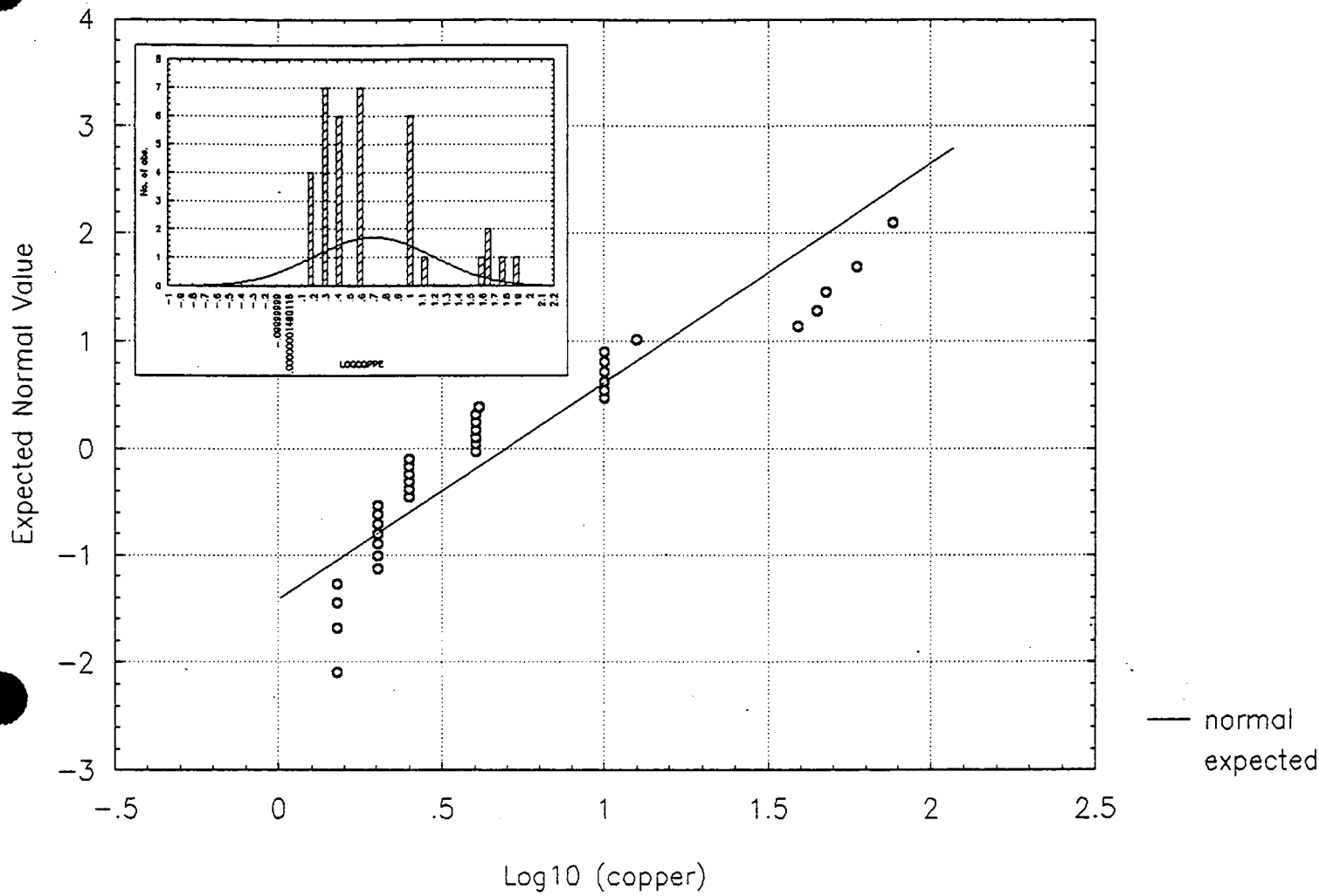


Normal Probablility Plot for Dissolved Copper
in Background Groundwater (Reduced Data Set)

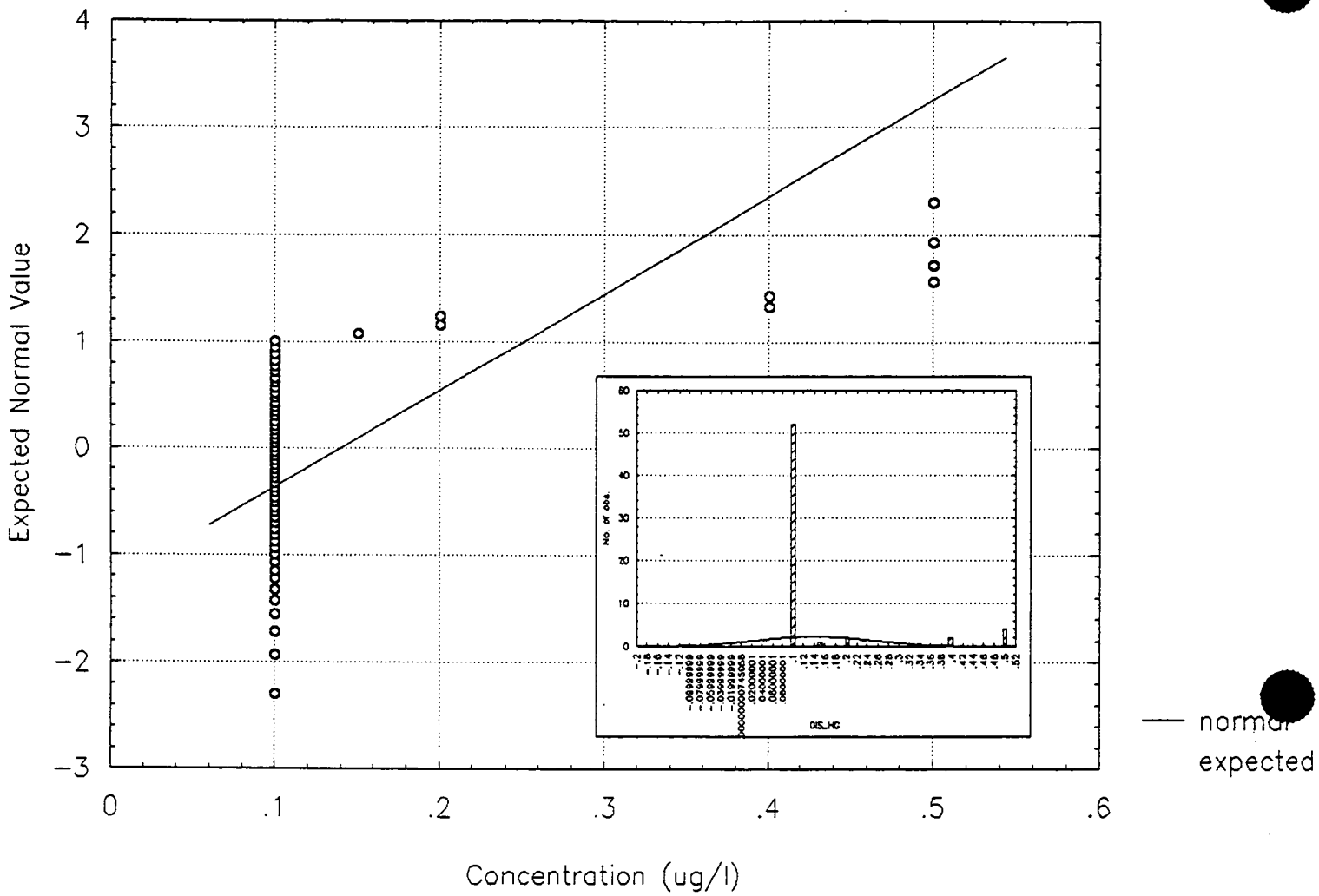


000548

Normal Probablility Plot for the Log Base 10
Transform of Dissolved Copper in Background Groundwater

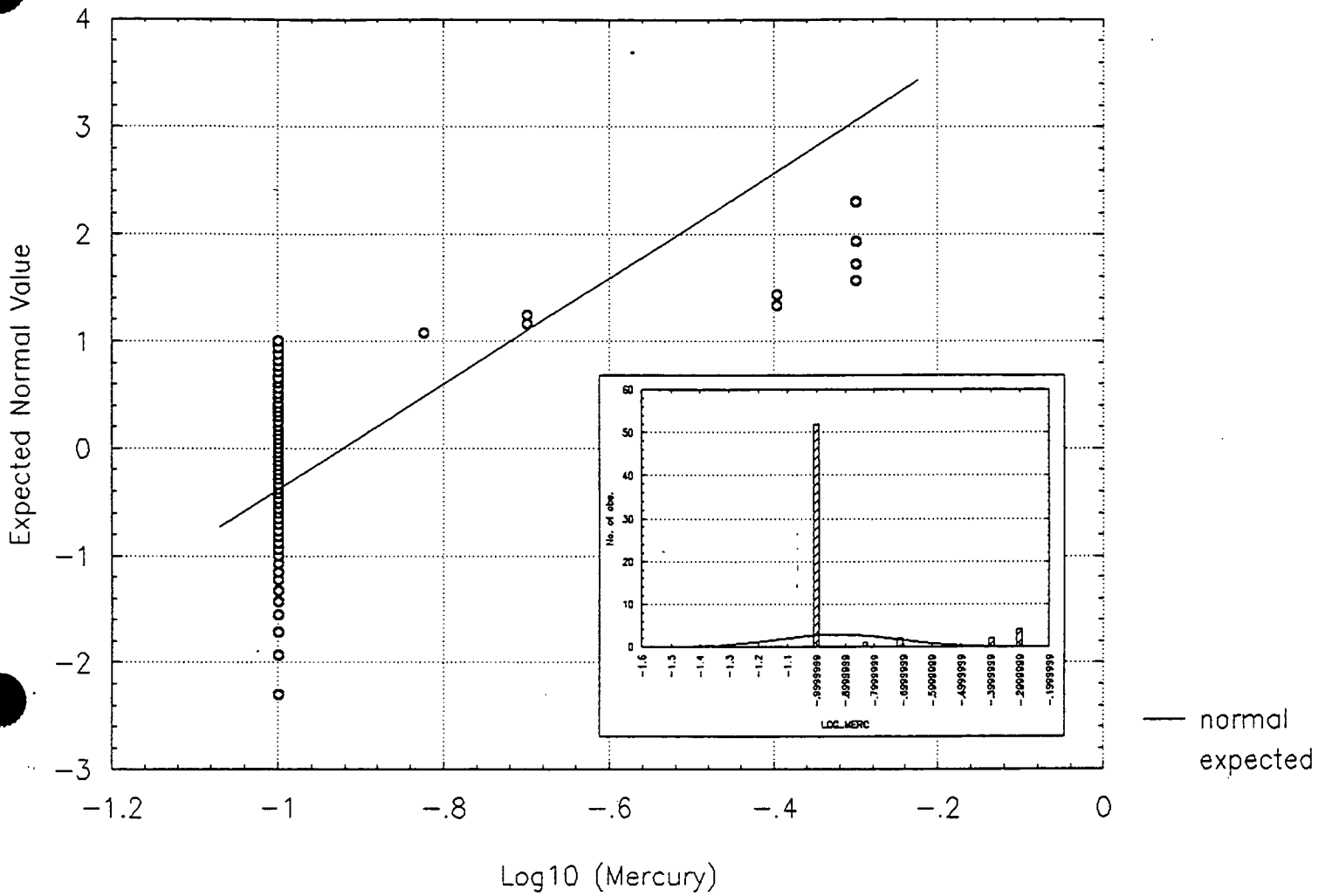


Normal Probablility Plot for Dissolved Mercury
in Background Groundwater (Reduced Data Set)

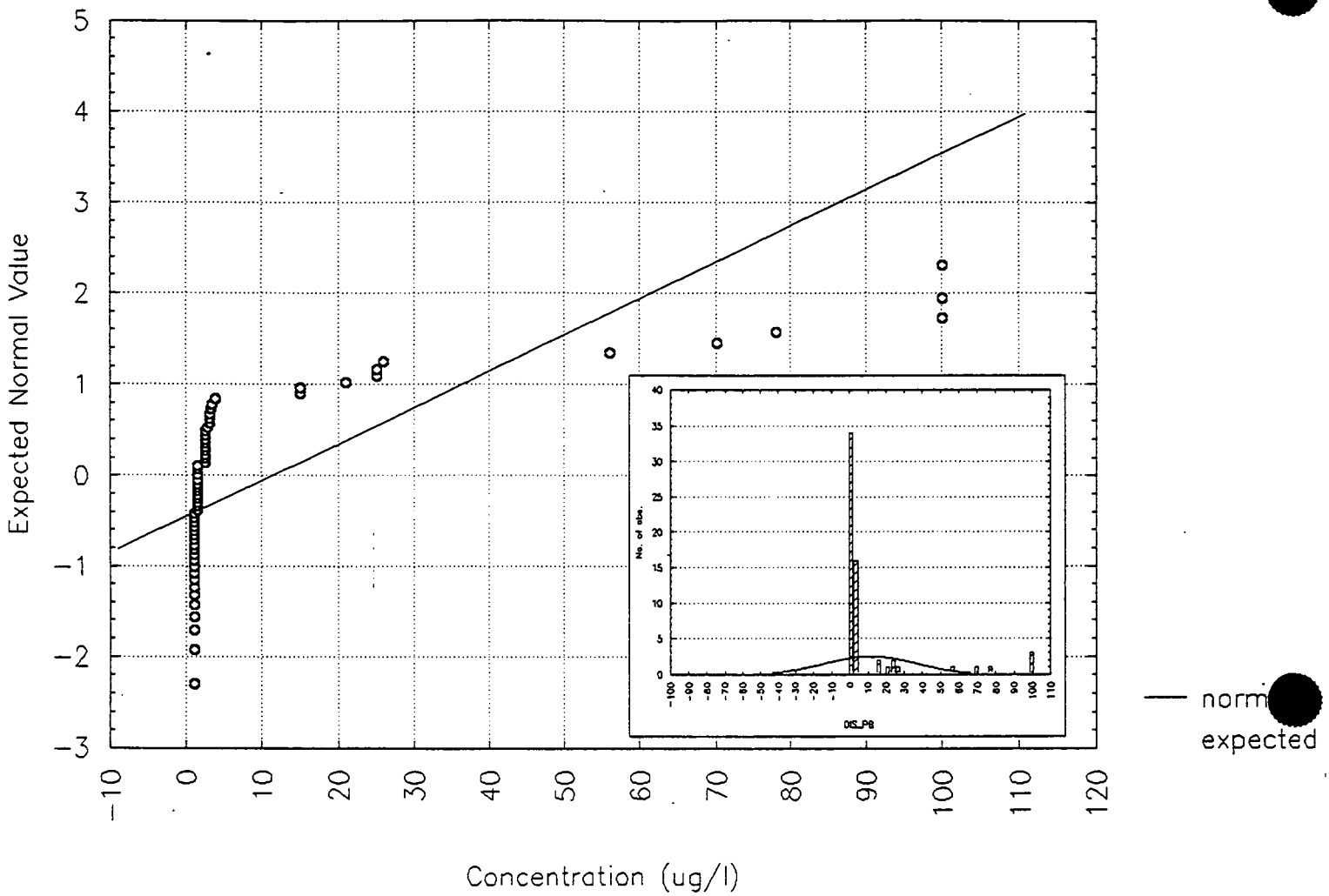


000550

Normal Probablility Plot for the Log Base 10 Transform
of Dissolved Mercury in the Background Groundwater

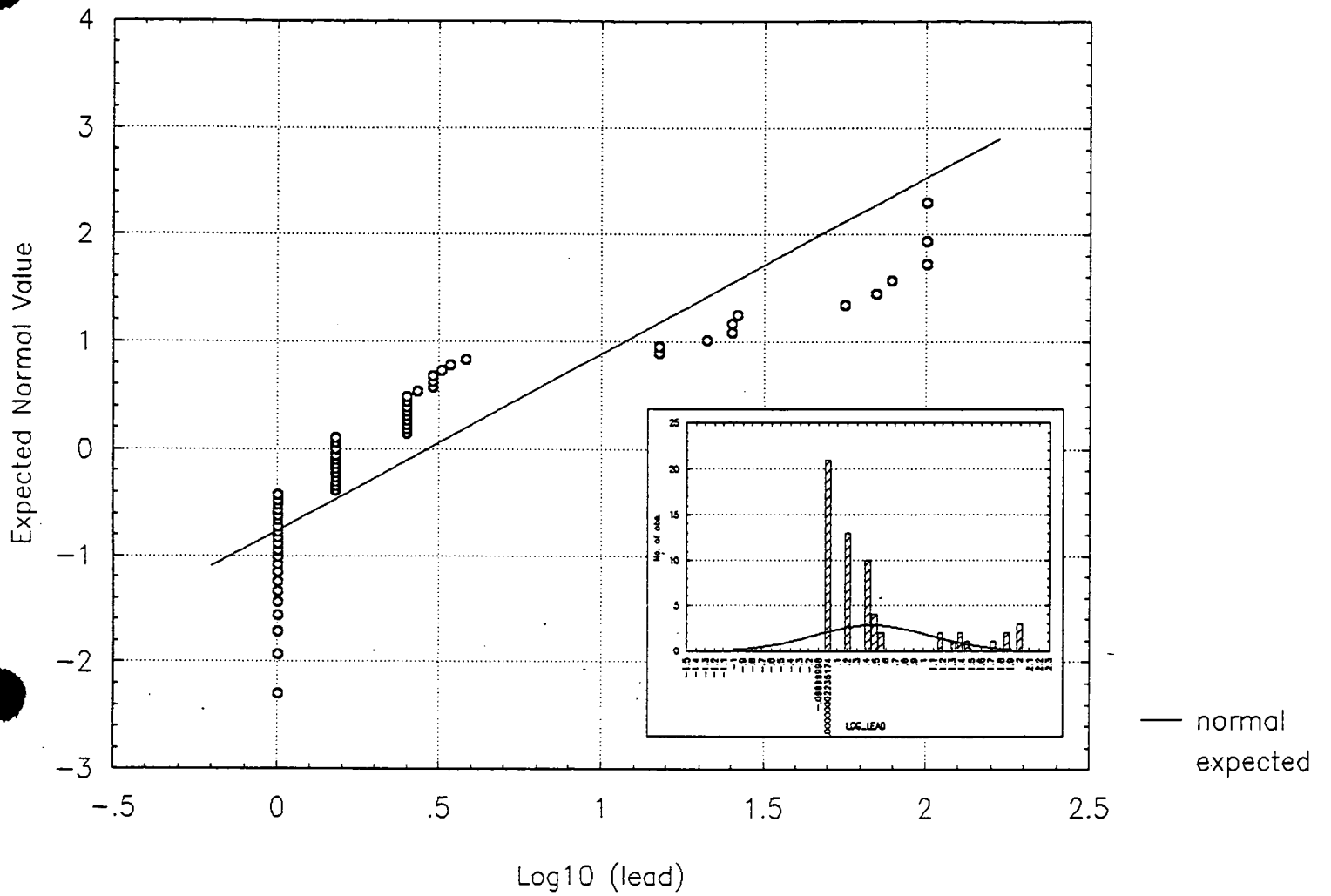


Normal Probablility Plot for Dissolved Lead
in Background Groundwater (Reduced Data Set)

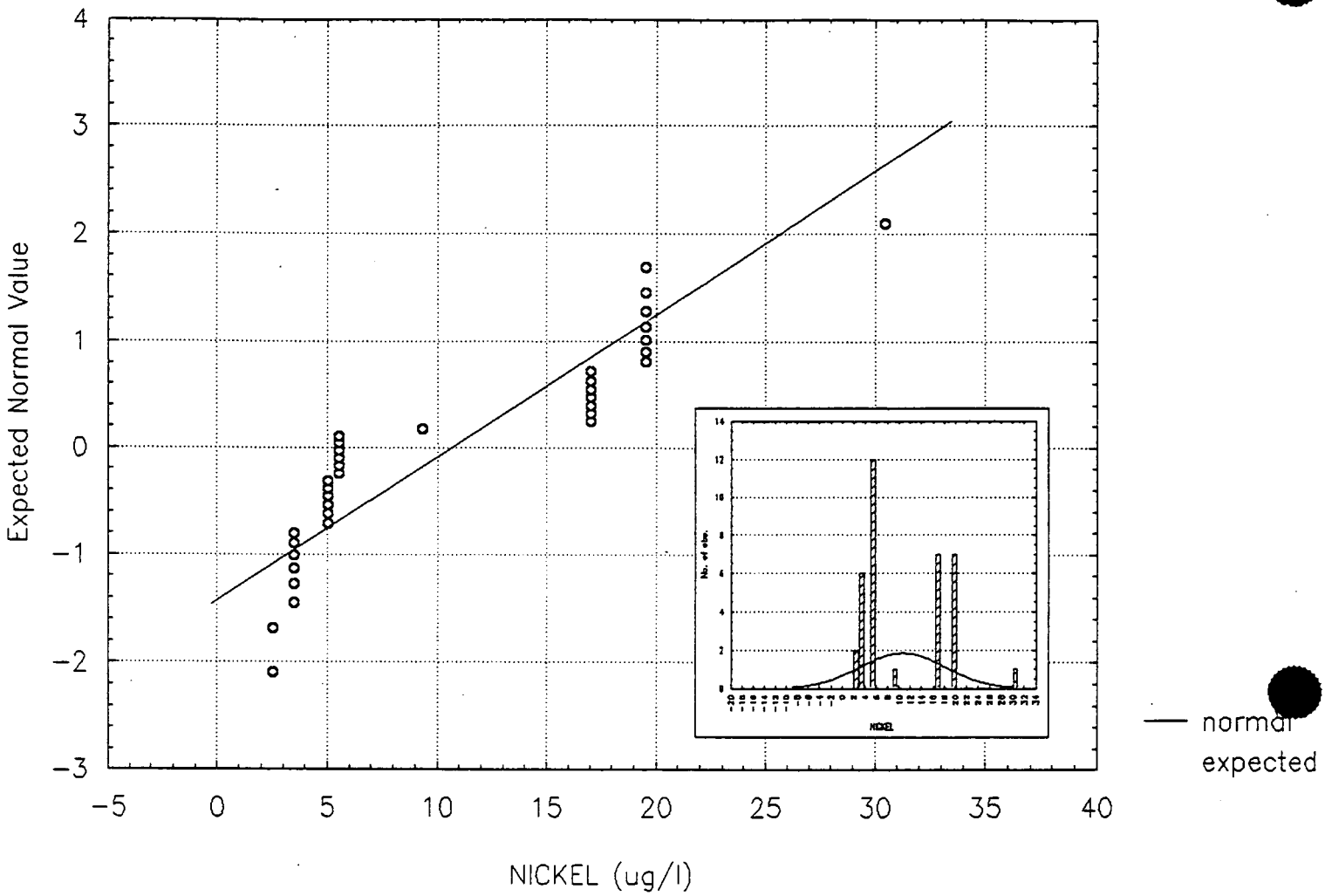


000552

Normal Probablility Plot for the Log Base 10 Transform
of Dissolved Lead in the Background Groundwater

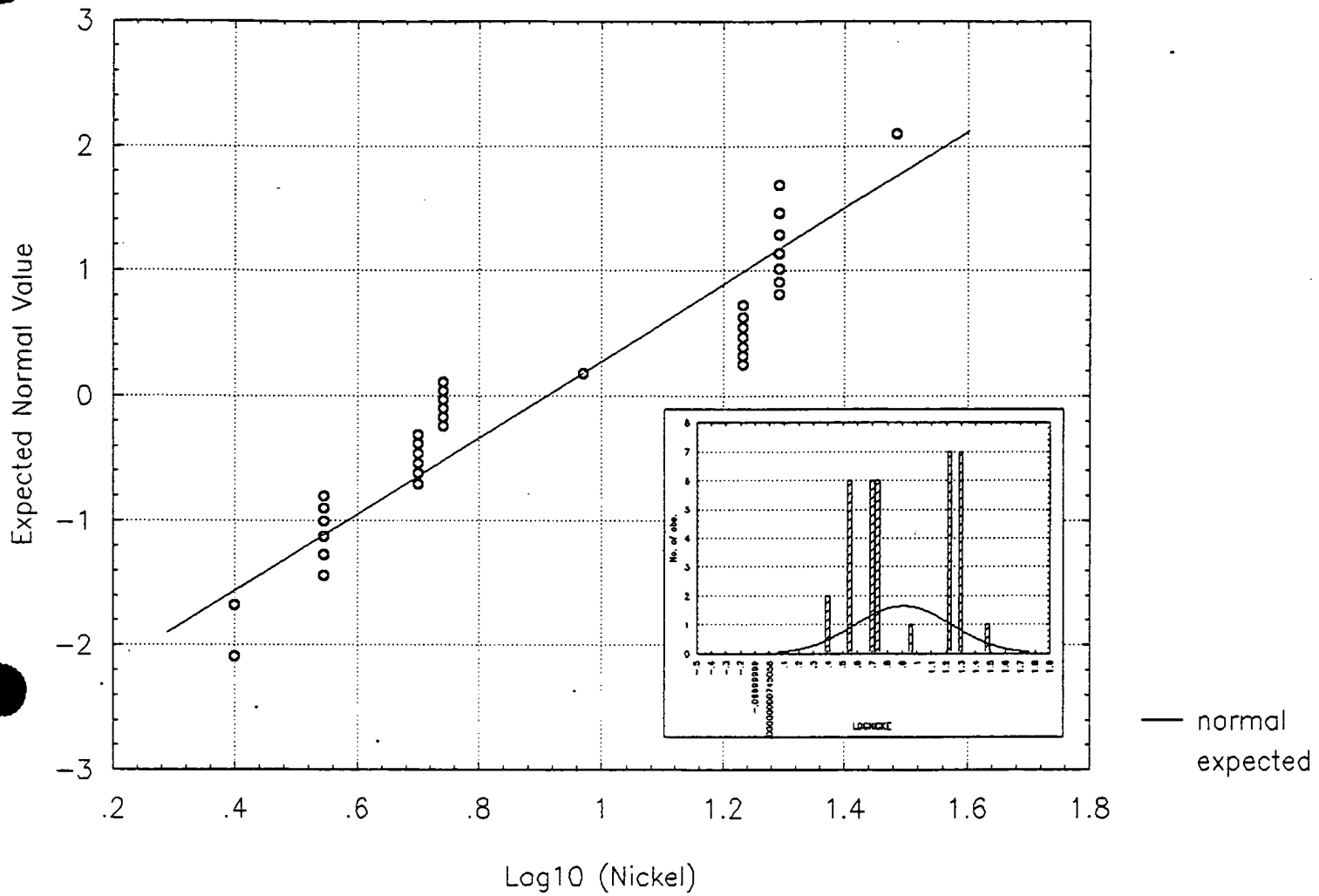


Normal Probablility Plot for Dissolved Nickel
in Background Groundwater (Reduced Data Set)

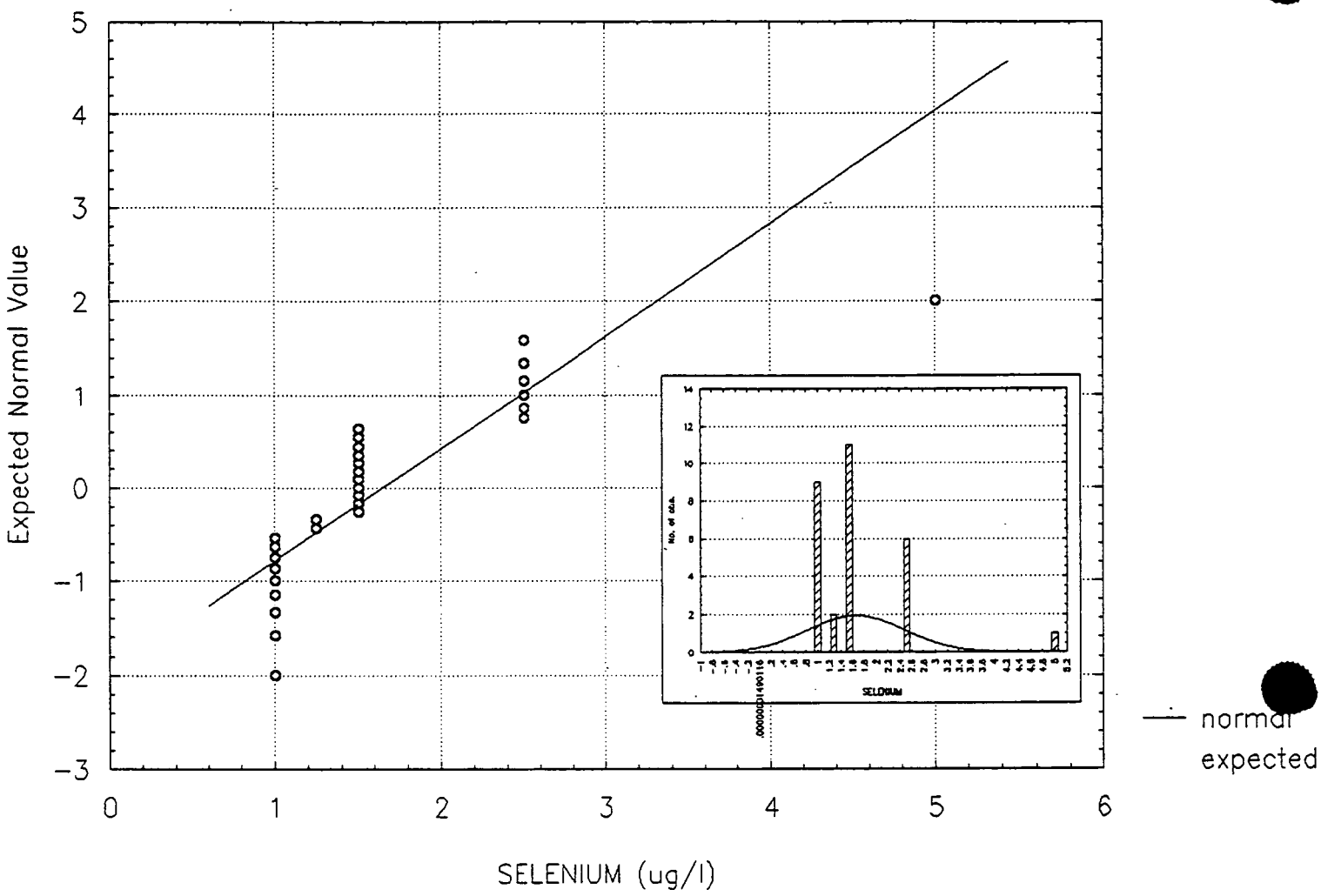


000554

Normal Probablility Plot for the Log Base 10 Transform
of Dissolved Nickel in the Background Groundwater

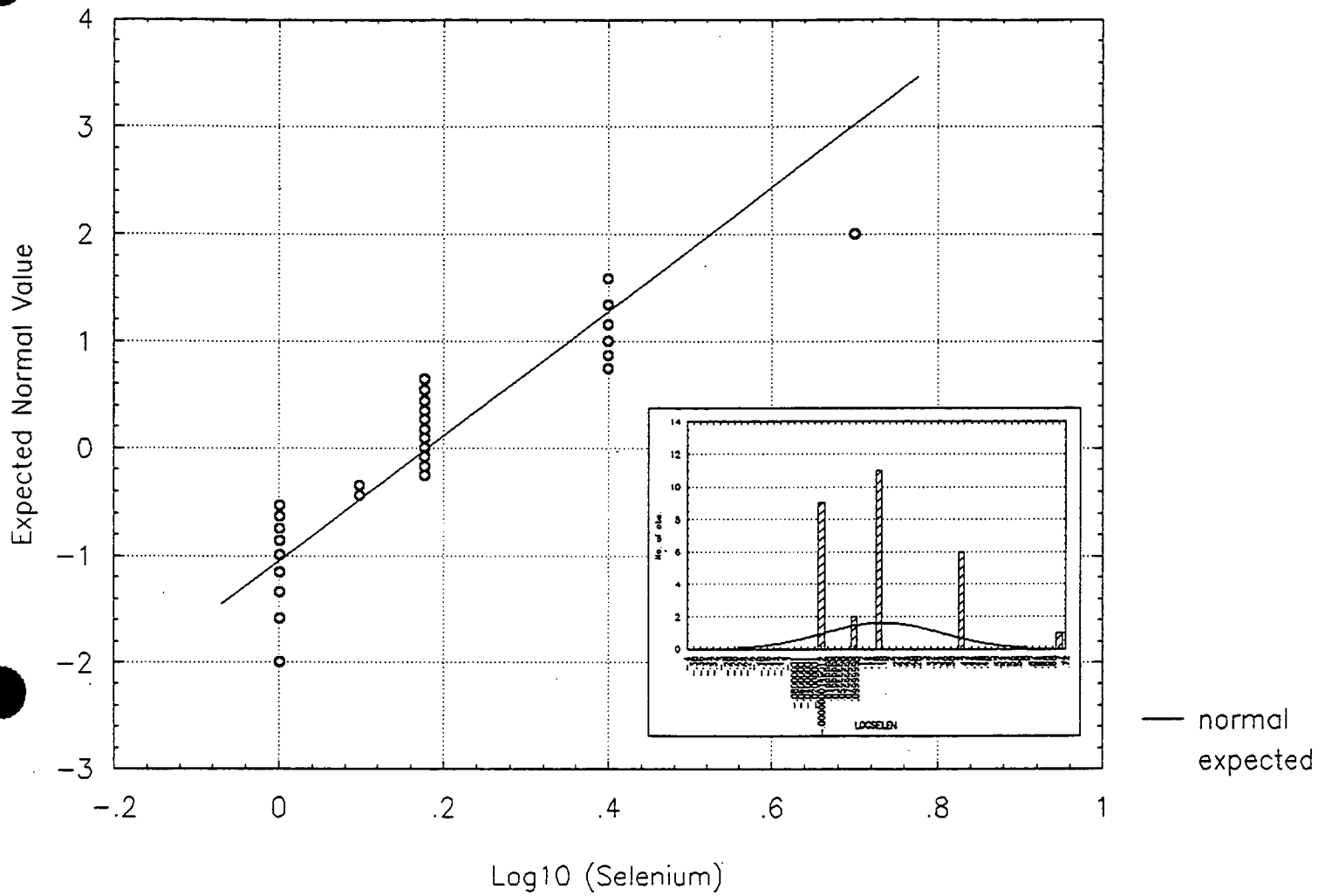


Normal Probablility Plot for Dissolved Selenium
in Background Groundwater (Reduced Data Set)

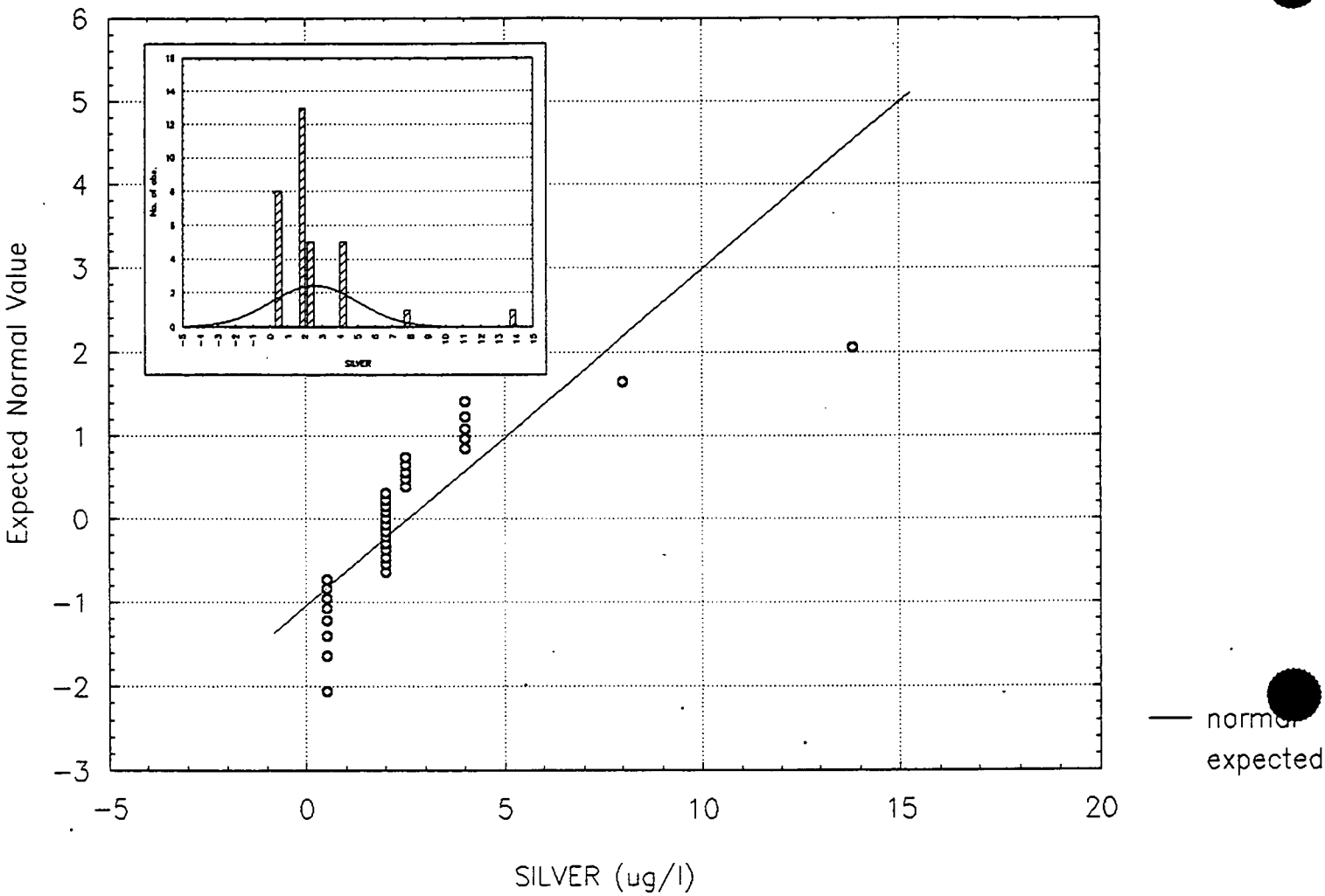


000556

Normal Probablility Plot for the Log Base 10 Transform
of Dissolved Selenium in the Background Groundwater

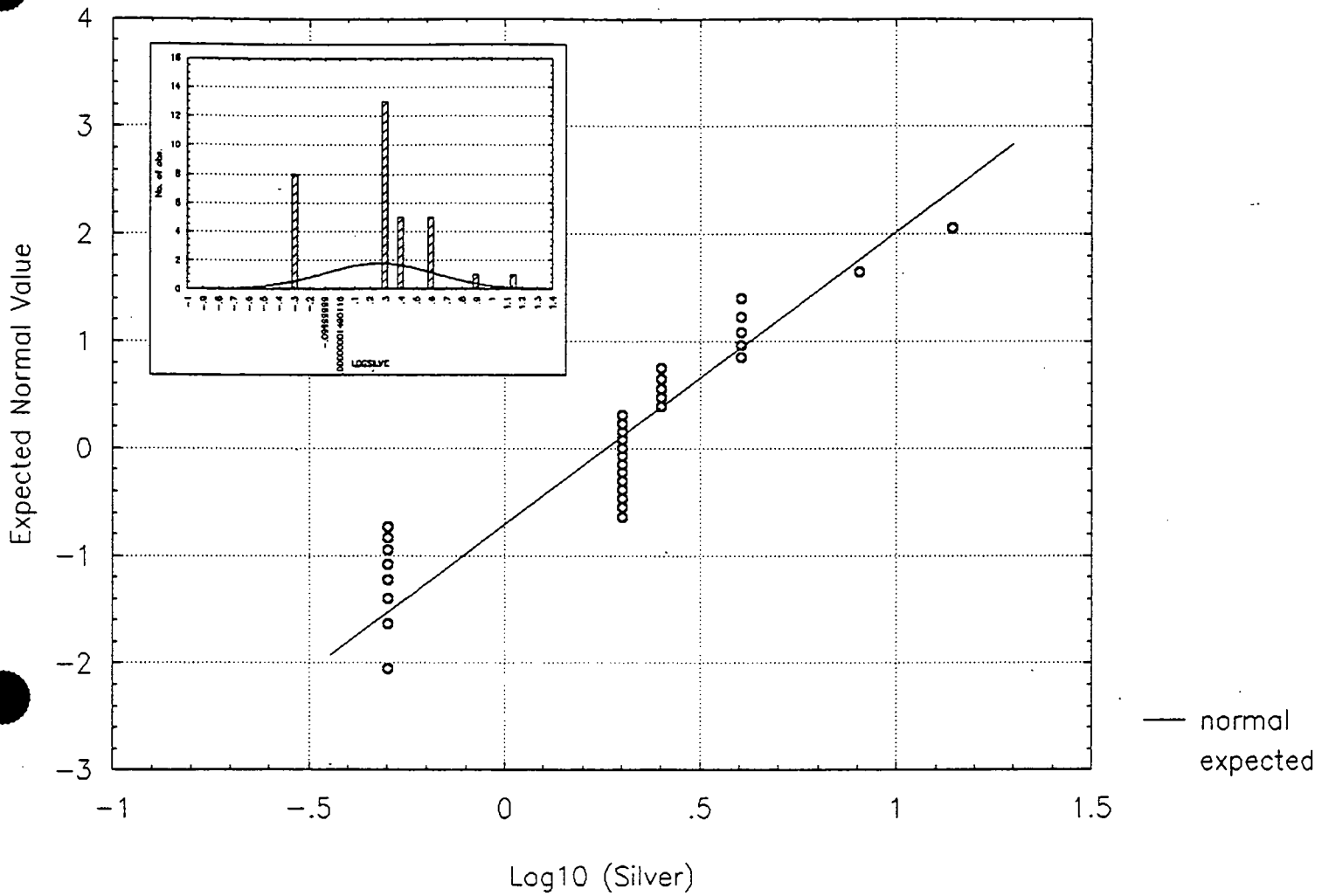


Normal Probablility Plot for Dissolved Silver
in Background Groundwater (Reduced Data Set)

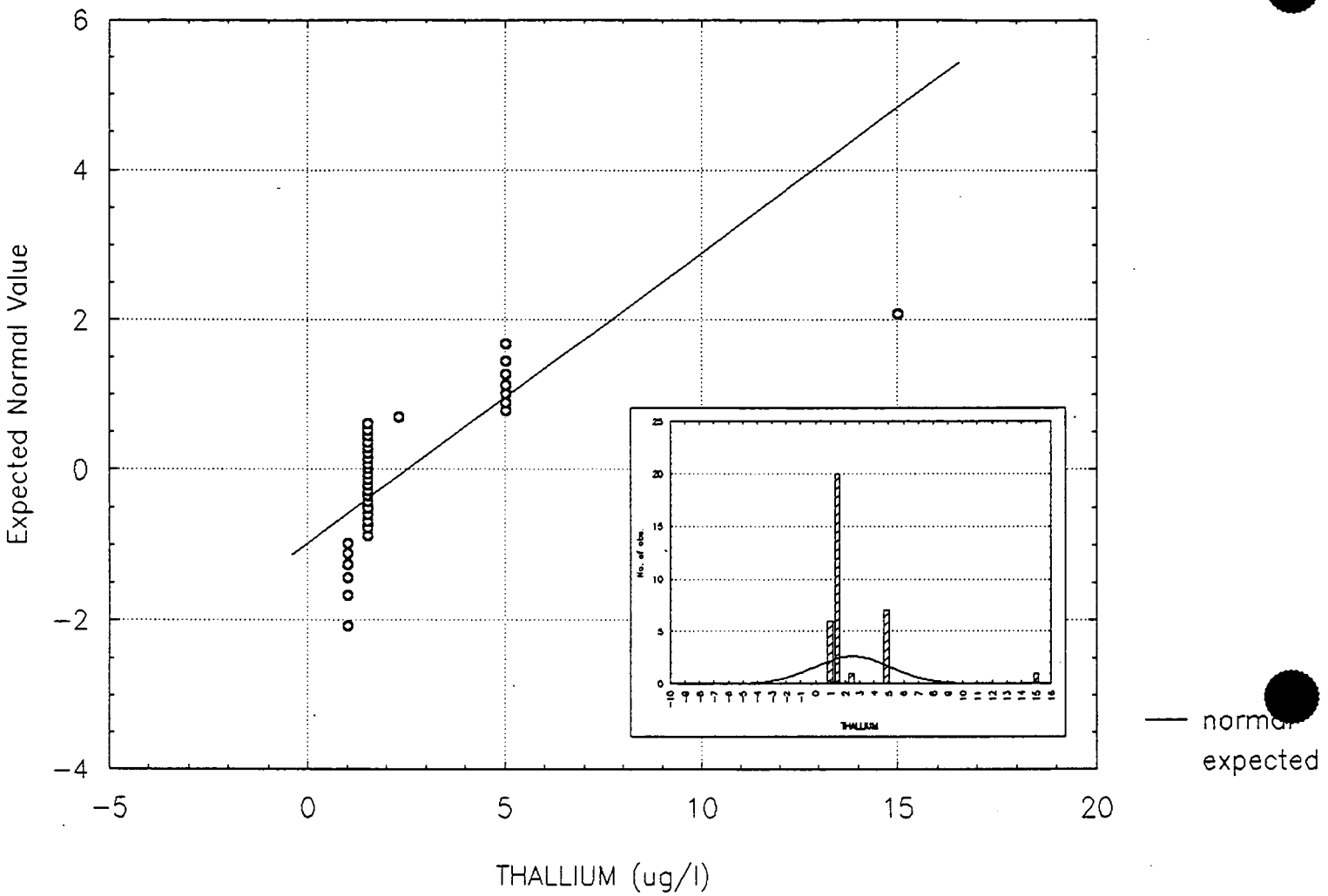


000558

Normal Probablility Plot for the Log Base 10 Transform
of Dissolved Silver in the Background Groundwater

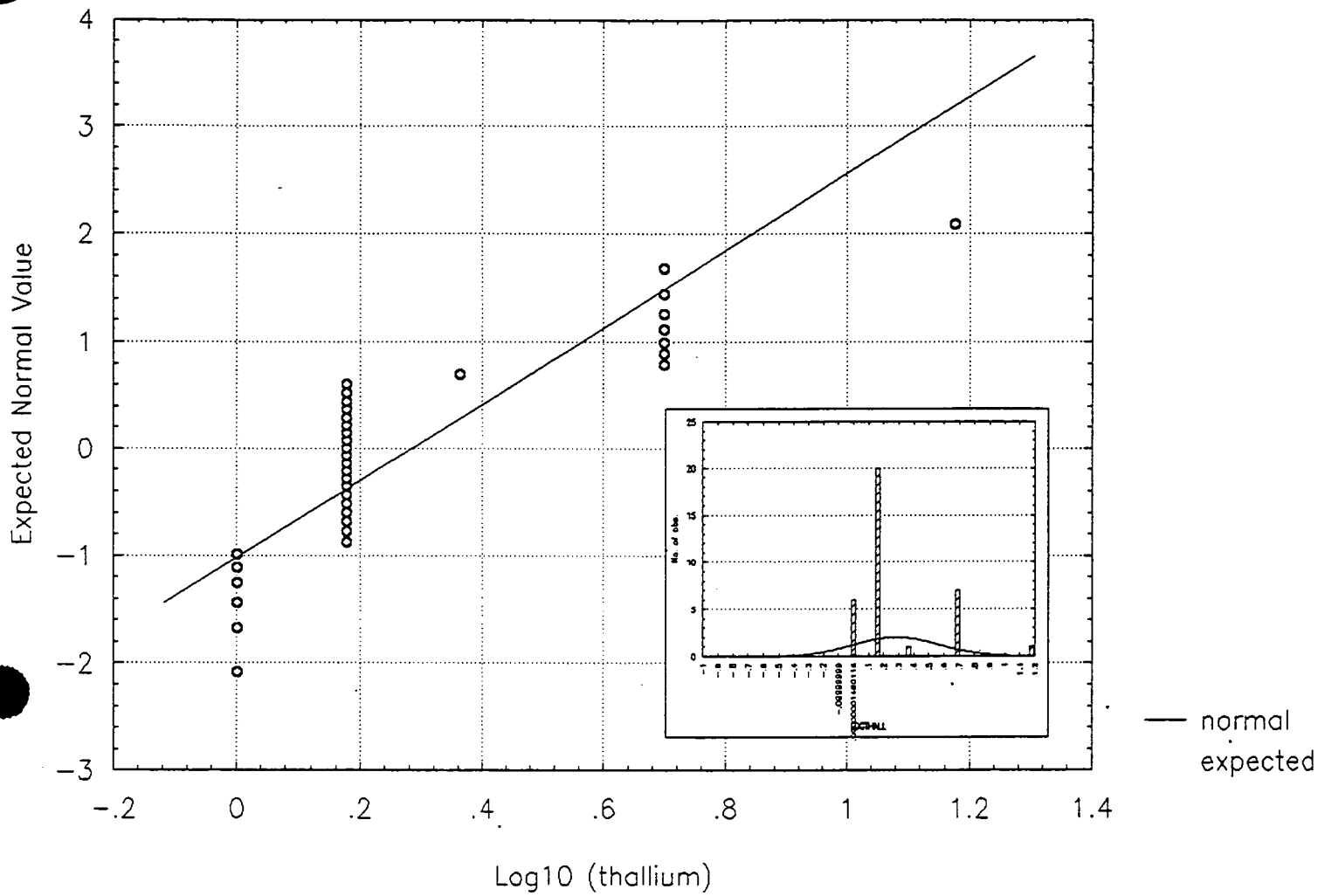


Normal Probablility Plot for Dissolved Thallium
in Background Groundwater (Reduced Data Set)

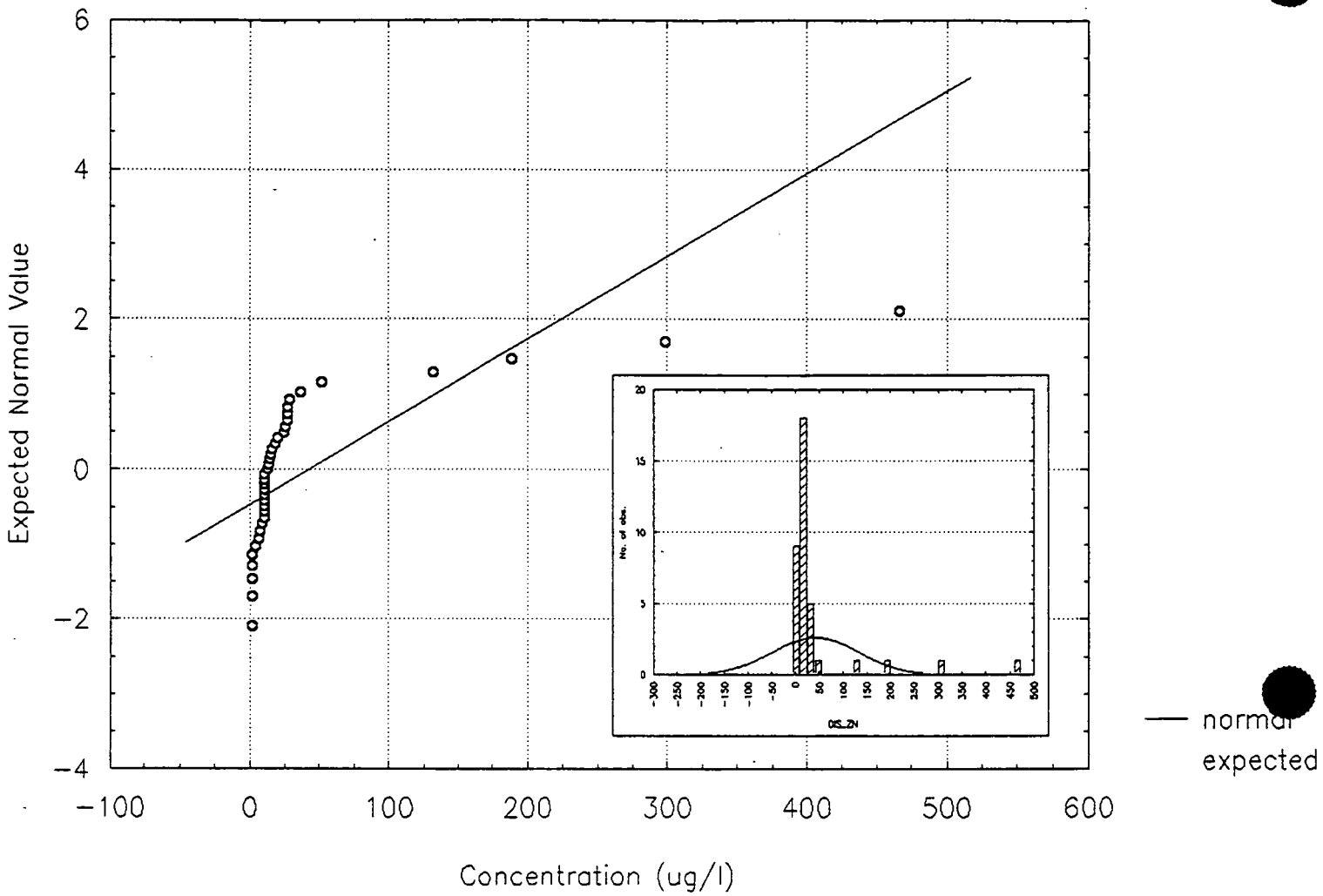


000560

Normal Probablility Plot for the Log Base 10 Transform
of Dissolved Thallium in Background Groundwater

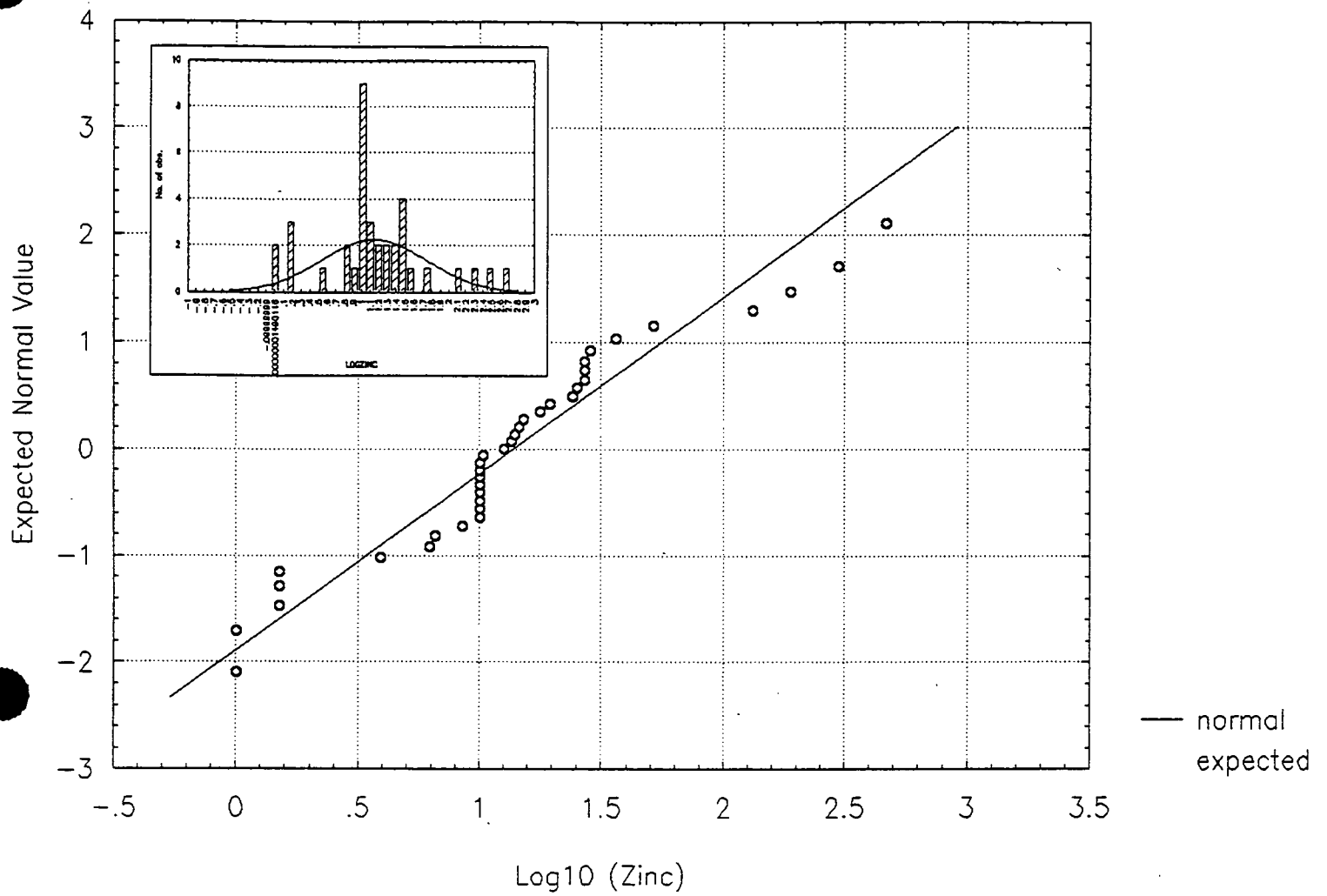


Normal Probablility Plot for Dissolved Zinc
in Background Groundwater (Reduced Data Set)

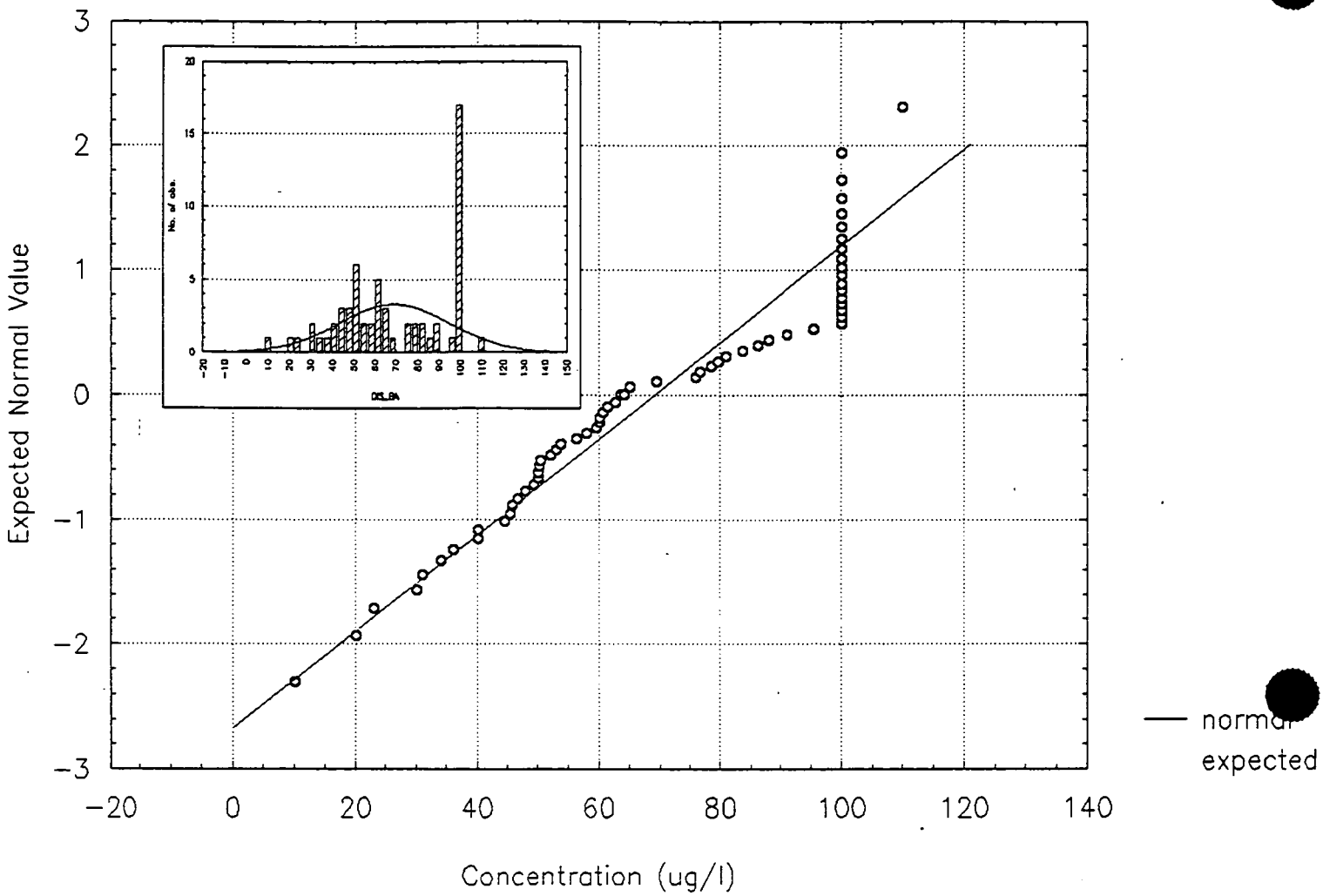


000562

Normal Probablility Plot for the Log Base 10 Transform
of Dissolved Zinc in the Background Groundwater

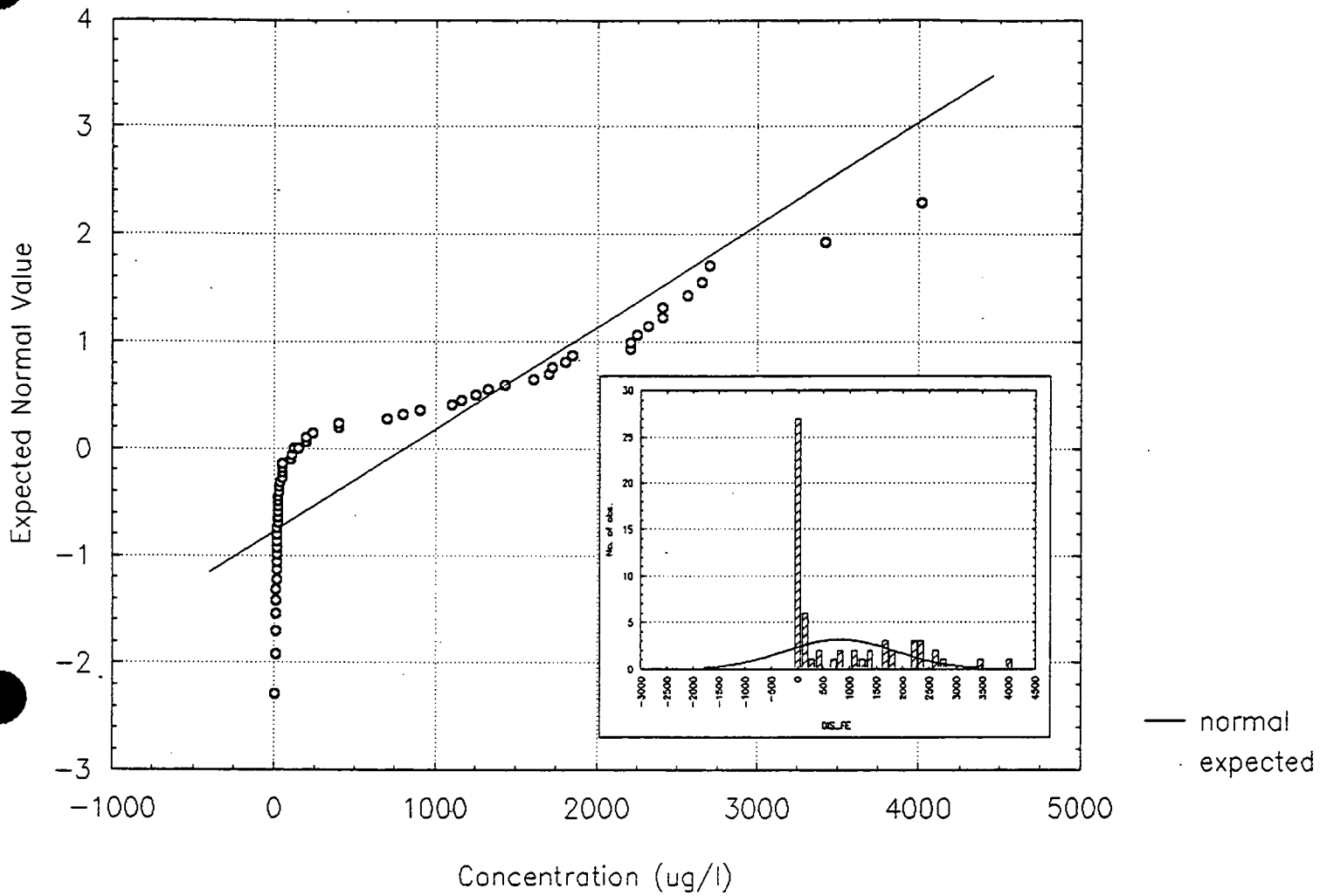


Normal Probablility Plot for Dissolved Barium
in Background Groundwater (Reduced Data Set)

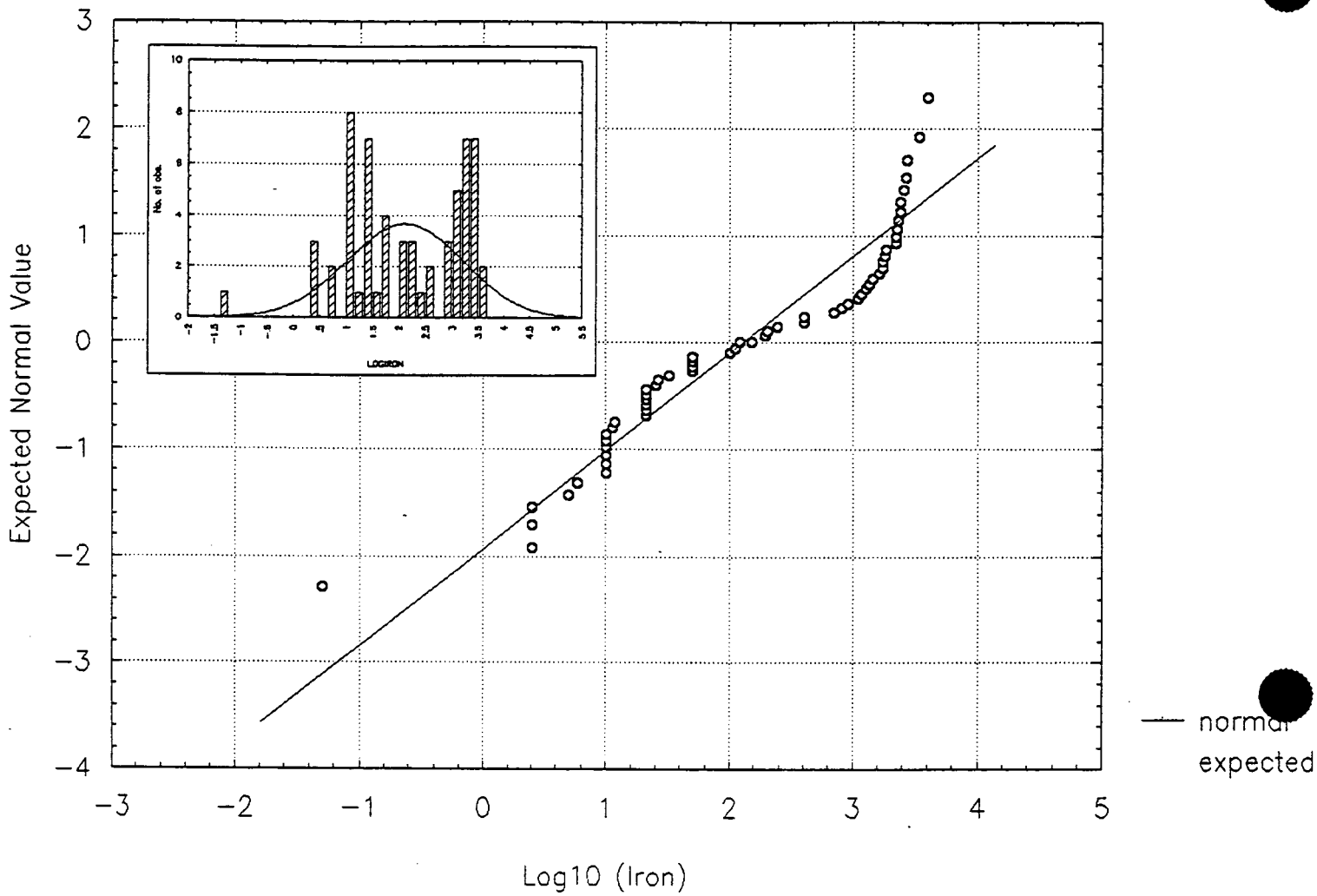


000564

Normal Probablility Plot for Dissolved Iron
in Background Groundwater (Reduced Data Set)

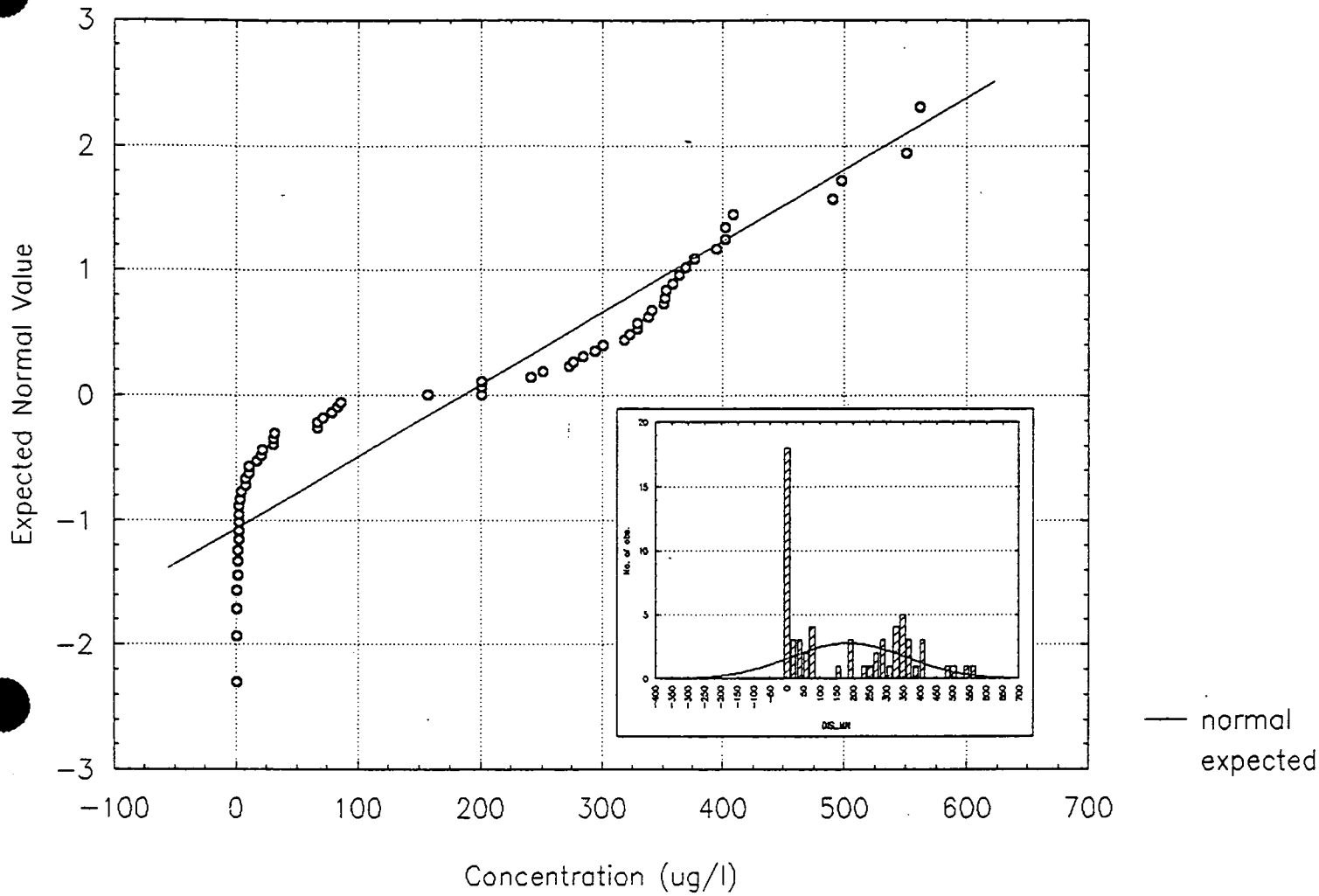


Normal Probablility Plot for the Log Base 10 Transform
of Dissolved Iron in the Background Groundwater

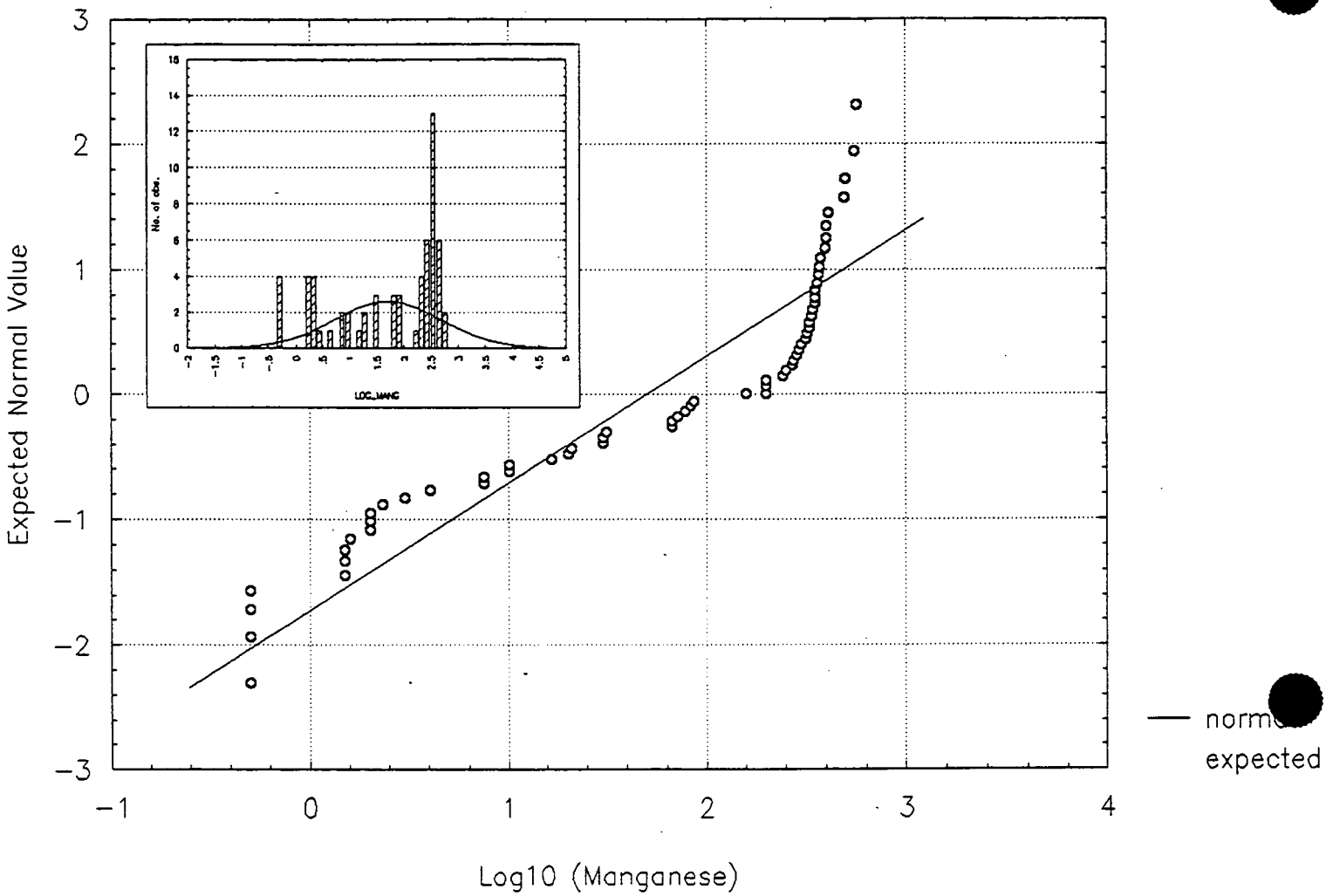


000566

Normal Probablility Plot for Dissolved Manganese
in Background Groundwater (Reduced Data Set)

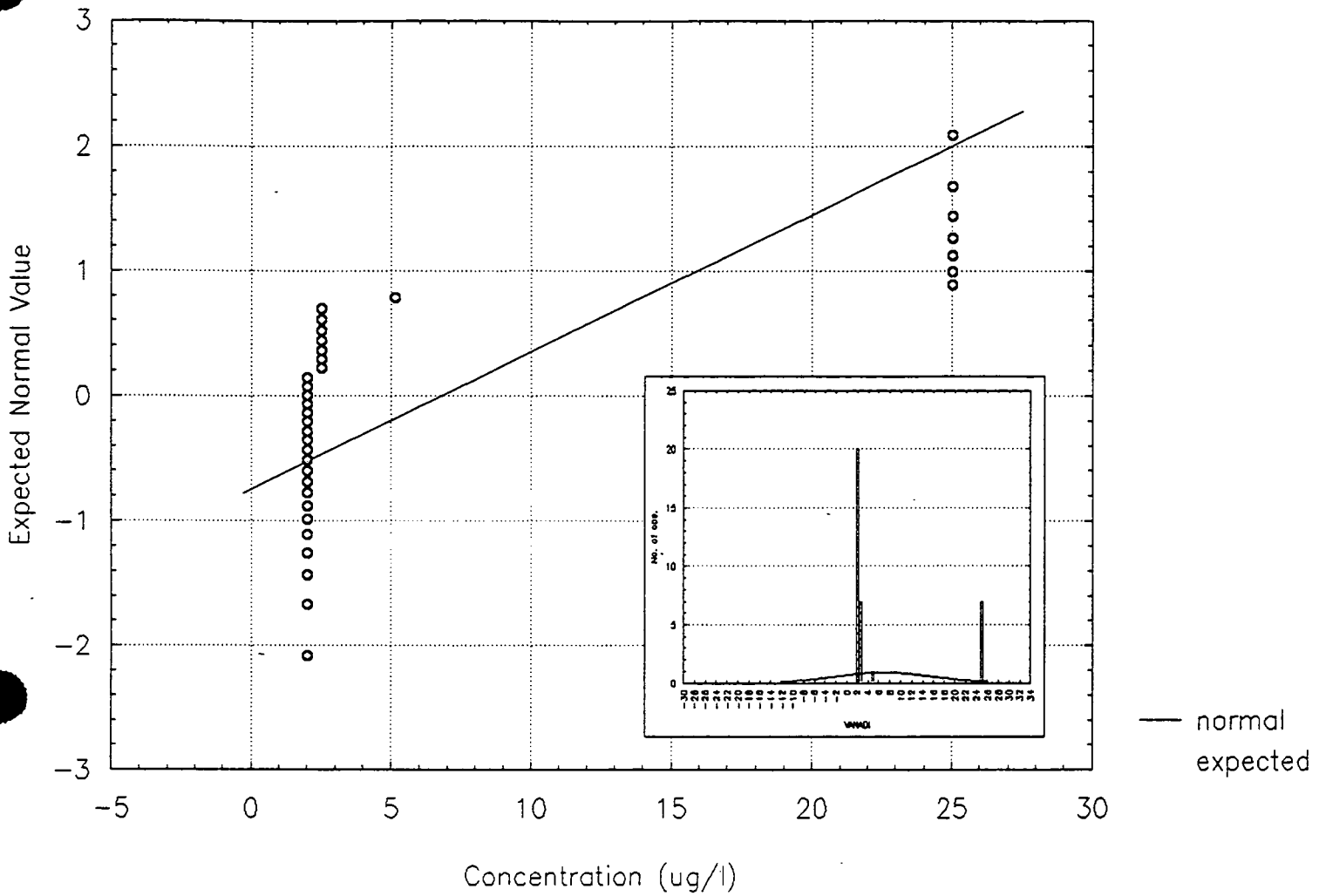


Normal Probablility Plot for the Log Base 10 Transform
of Dissolved Managanese in Background Groundwater

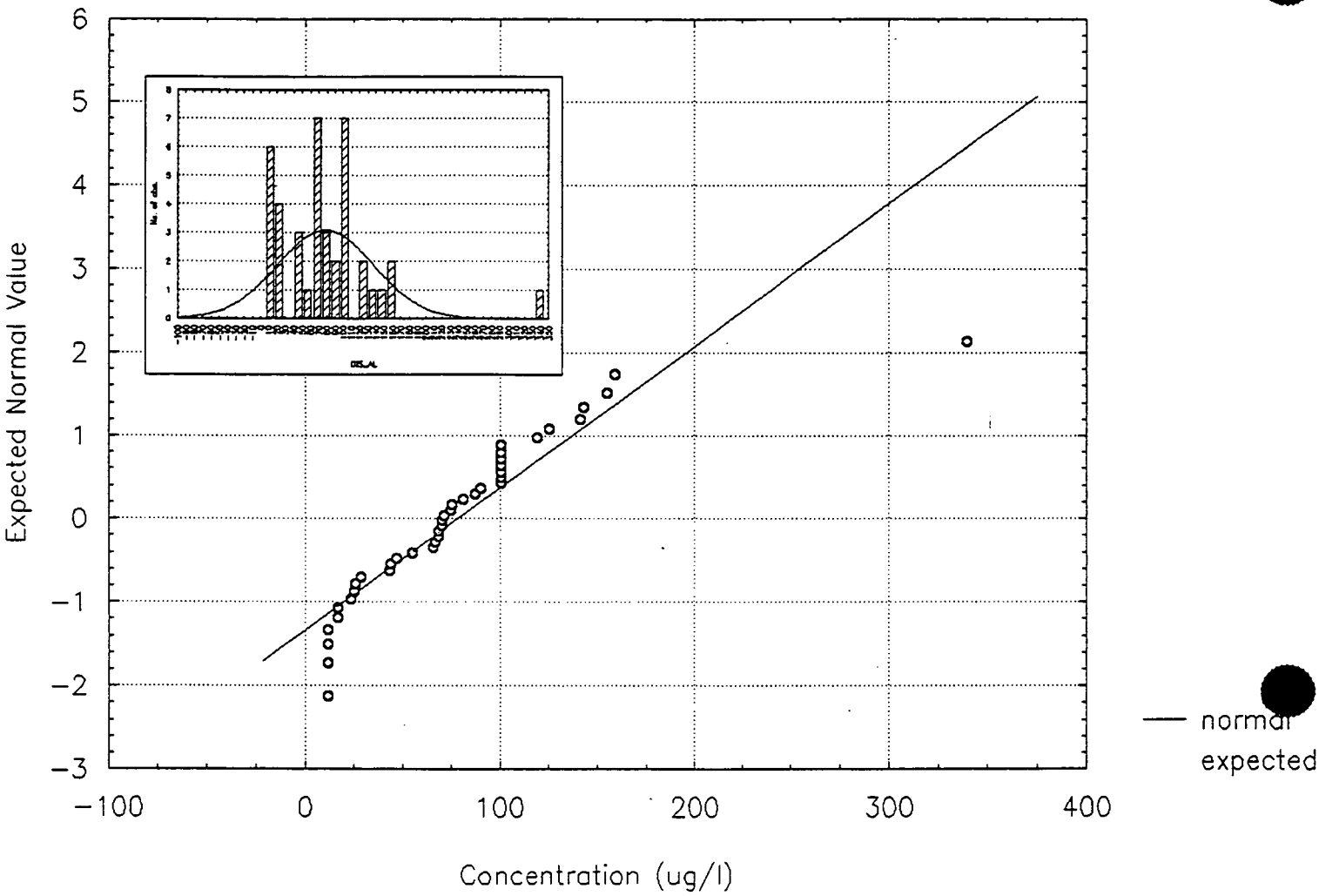


000568

Normal Probablility Plot for Dissolved Vanadium
in Background Groundwater (Reduced Data Set)

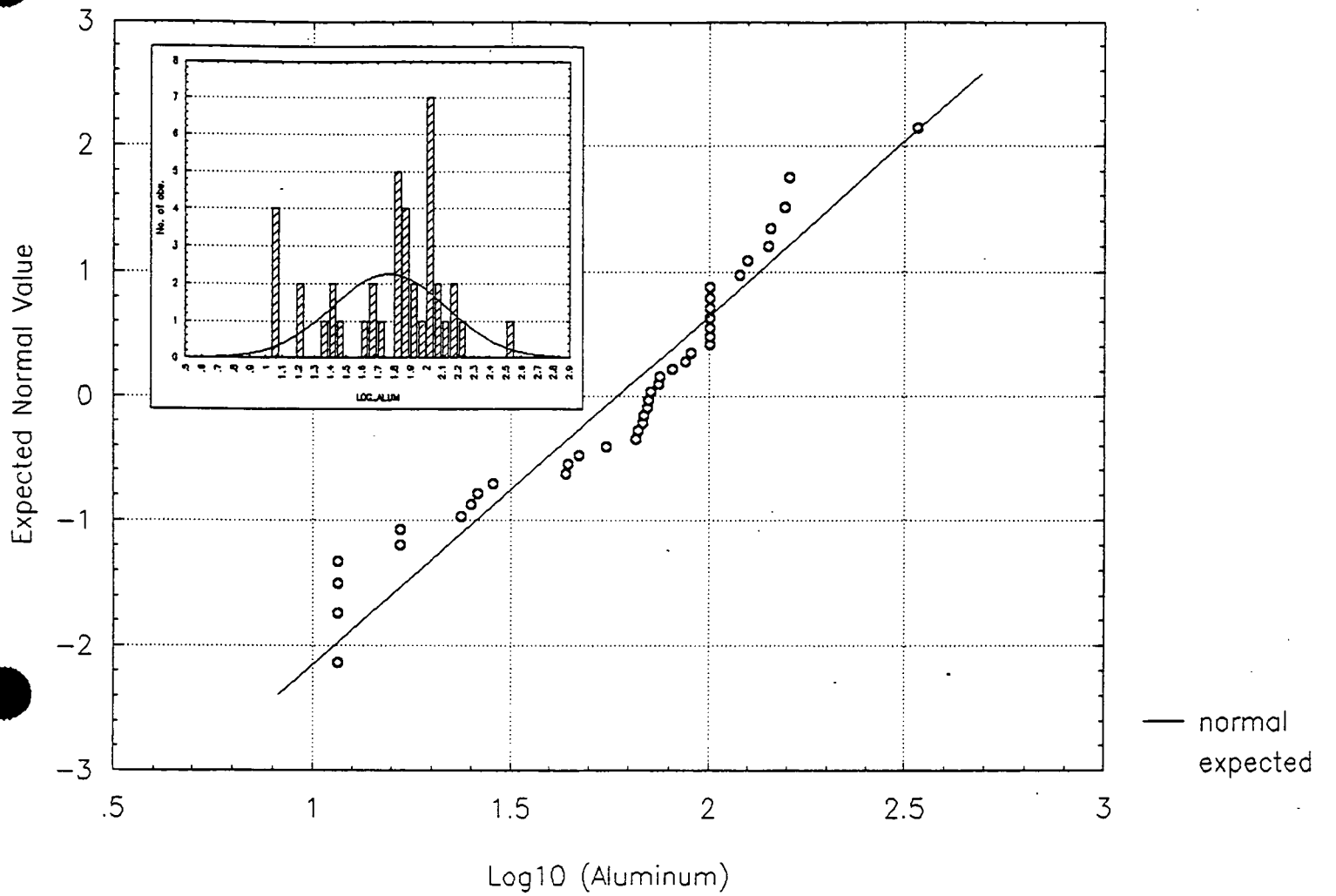


Normal Probablility Plot for Dissolved Aluminum
in Background Groundwater (Reduced Data Set)

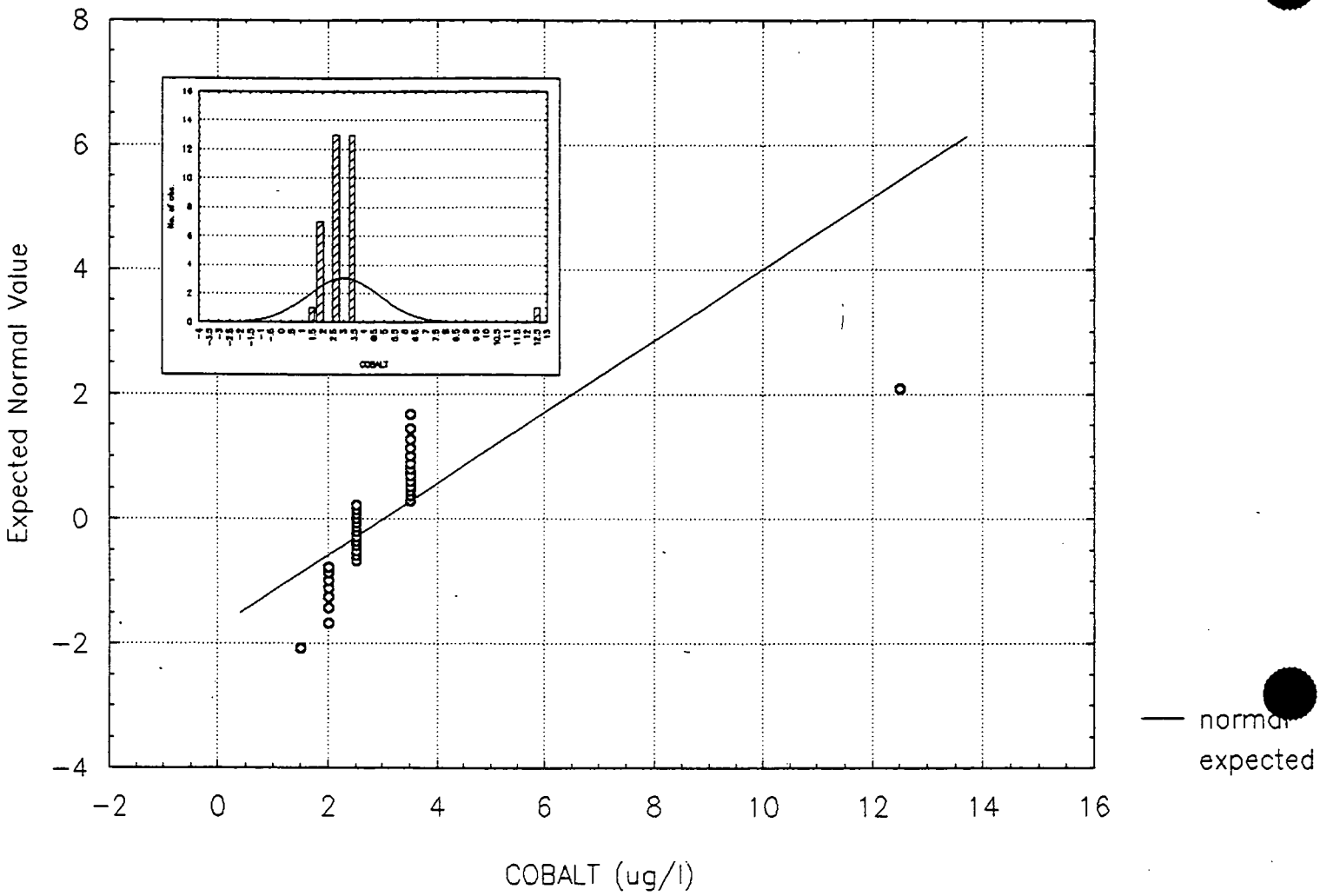


000570

Normal Probablility Plot for the Log Base 10 Transform
of Dissolved Aluminum in Background Groundwater

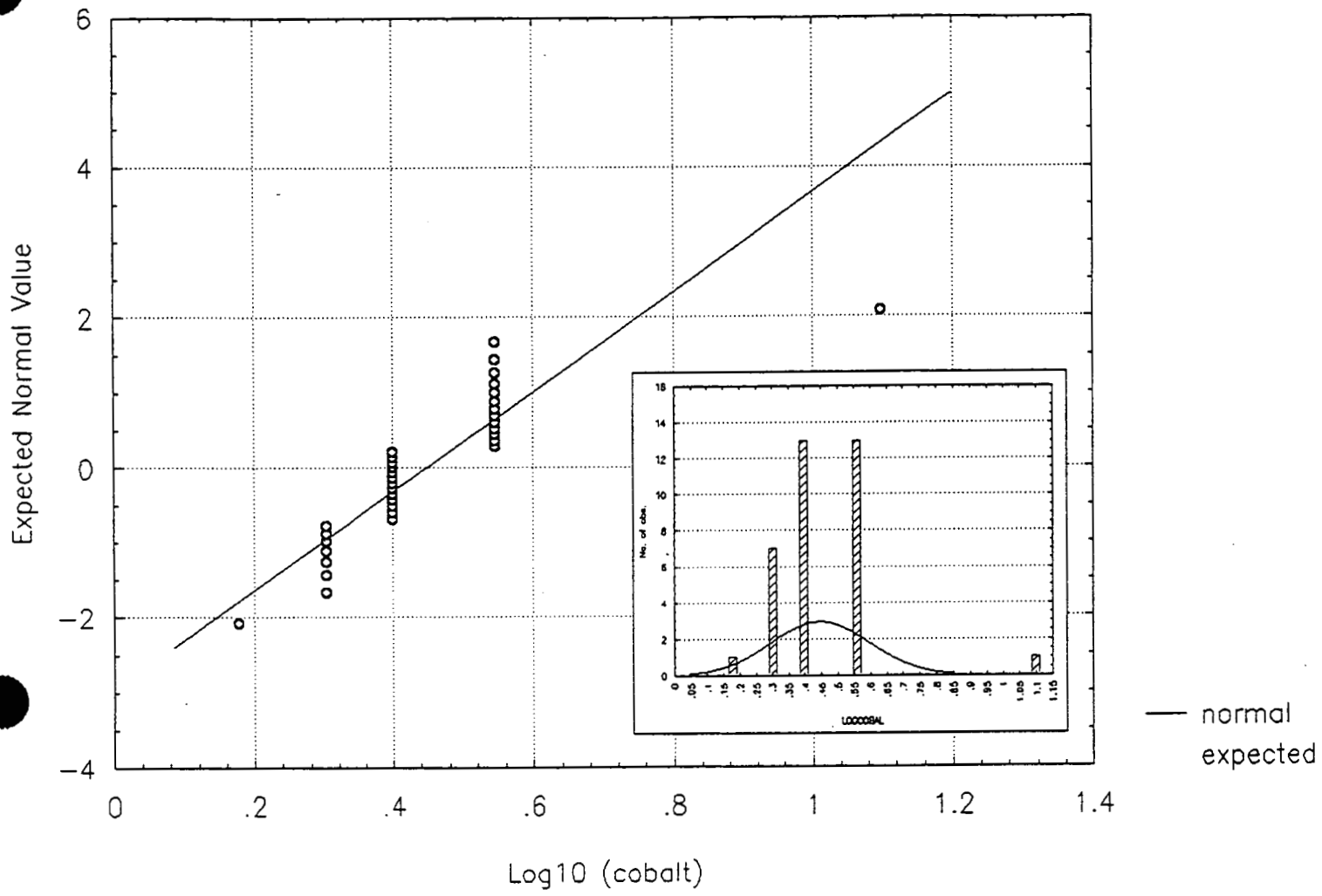


Normal Probablility Plot for Dissolved Cobalt
in Background Groundwater (Reduced Data Set)

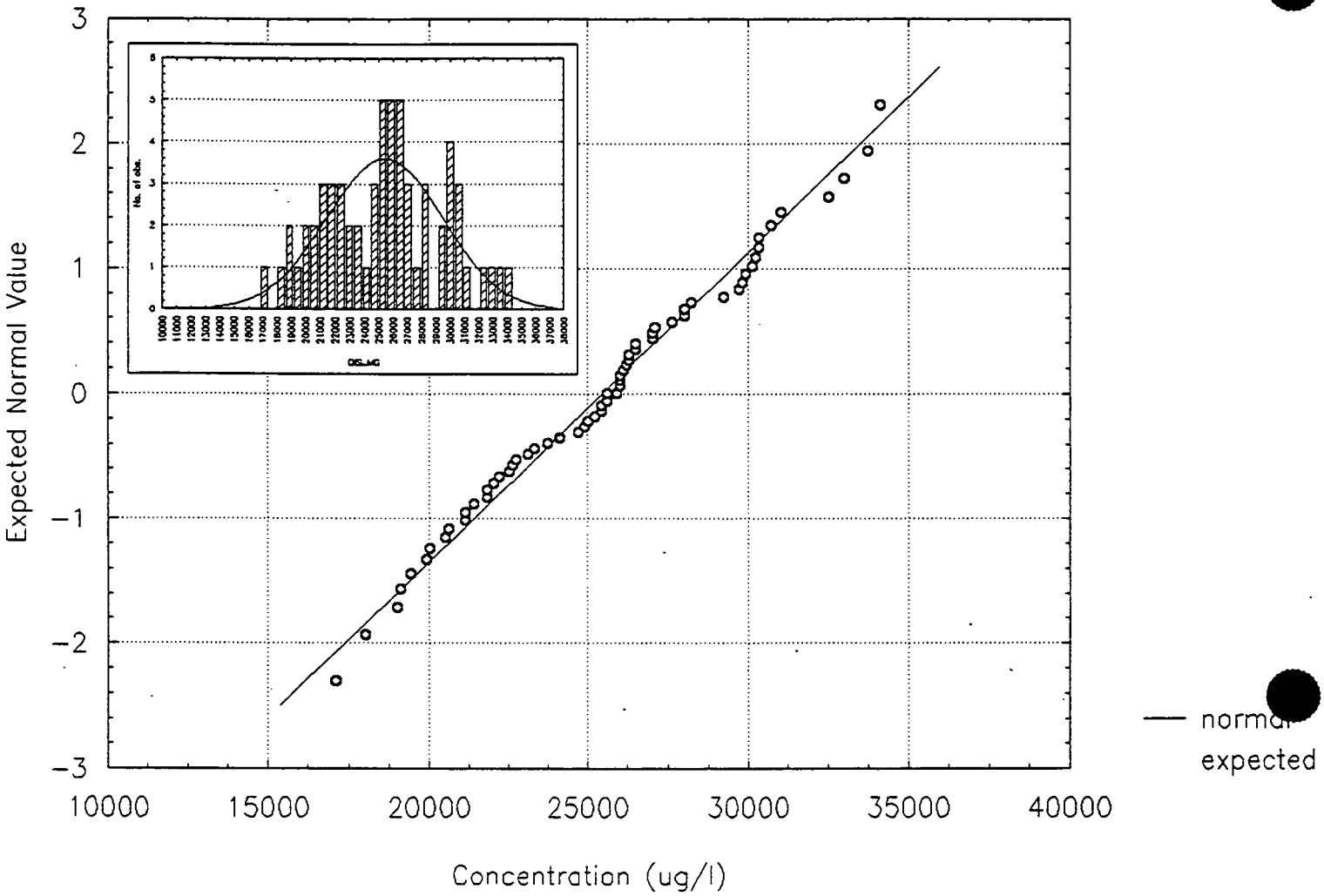


000572

Normal Probablility Plot for the Log Base 10 Transform
of Dissolved Cobalt in Background Groundwater

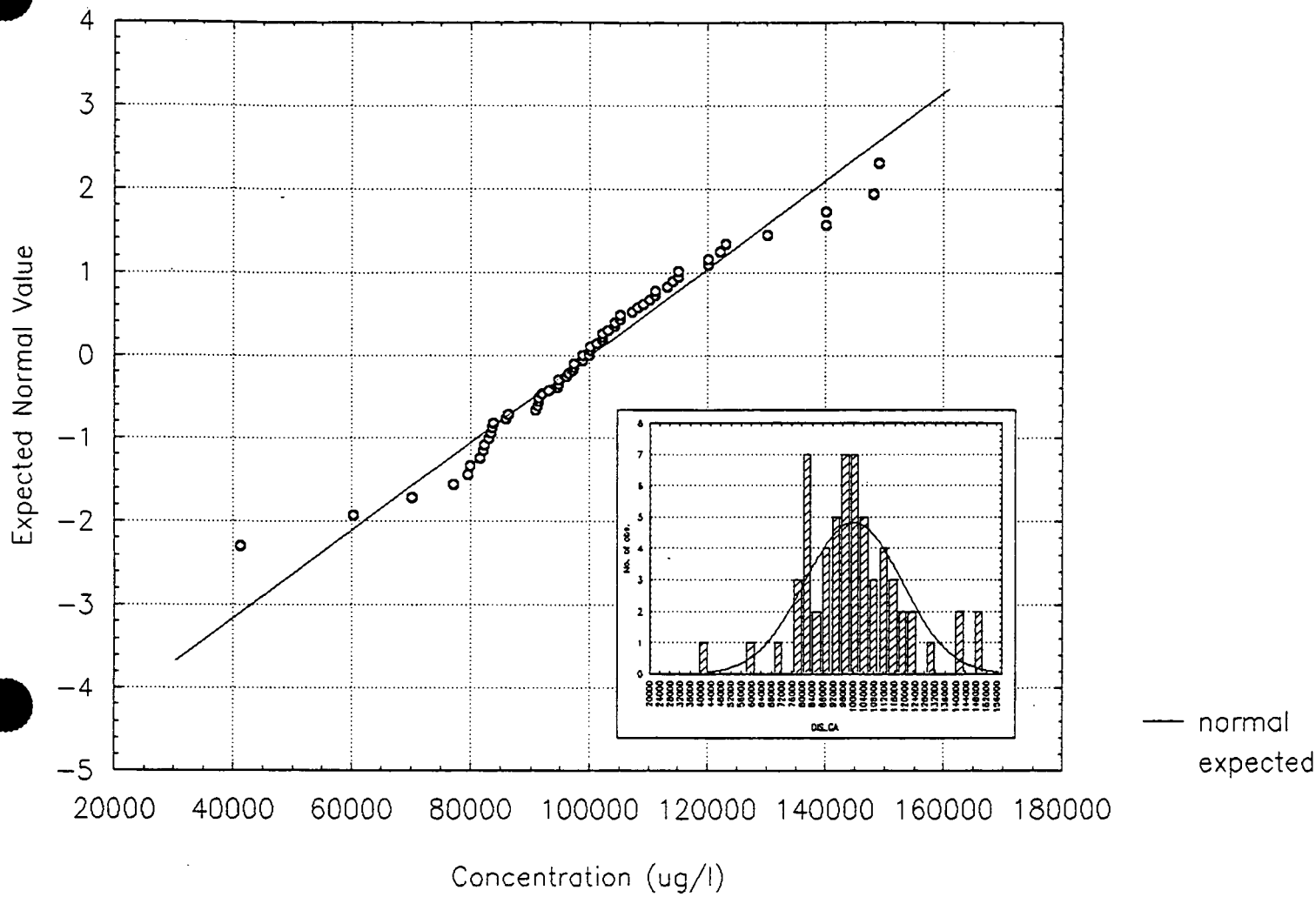


Normal Probablility Plot for Dissolved Magnesium
in Background Groundwater (Reduced Data Set)

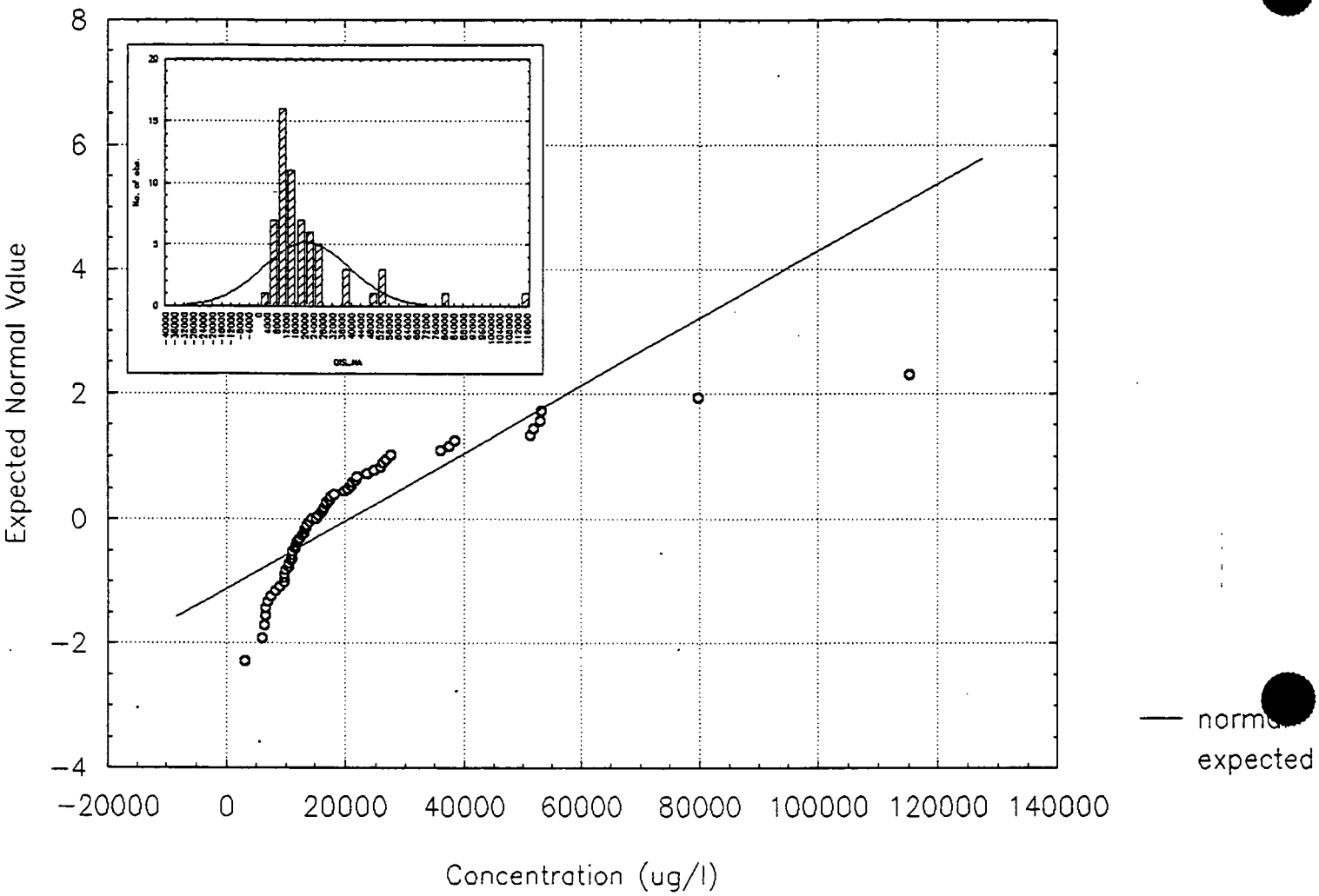


000574

Normal Probablility Plot for Dissolved Calcium
in Background Groundwater (Reduced Data Set)

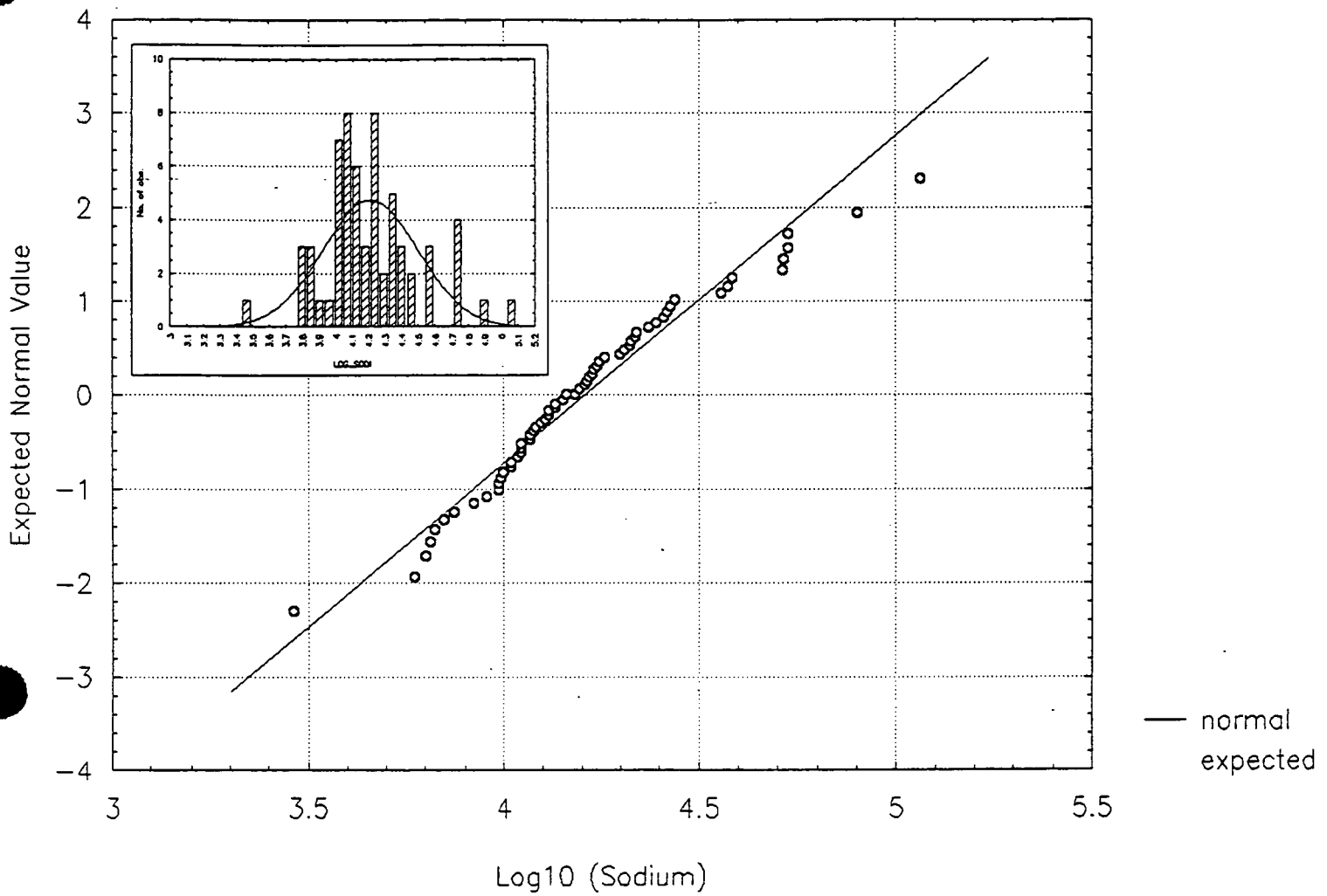


Normal Probablility Plot for Dissolved Sodium
in Background Groundwater (Reduced Data Set)

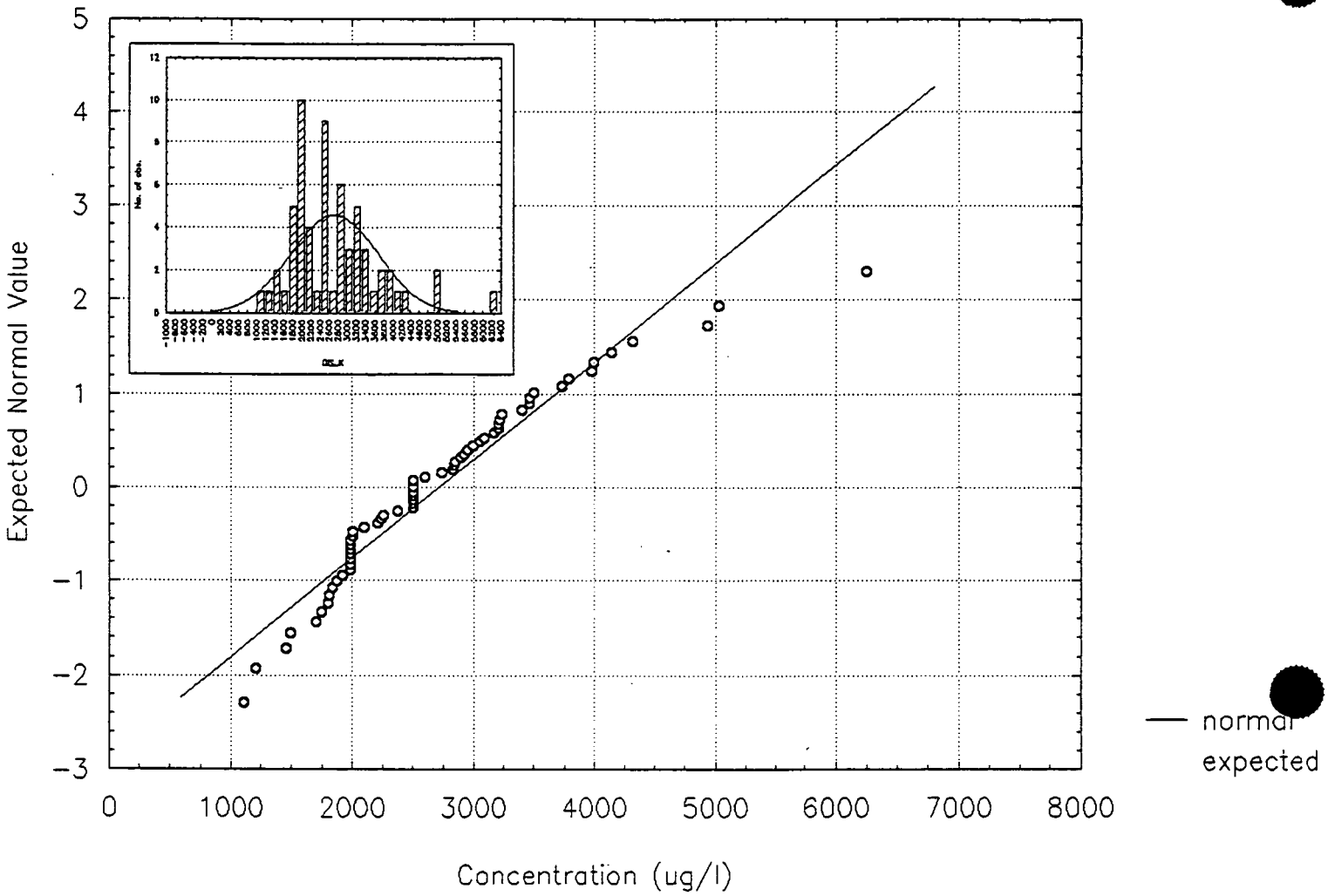


000576

Normal Probablility Plot for the Log Base 10 Transform
of Dissolved Sodium in the Background Groundwater

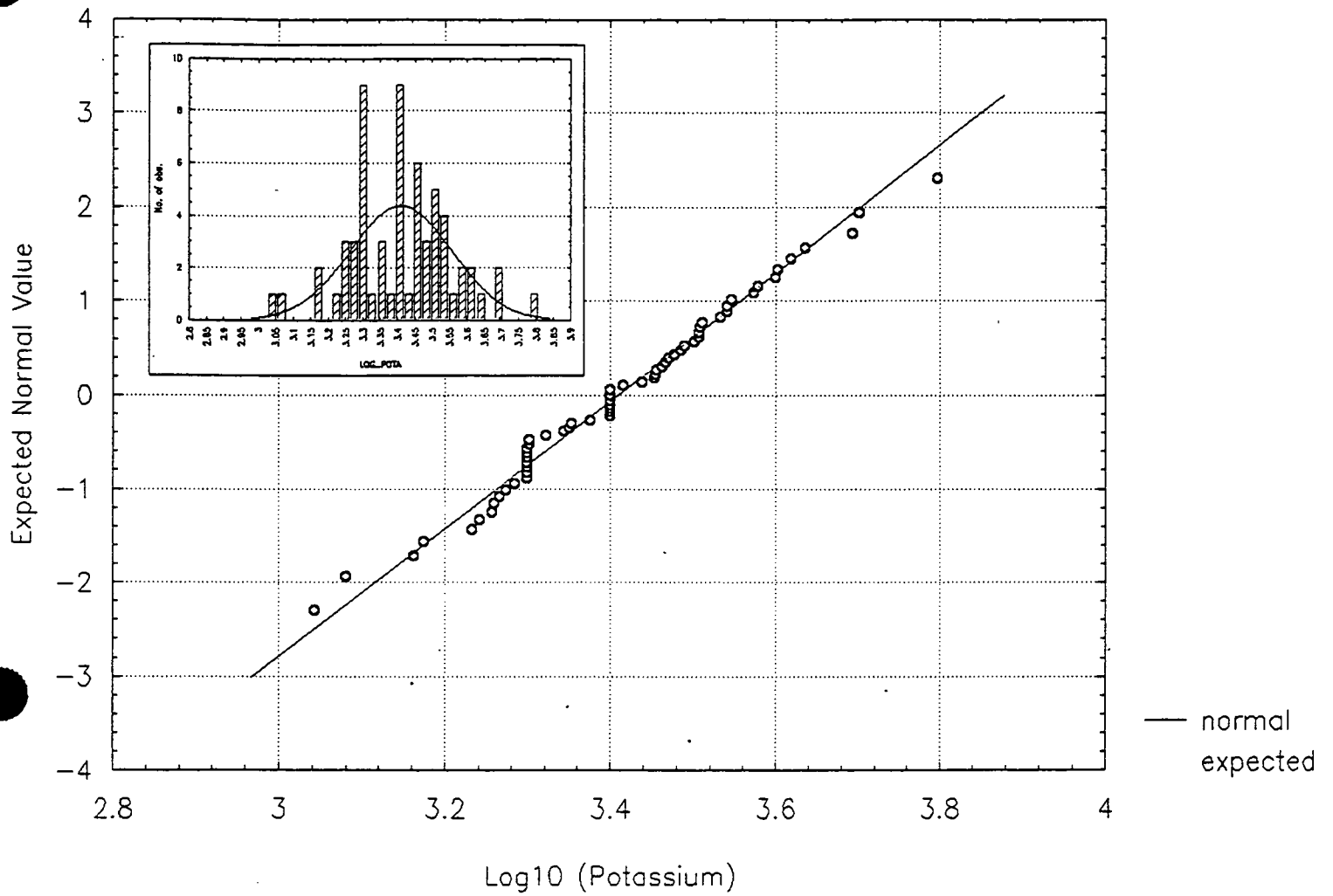


Normal Probablility Plot for Dissolved Potassium
in Background Groundwater (Reduced Data Set)



000578

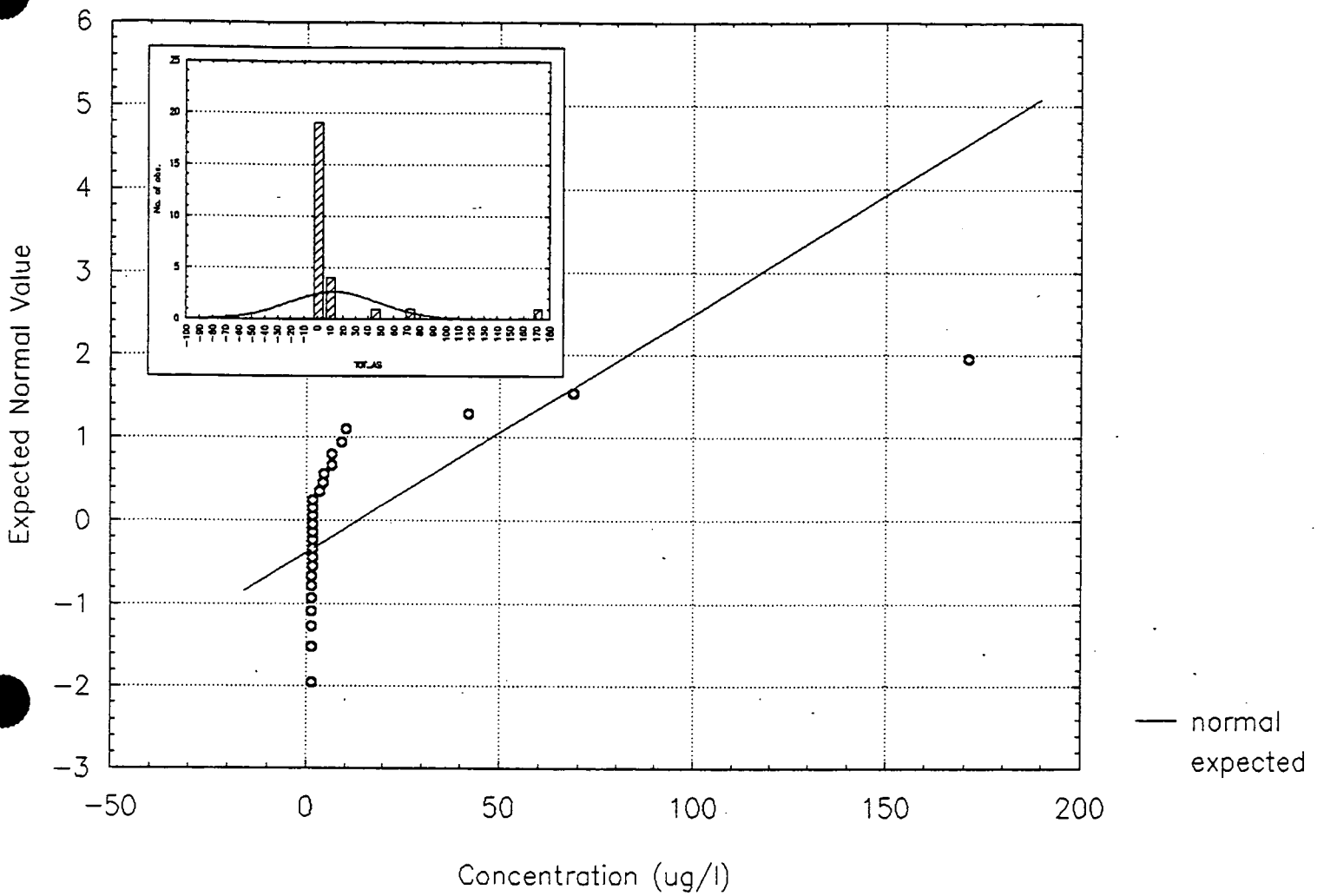
Normal Probablility Plot for the Log Base 10
Transform of Dissolved Potassium in Bacgkround Groundwater



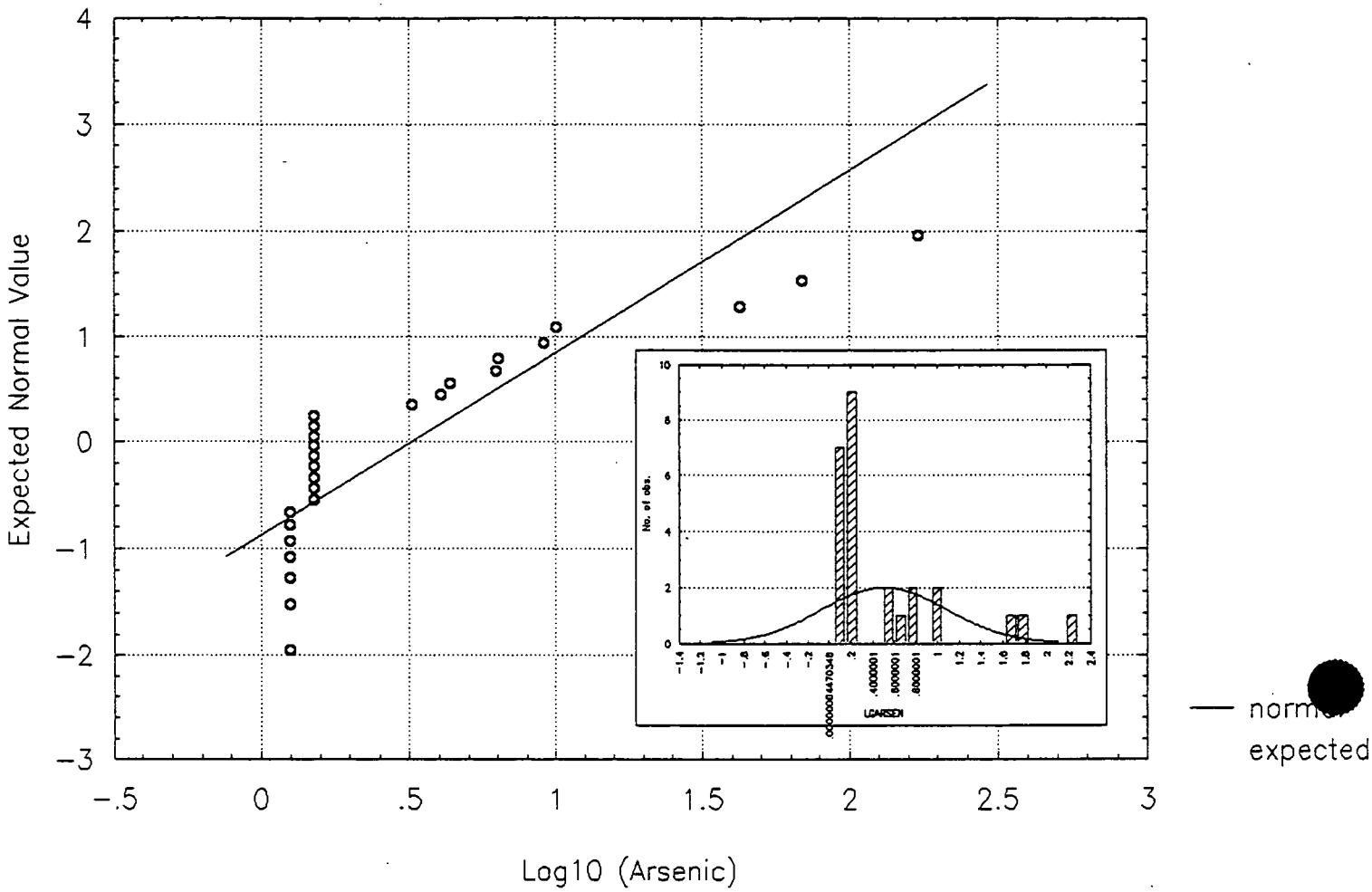
TOTAL METALS

EVALUATION OF SELECT CHEMICALS USING ENTIRE BACKGROUND DATA SET

Normal Probablility Plot for Total
Arsenic in Background Groundwater

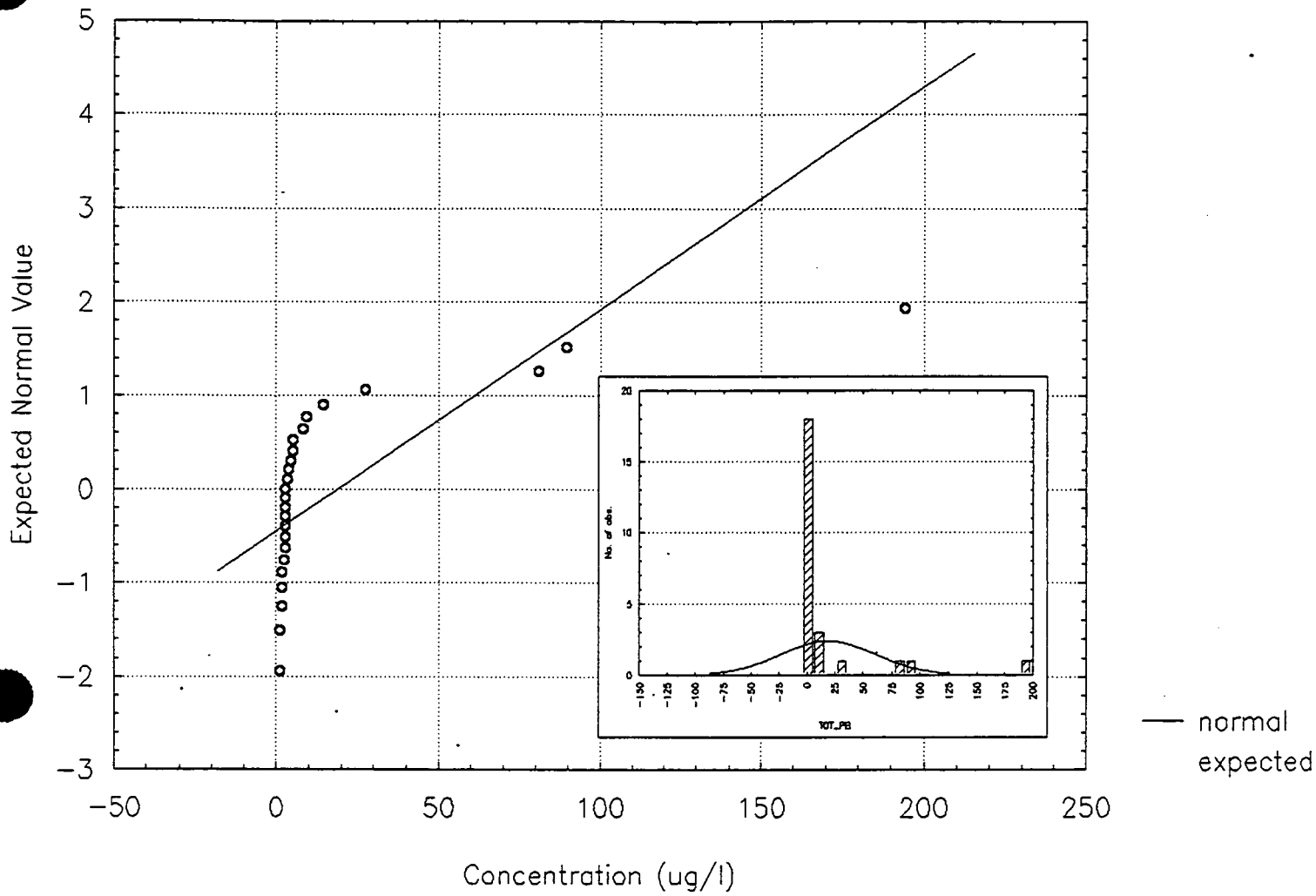


Normal Probablility Plot for Log Base 10 of Total Arsenic (Original Data Set) in Background Groundwater

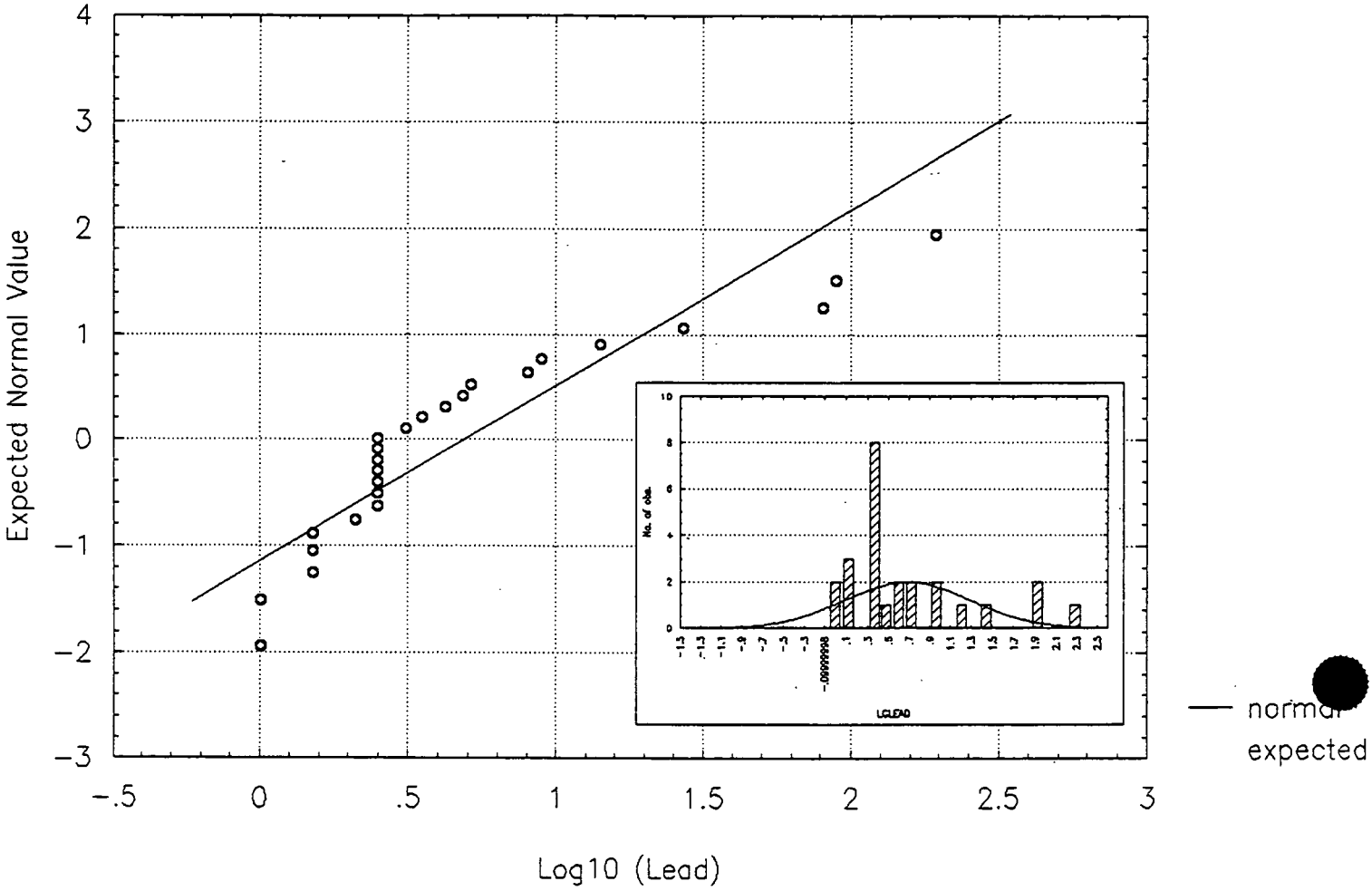


000583

Normal Probablility Plot for Total Lead
in Background Groundwater

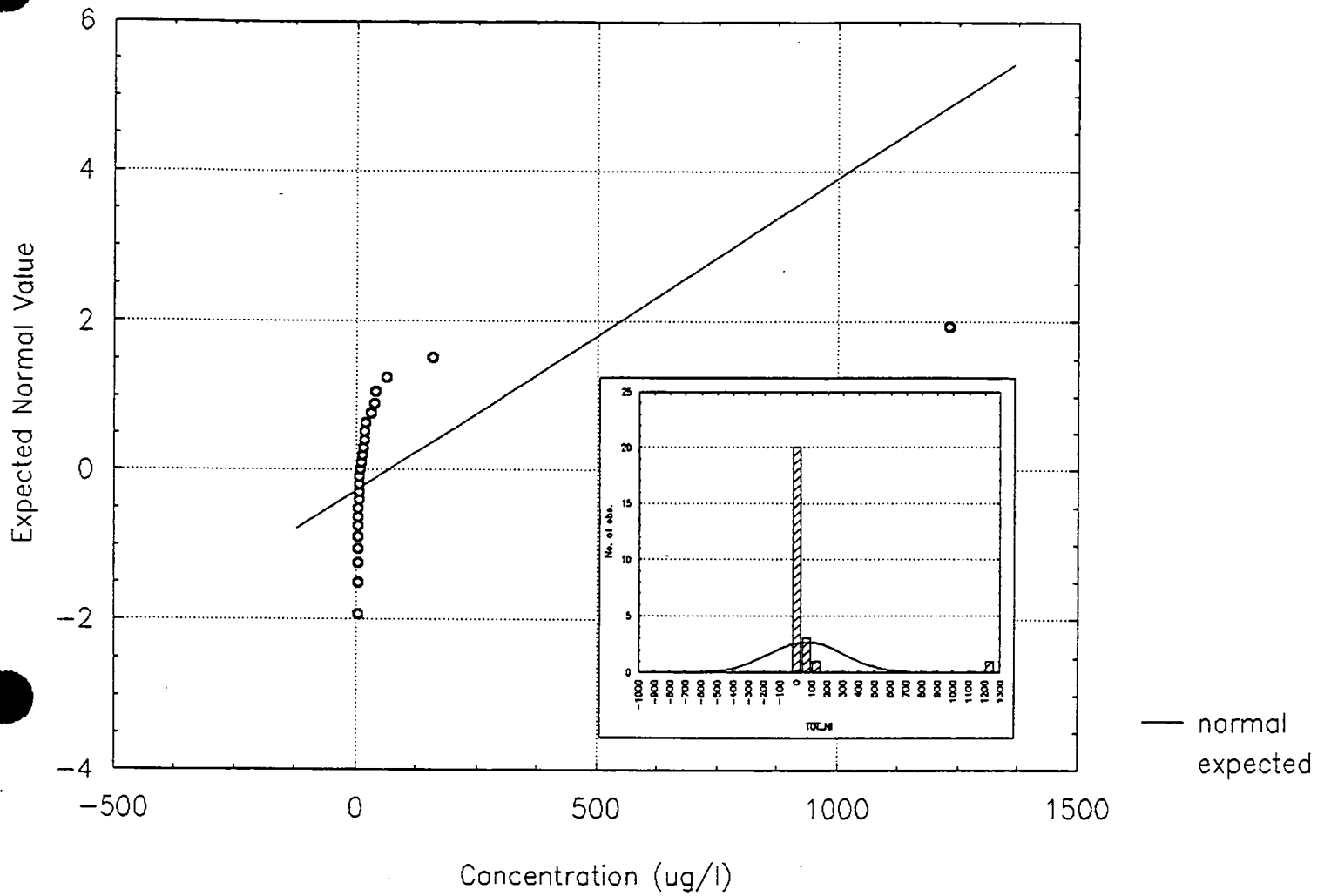


Normal Probablility Plot for the Log Base 10 Transform of Total Lead (Original Data Set) in Background Groundwater

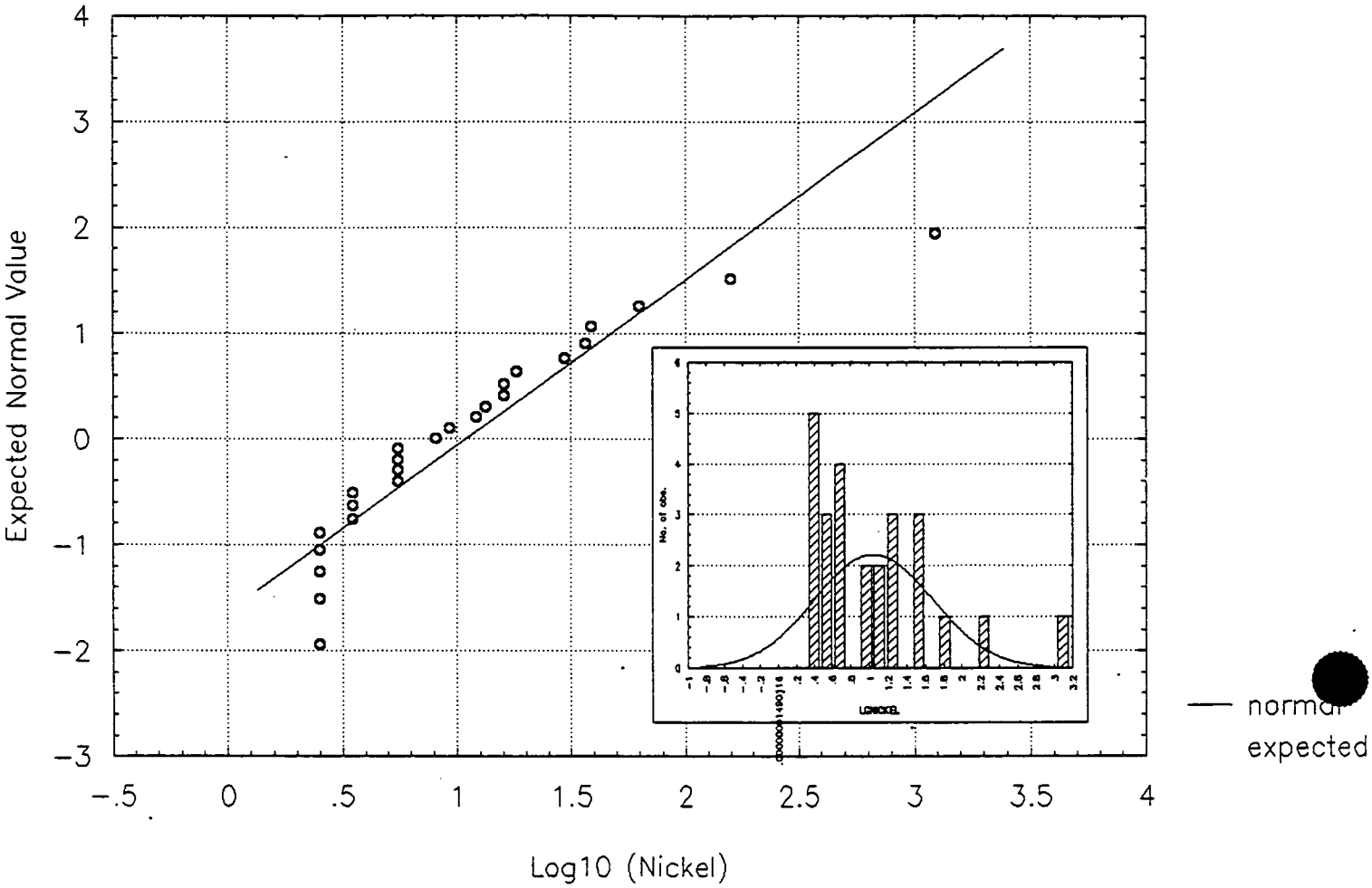


000585

Normal Probablility Plot for Total Nickel in Background Groundwater



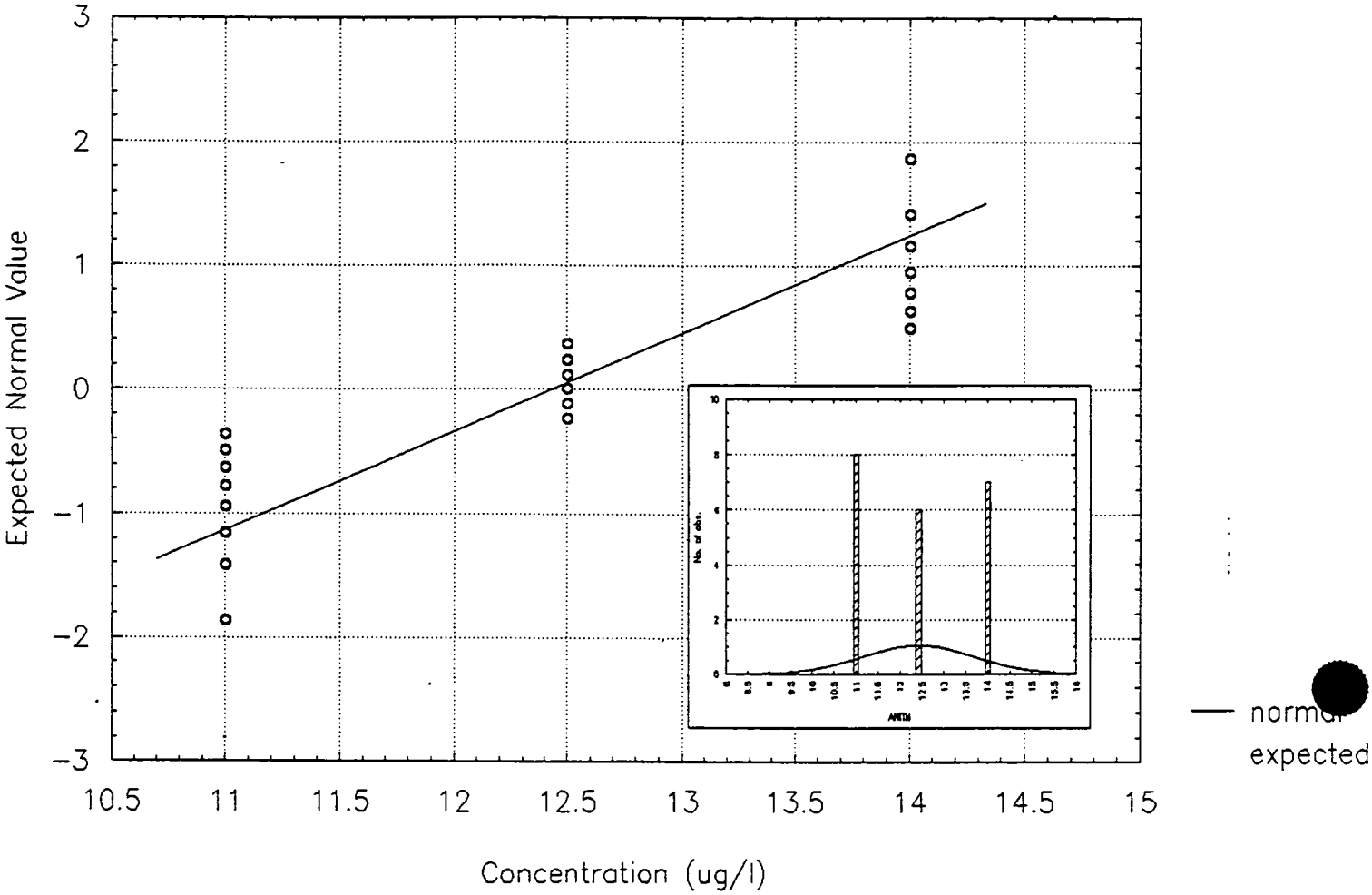
Normal Probablility Plot for the Log Base 10 Transform of Nickel (Original Data Set) in Background Groundwater



000587

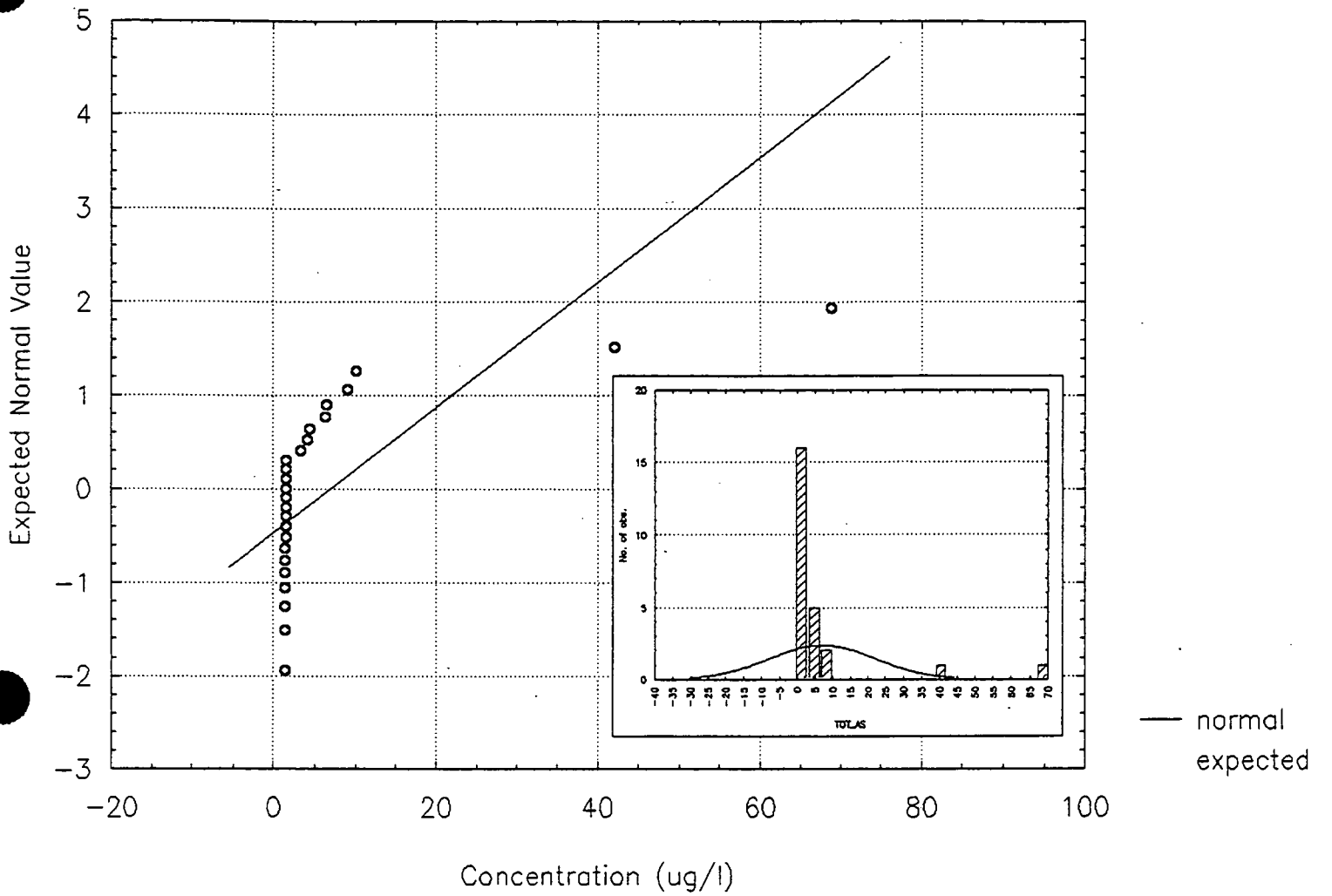
STATISTICAL EVALUATION USING REDUCED DATA SET (MW-1D FOR THIRD ROUND REMOVED)

Normal Probablility Plot for Total Antimony (Reduced Data Set) in Background Groundwater

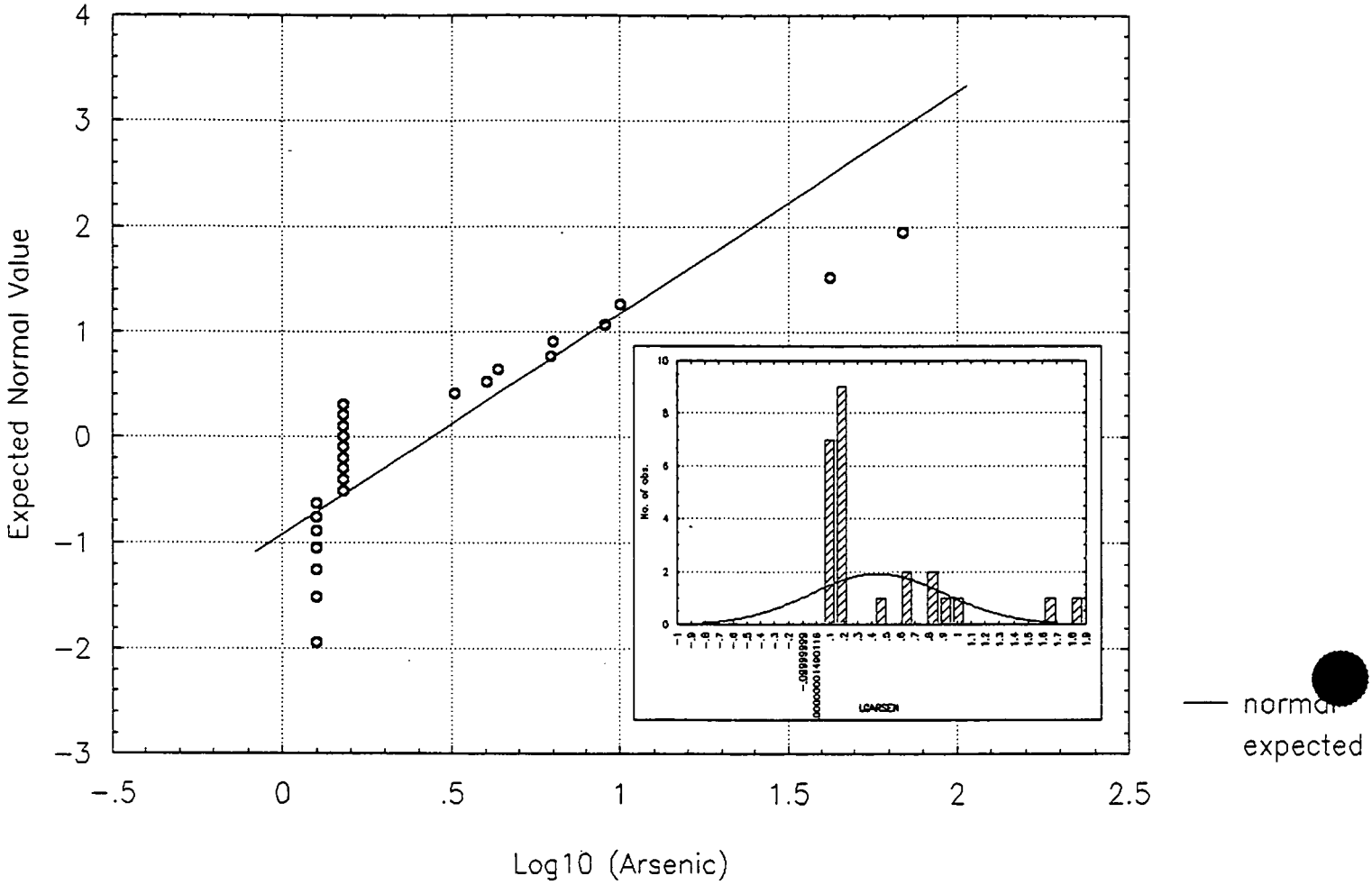


000589

Normal Probablility Plot for Total Arsenic
(Reduced Data Set) in Background Groundwater

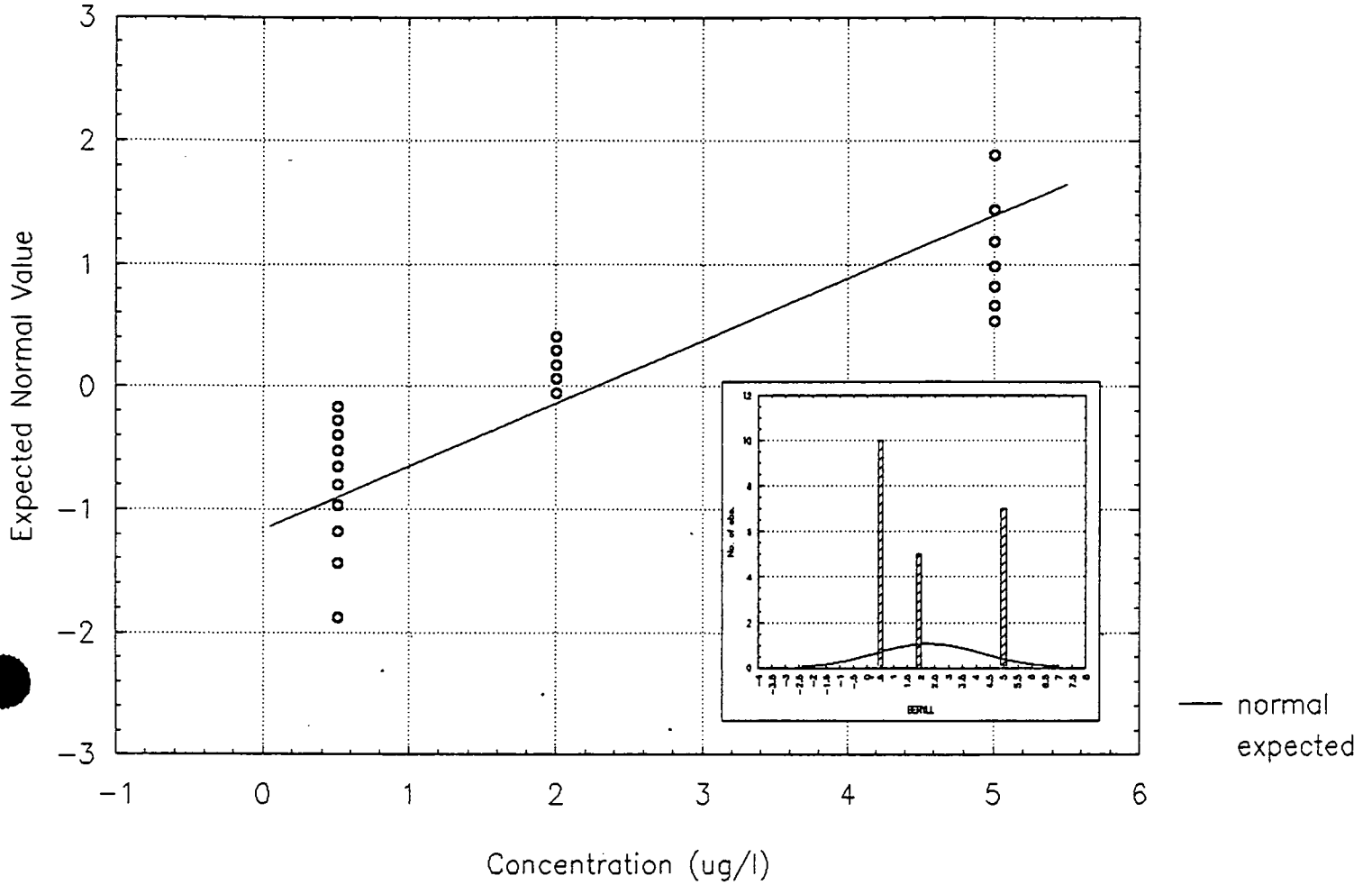


Normal Probablility Plot for the Log Base 10
Transform of Total Arsenic (Reduced Data Set)
in Background Groundwater

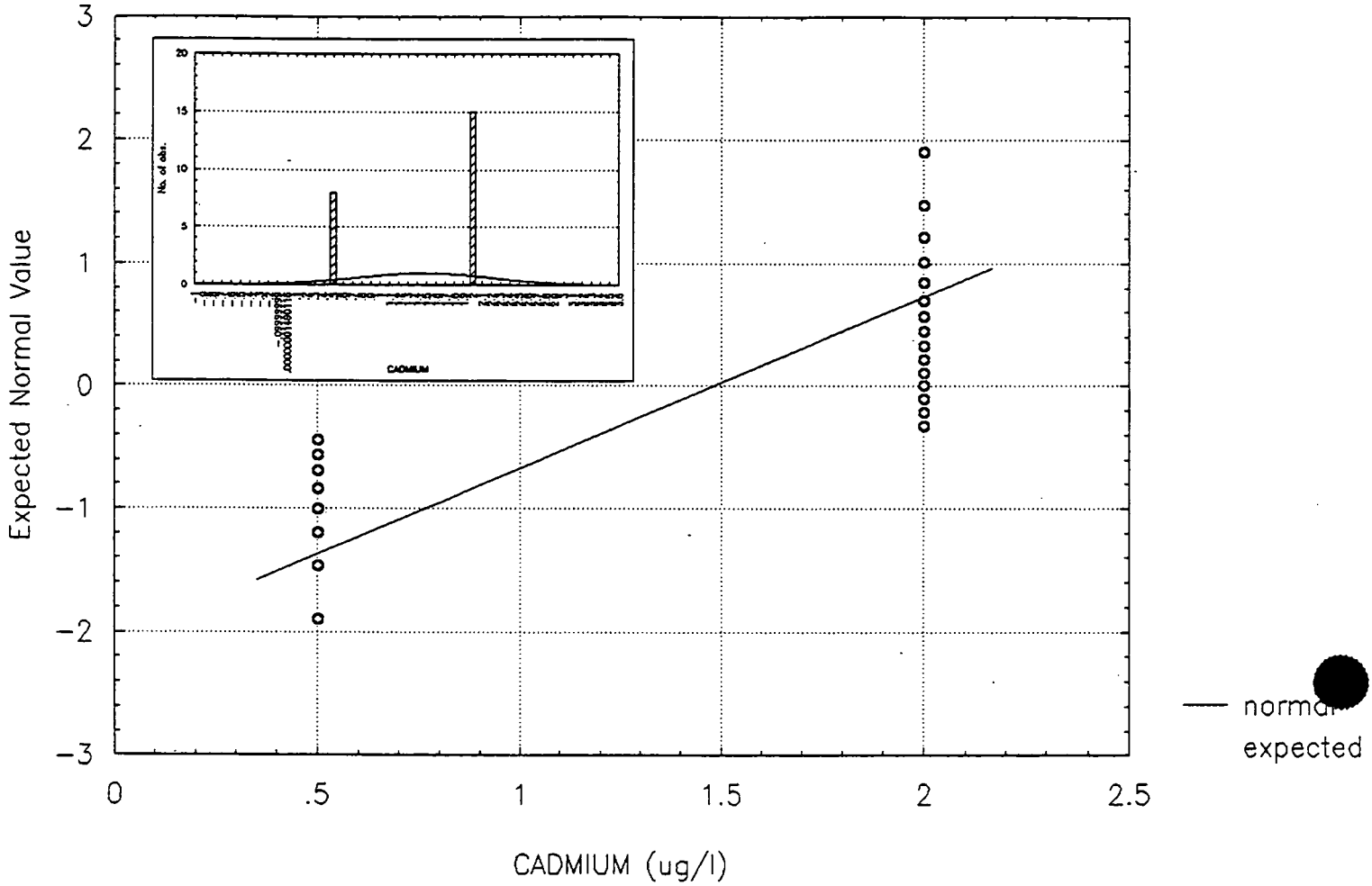


000591

Normal Probablility Plot for Total Beryllium (Reduced Data Set) in Background Groundwater

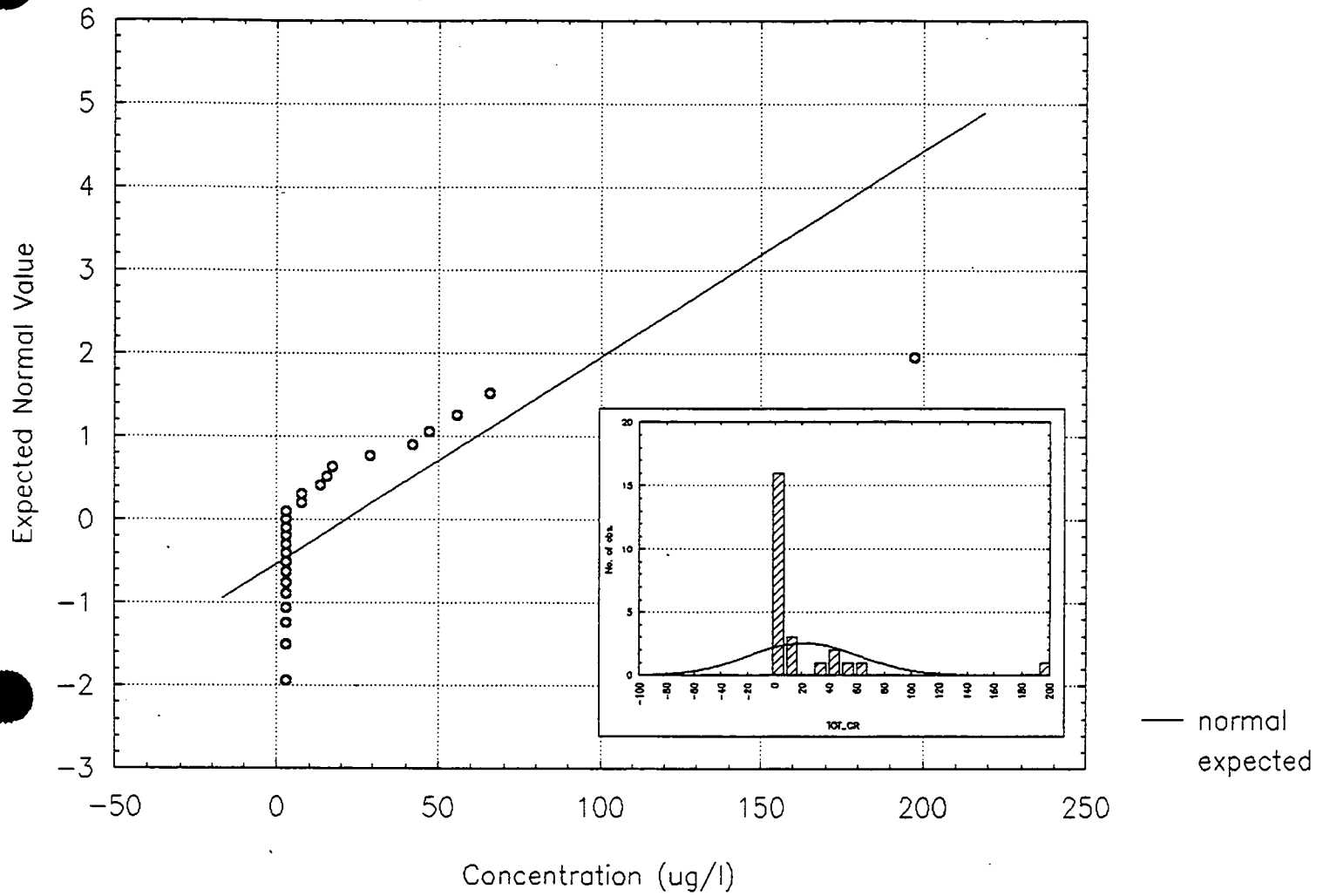


Normal Probablility Plot for Total Cadmium (Reduced Data Set) in Background Groundwater

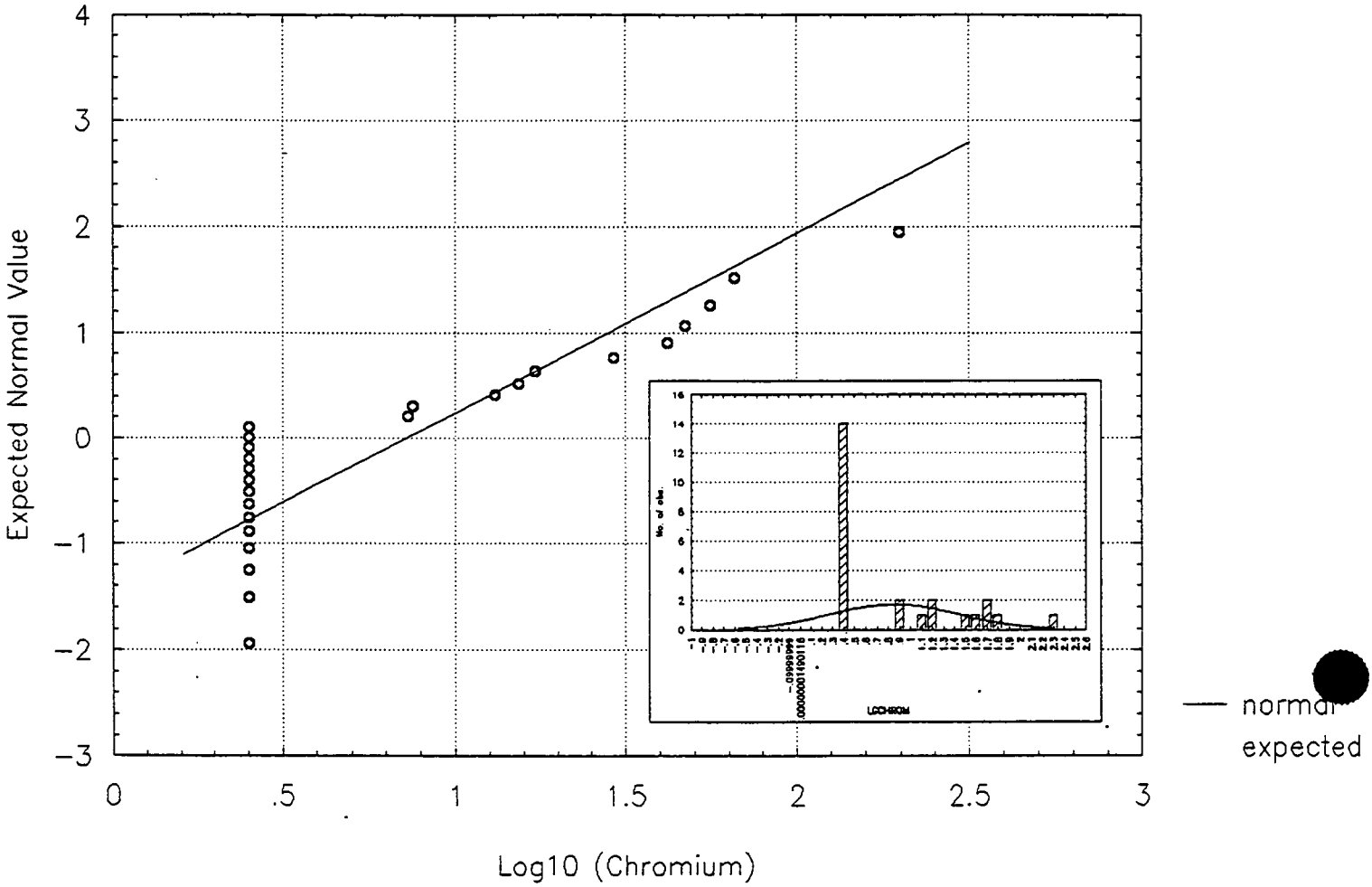


000593

Normal Probablility Plot for Total Chromium
(Reduced Set) in Background Groundwater

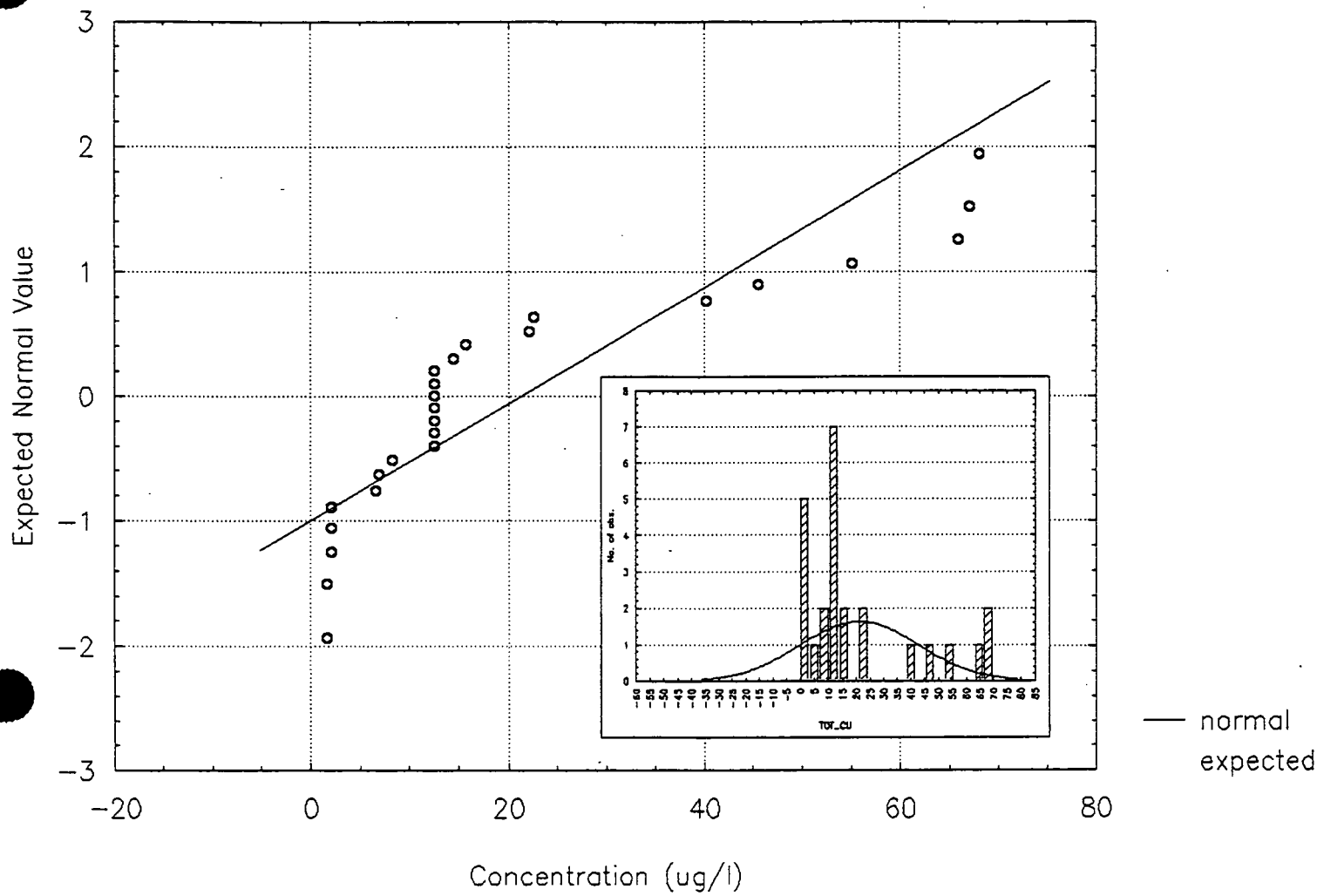


Normal Probablility Plot for the Log Base 10
Transform of Total Chromium (Reduced Data Set)
in Background Groundwater

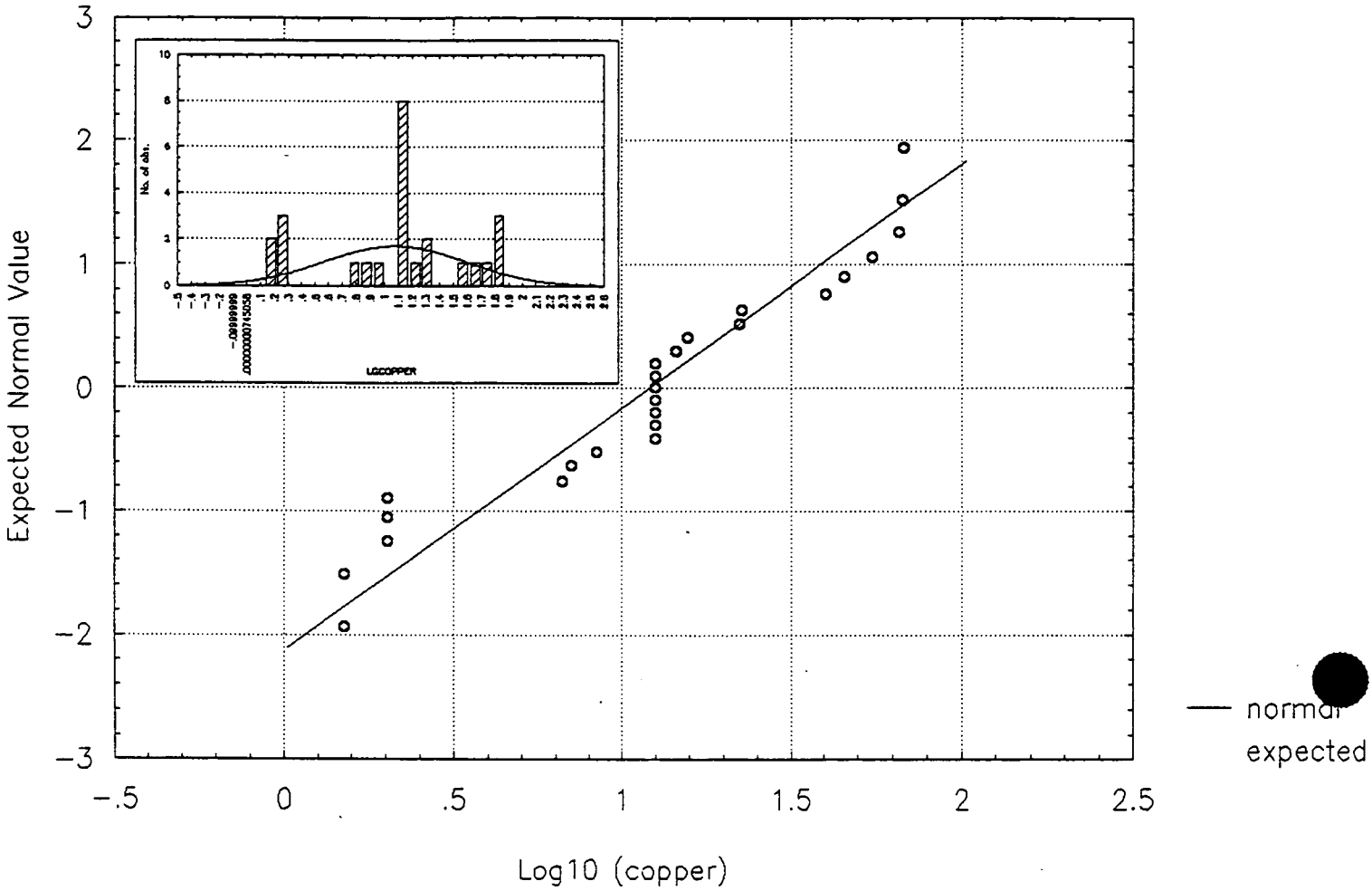


000595

Normal Probablility Plot for Total Copper
(Reduced Set) in Background Groundwater

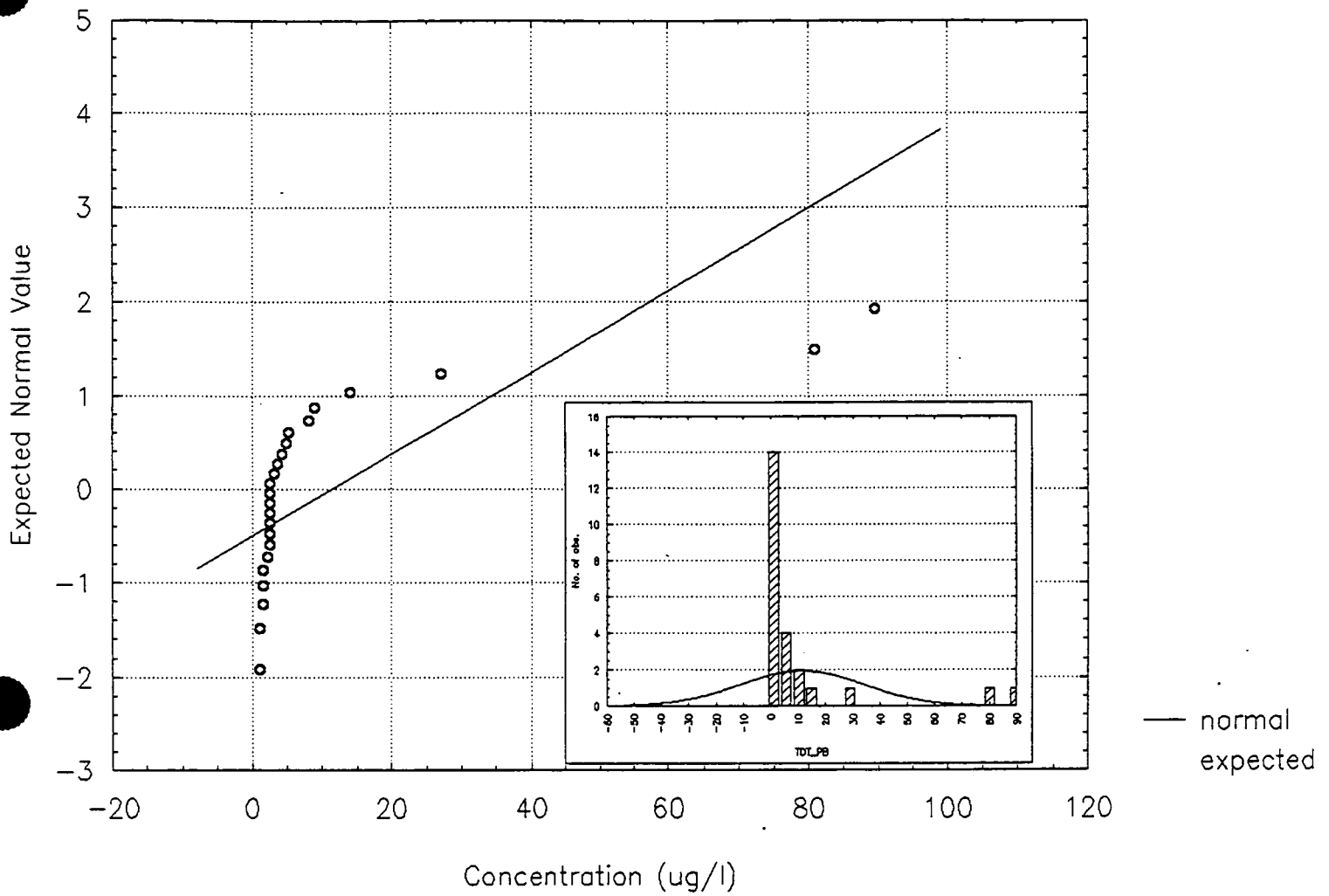


Normal Probablility Plot for the Log Base 10
Transform of Total Copper (Reduced Data Set)
in Background Groundwater

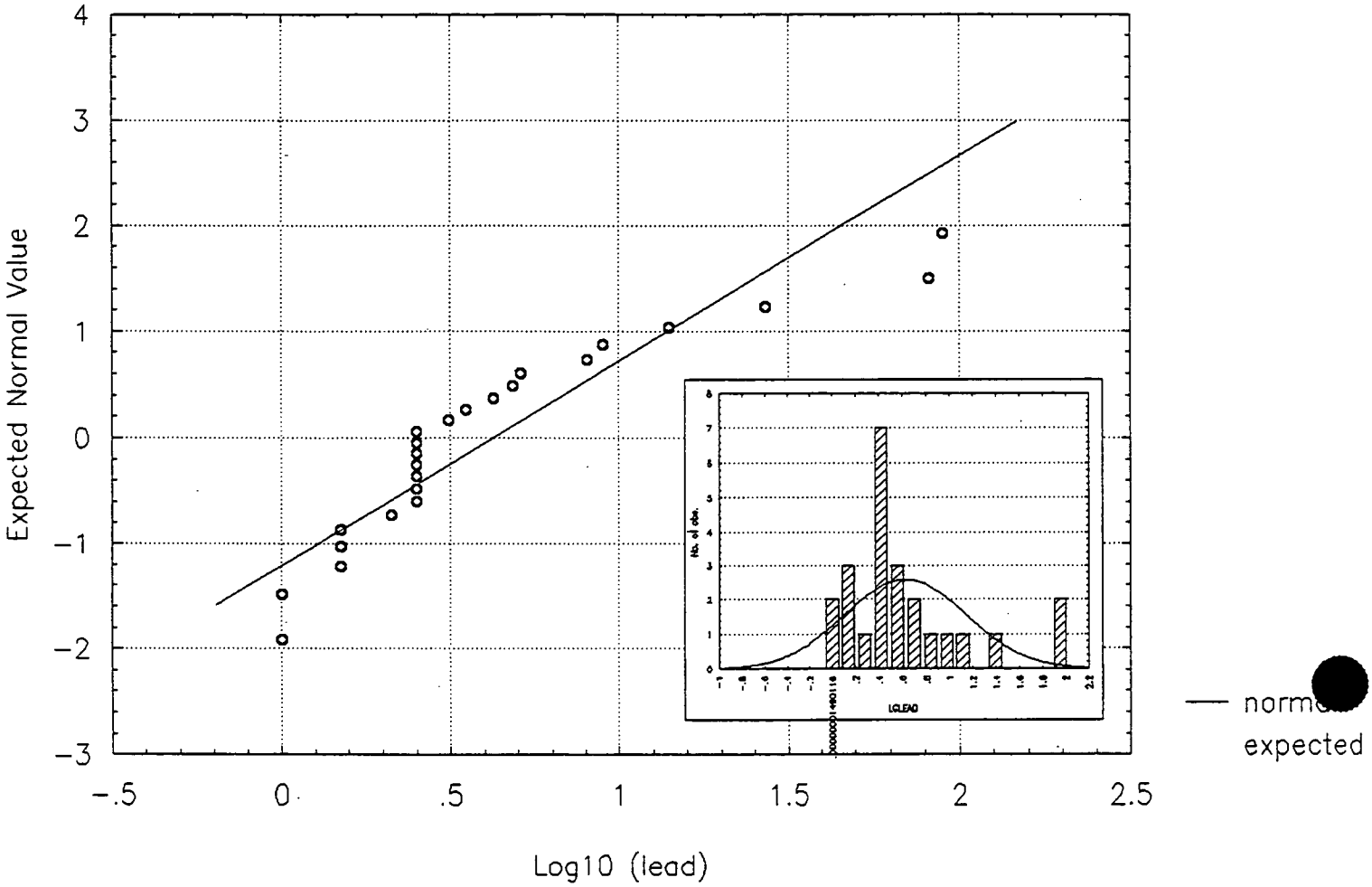


000597

Normal Probablility Plot for Total Lead
(Reduced Set) in Background Groundwater

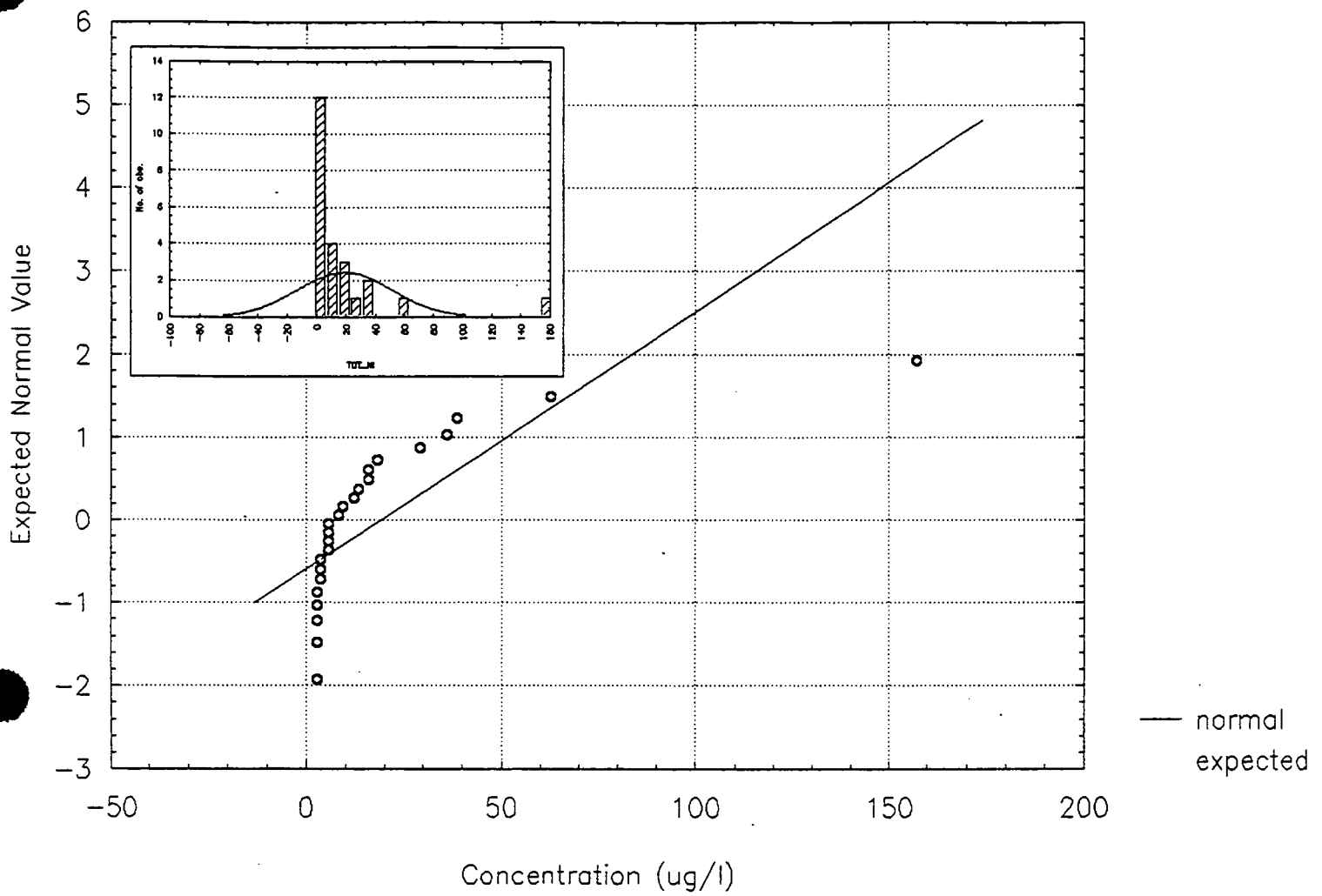


Normal Probablility Plot for the Log Base 10
Transform of Total Lead (Reduced Data Set)
in Background Groundwater

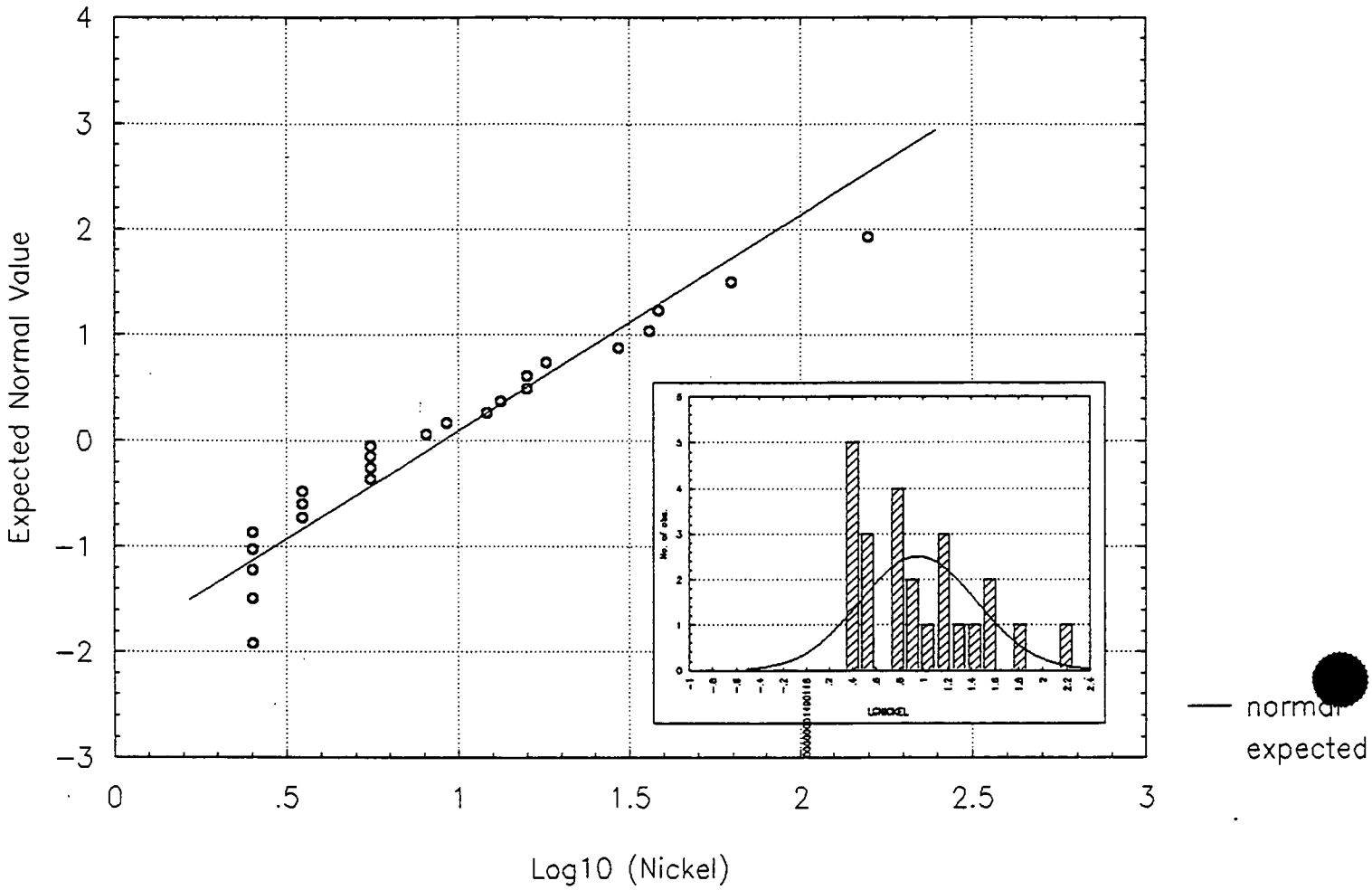


000599

Normal Probablility Plot for Total Nickel
(Reduced Set) in Background Groundwater

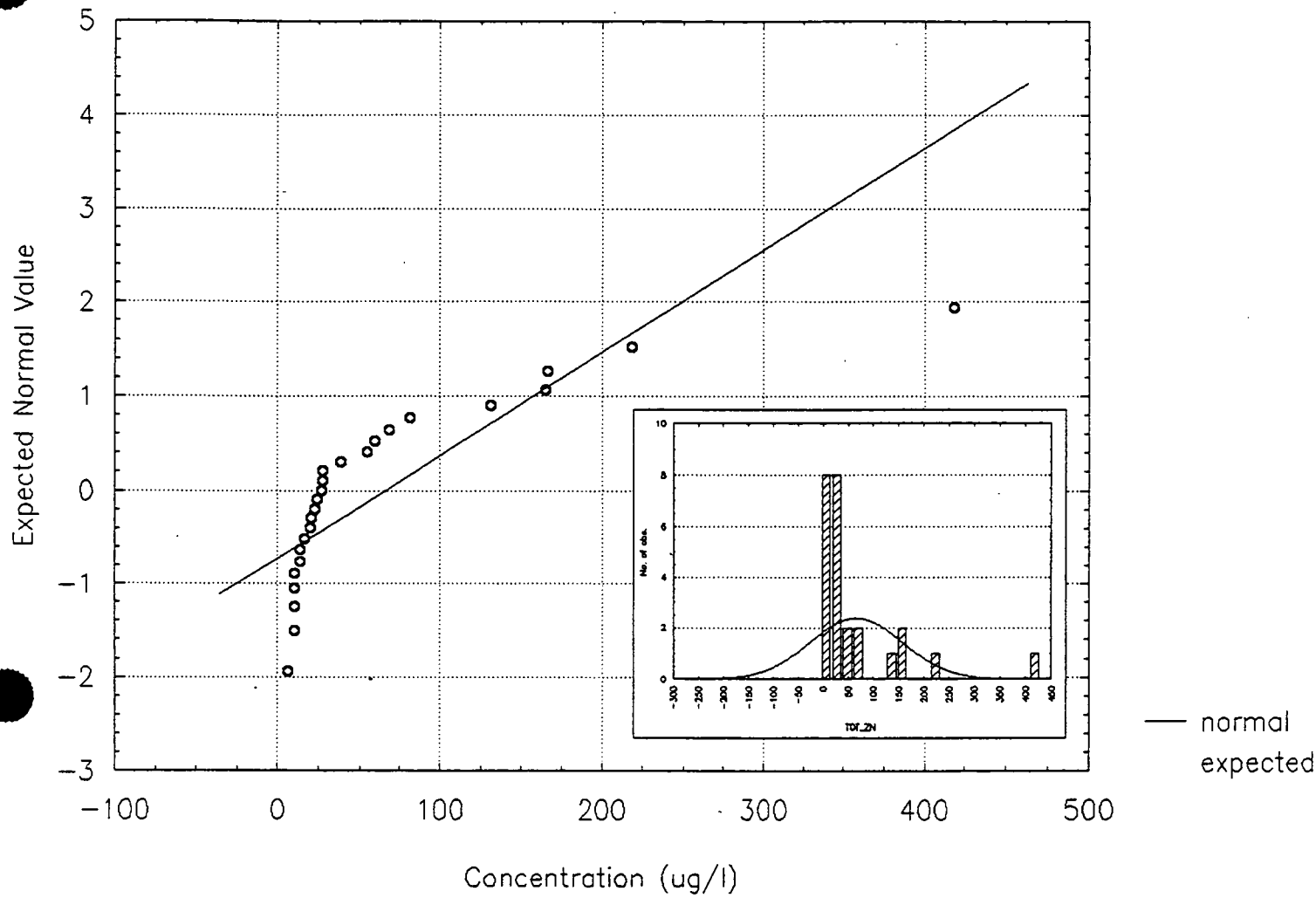


Normal Probablility Plot for the Log Base 10
Transform of Total Nickel (Reduced Data Set)
in Background Groundwater

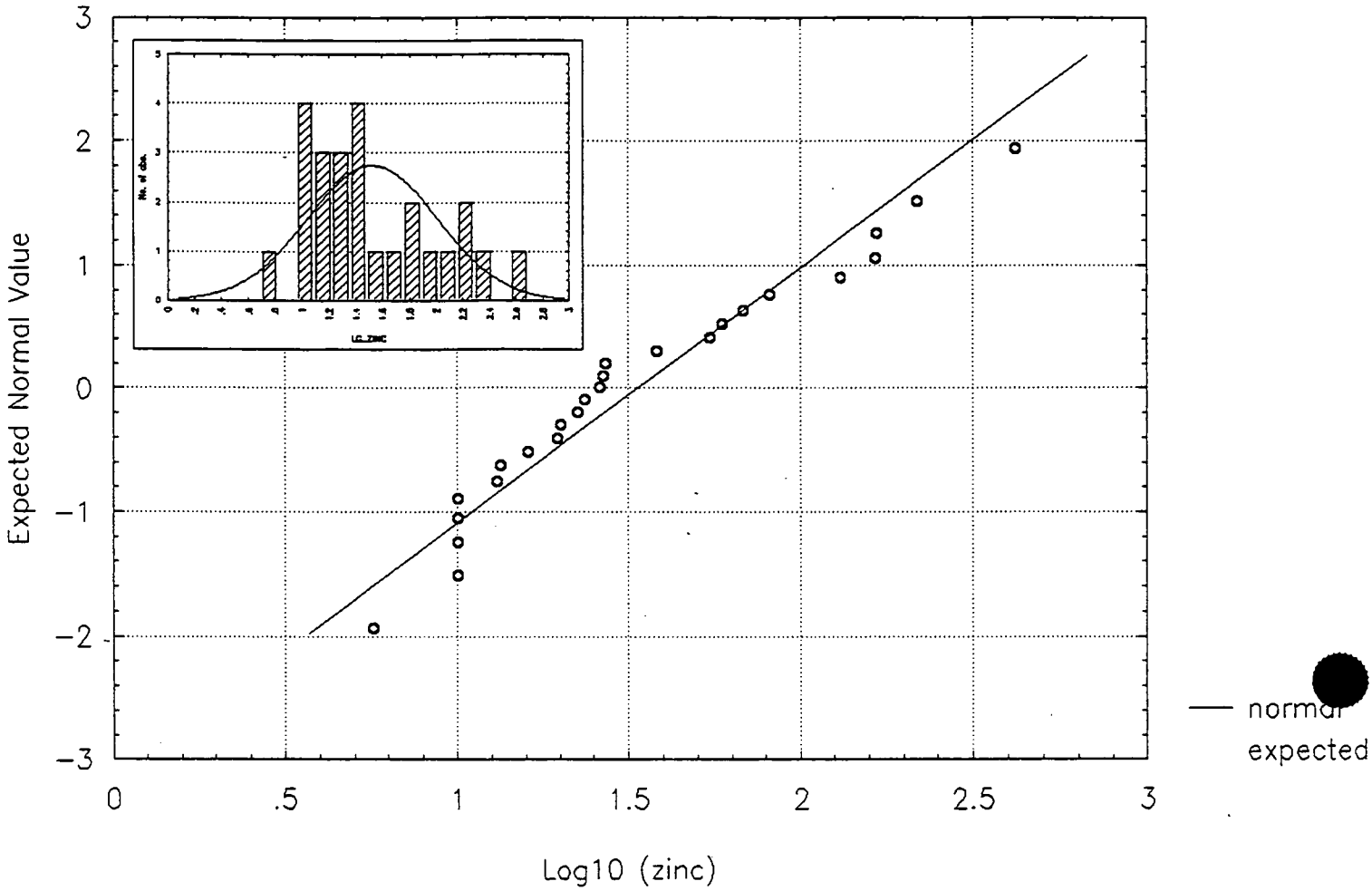


000601

Normal Probablility Plot for Total Zinc
(Reduced Set) in Background Groundwater

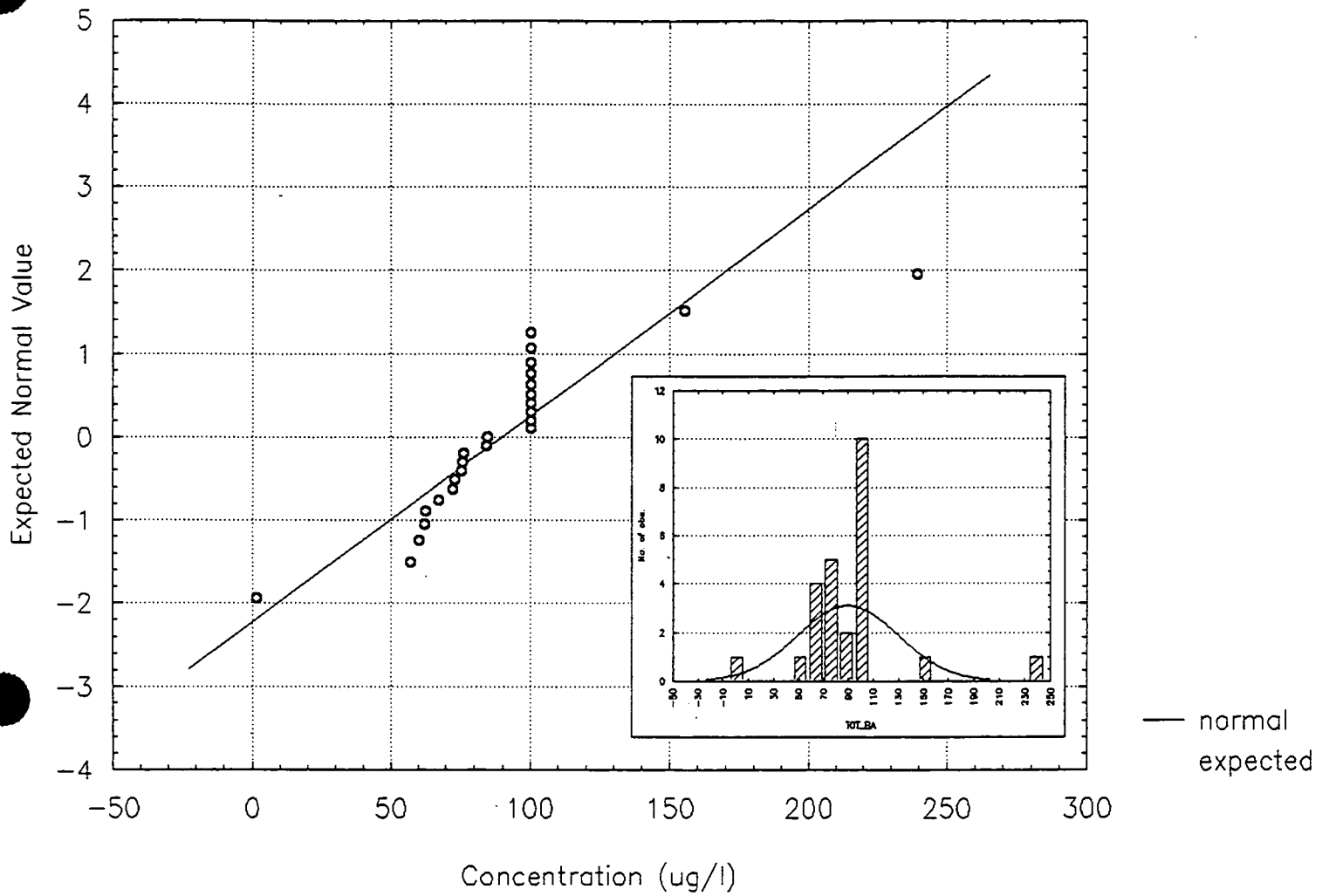


Normal Probablility Plot for the Log Base 10
Transform of Total Zinc (Reduced Data Set)
in Background Groundwater

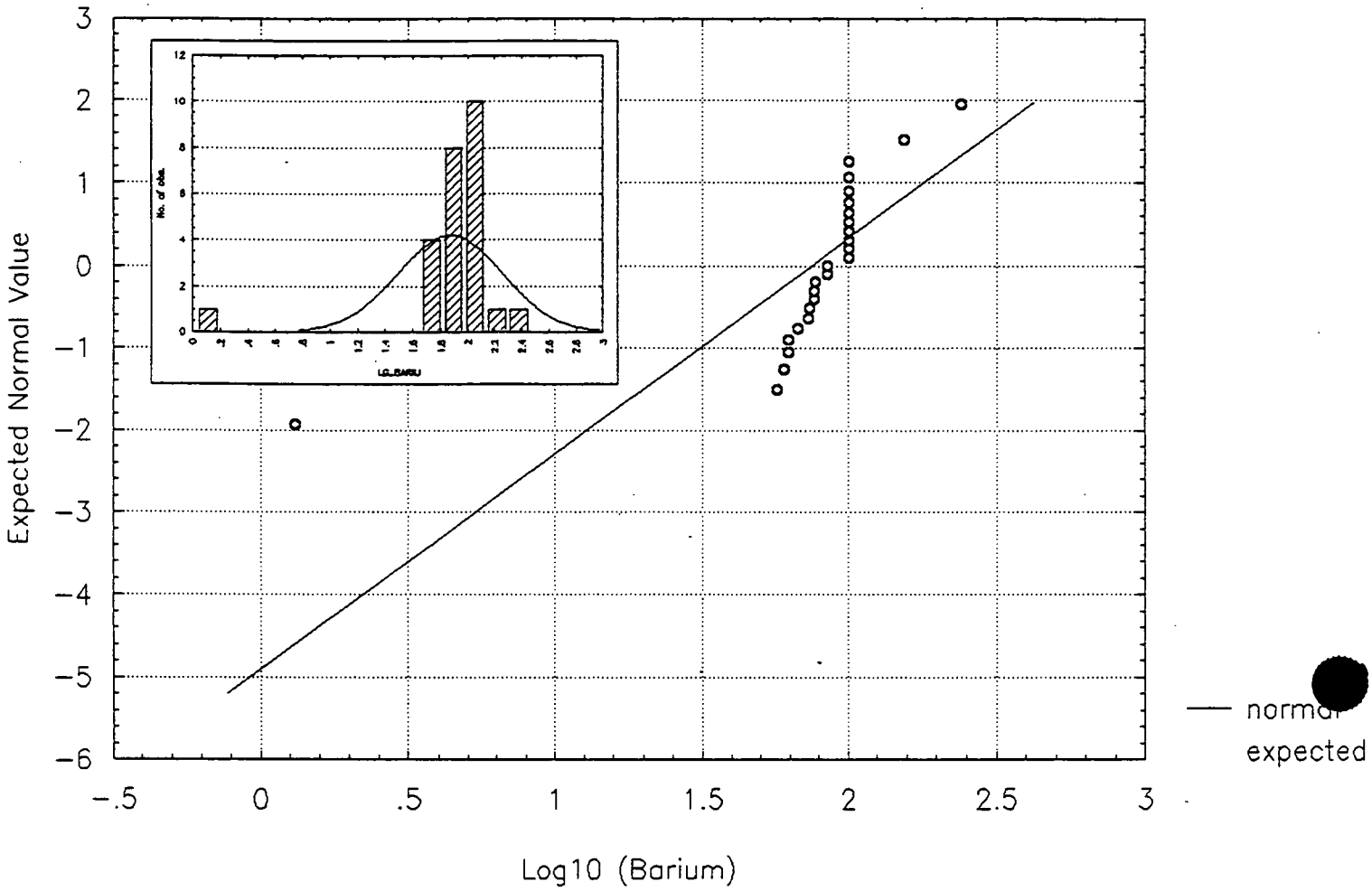


000603

Normal Probablility Plot for Total Barium
(Reduced Data Set) in Background Groundwater

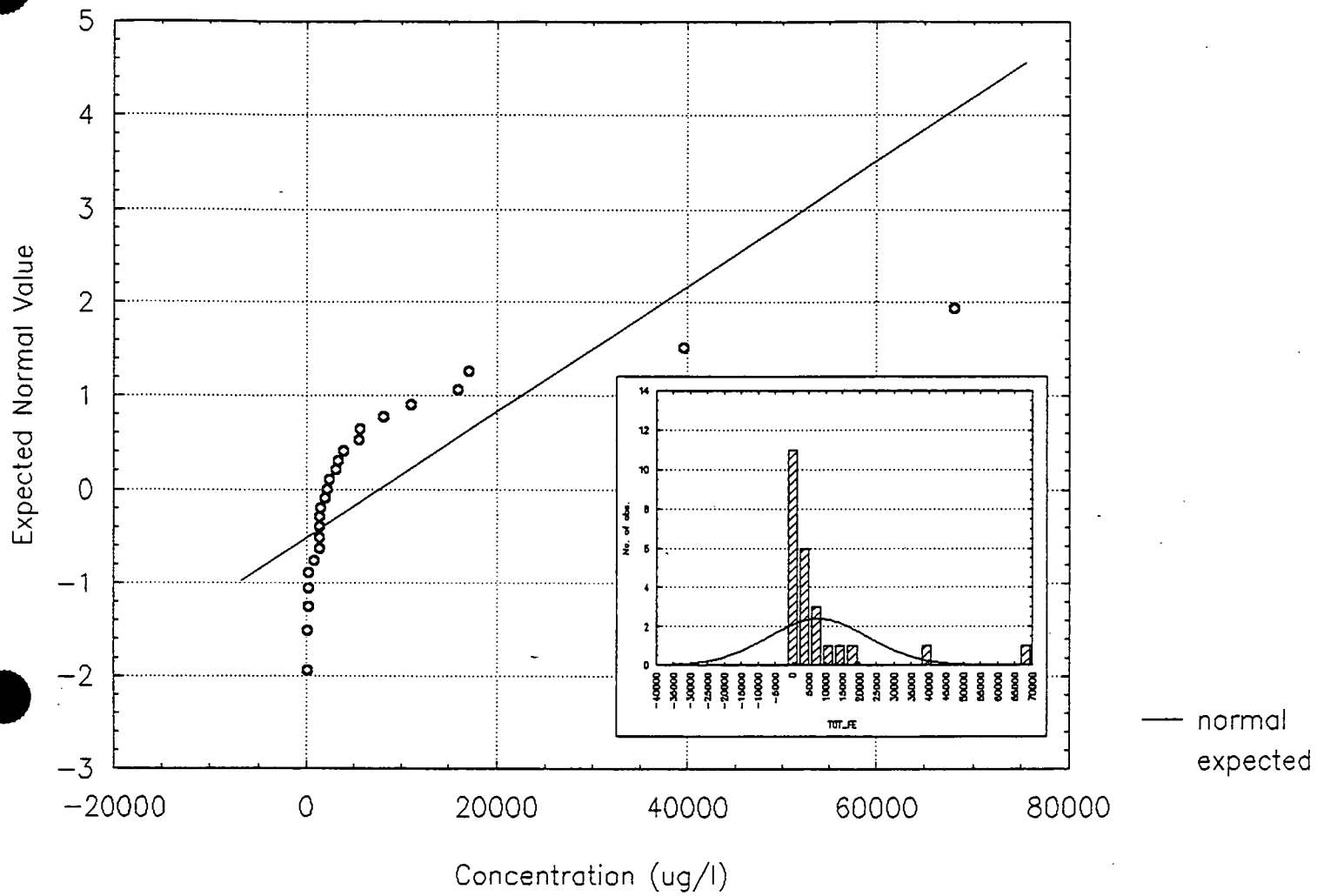


Normal Probablility Plot for the Log Base 10
Transform of Total Barium (Reduced Data Set)
in Background Groundwater

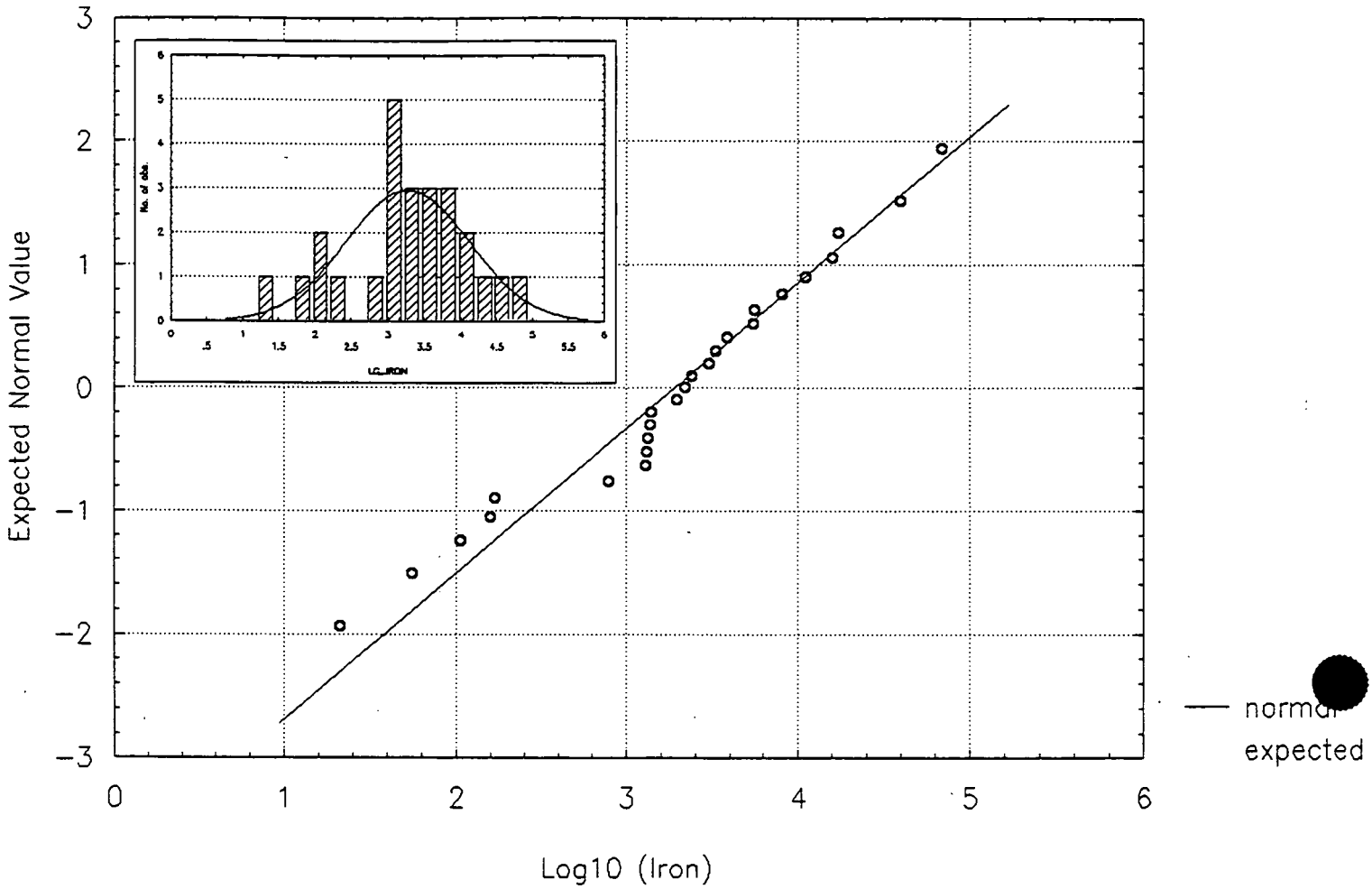


000605

Normal Probablility Plot for Total Iron
(Reduced Set) in Background Groundwater

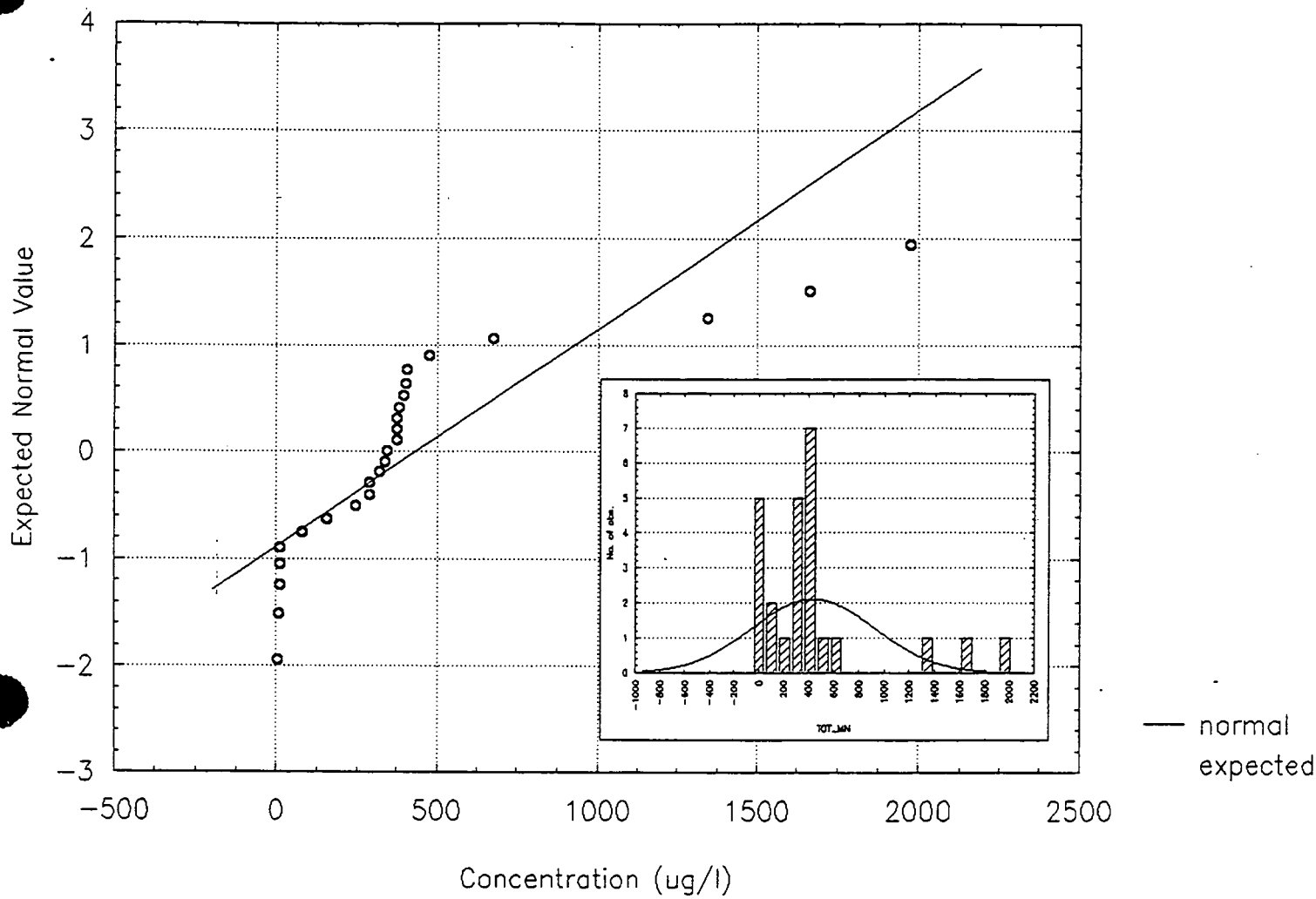


Normal Probablility Plot for the Log Base 10
Transform of Total Iron (Reduced Data Set)
in Background Groundwater

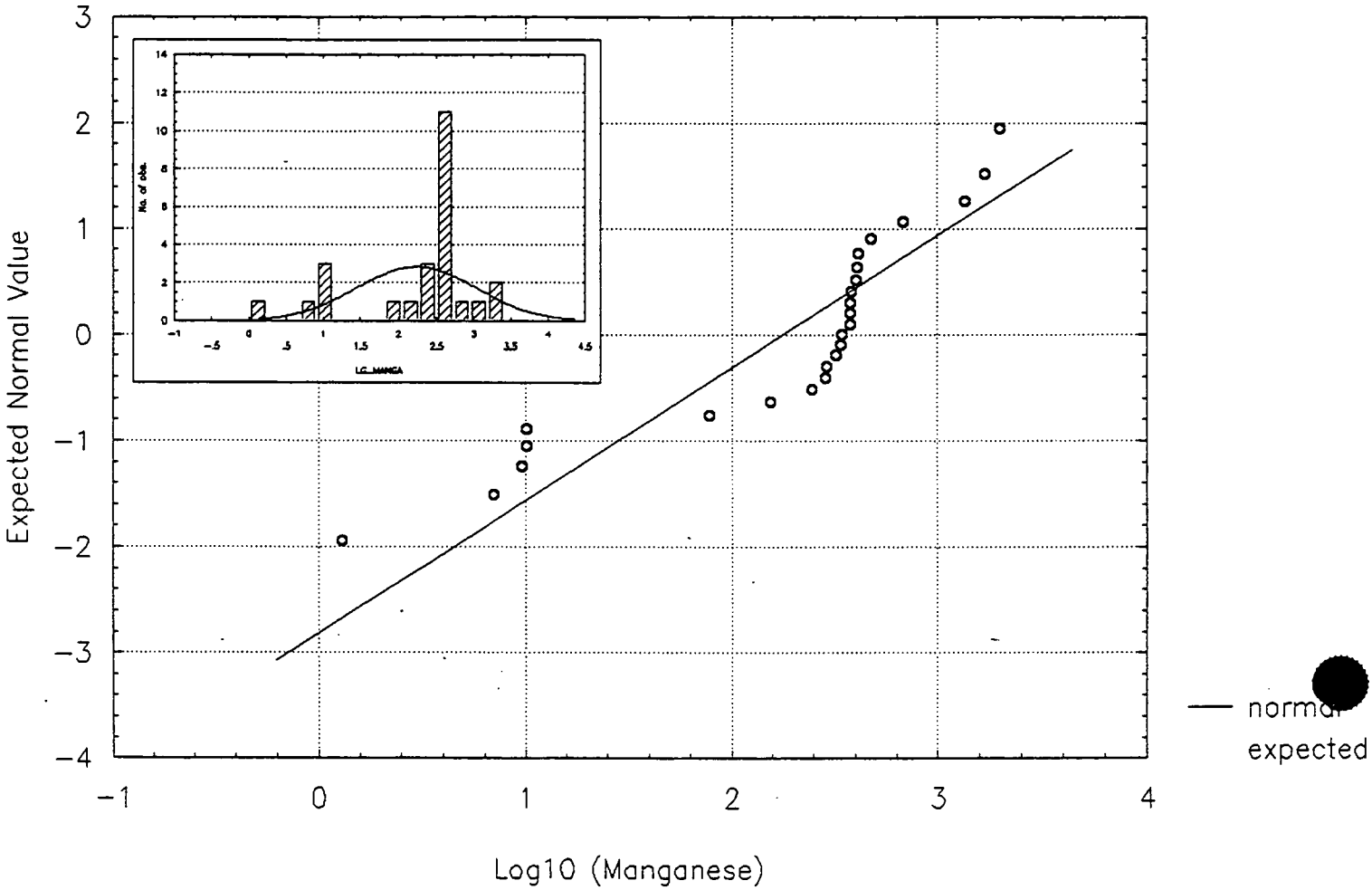


000607

Normal Probablility Plot for Total Manganese
(Reduced Data Set) in Background Groundwater

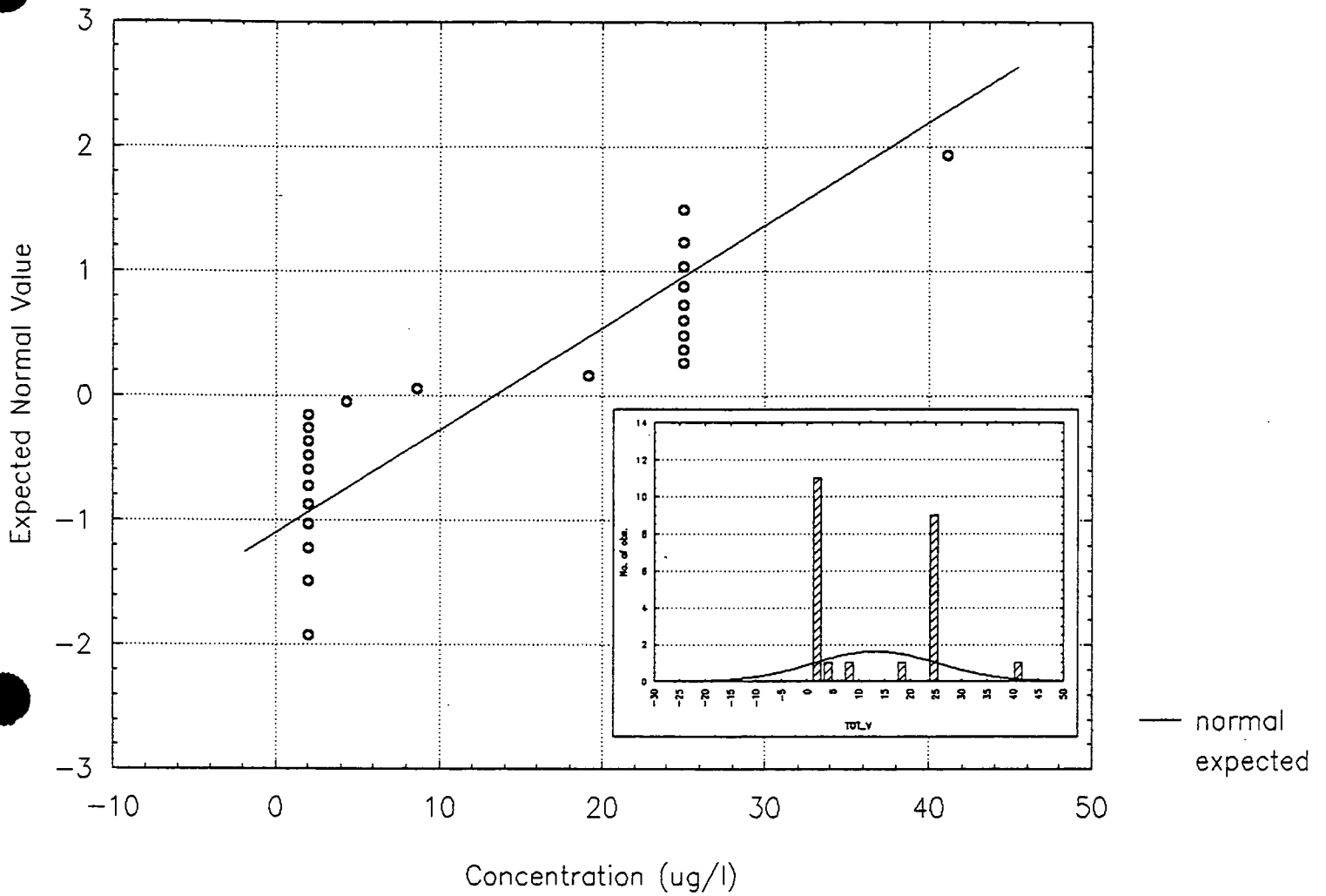


Normal Probablility Plot for the Log Base 10
Transform of Total Manganese (Reduced Data Set)
in Background Groundwater

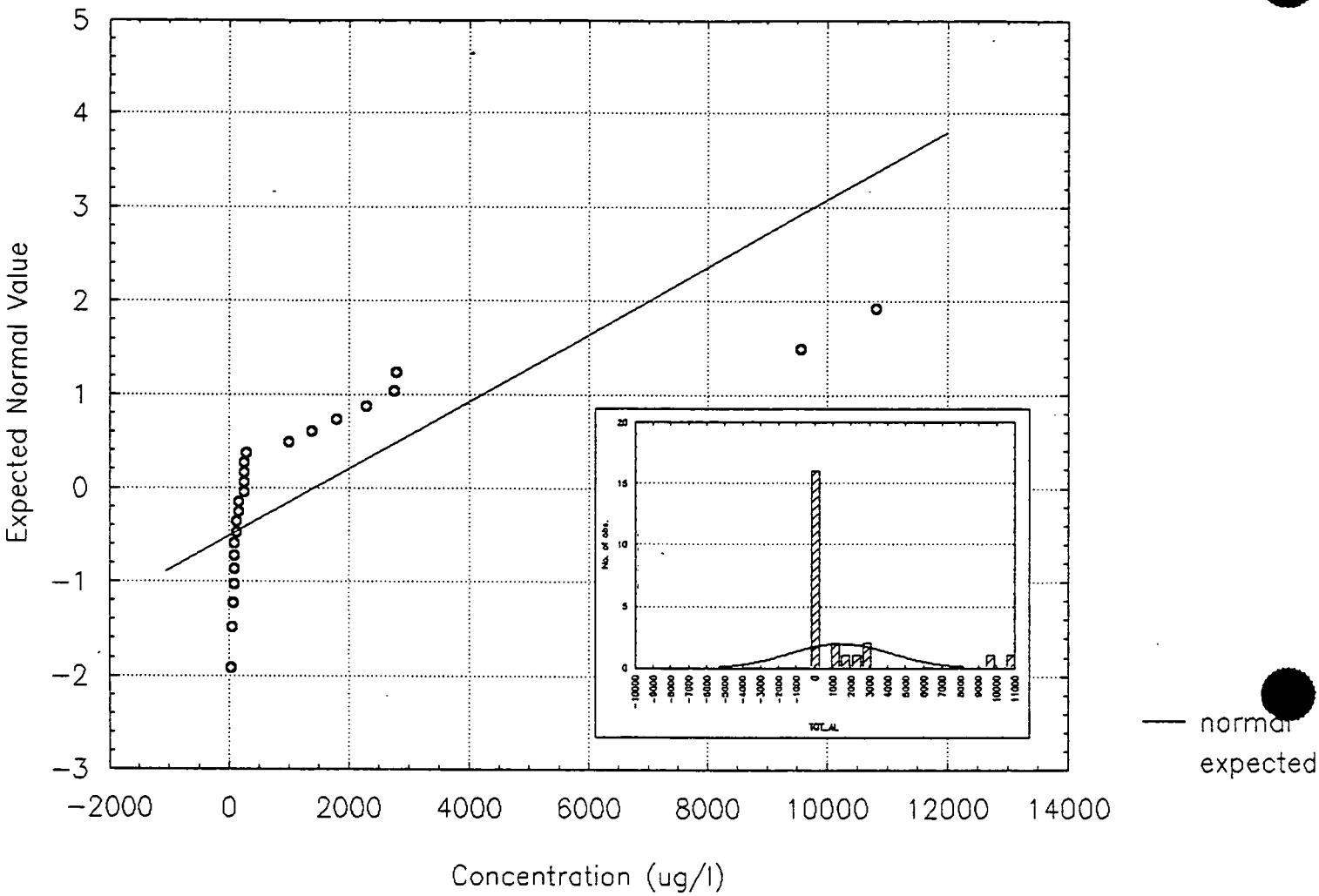


000609

Normal Probablility Plot for Total Vanadium
(Reduced Data Set) in Background Groundwater

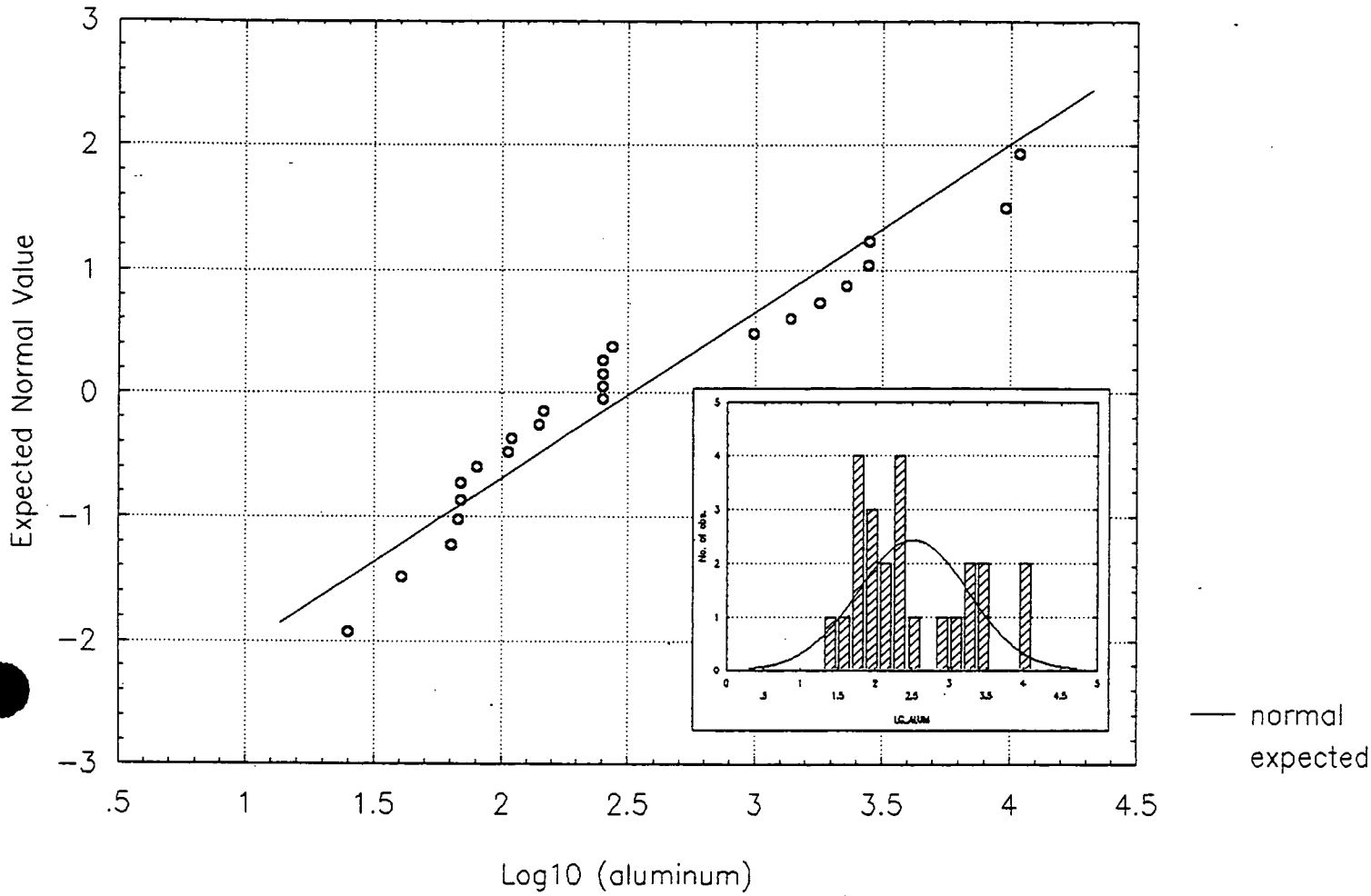


Normal Probablility Plot for Total Aluminum
(Reduced Data Set) in Background Groundwater

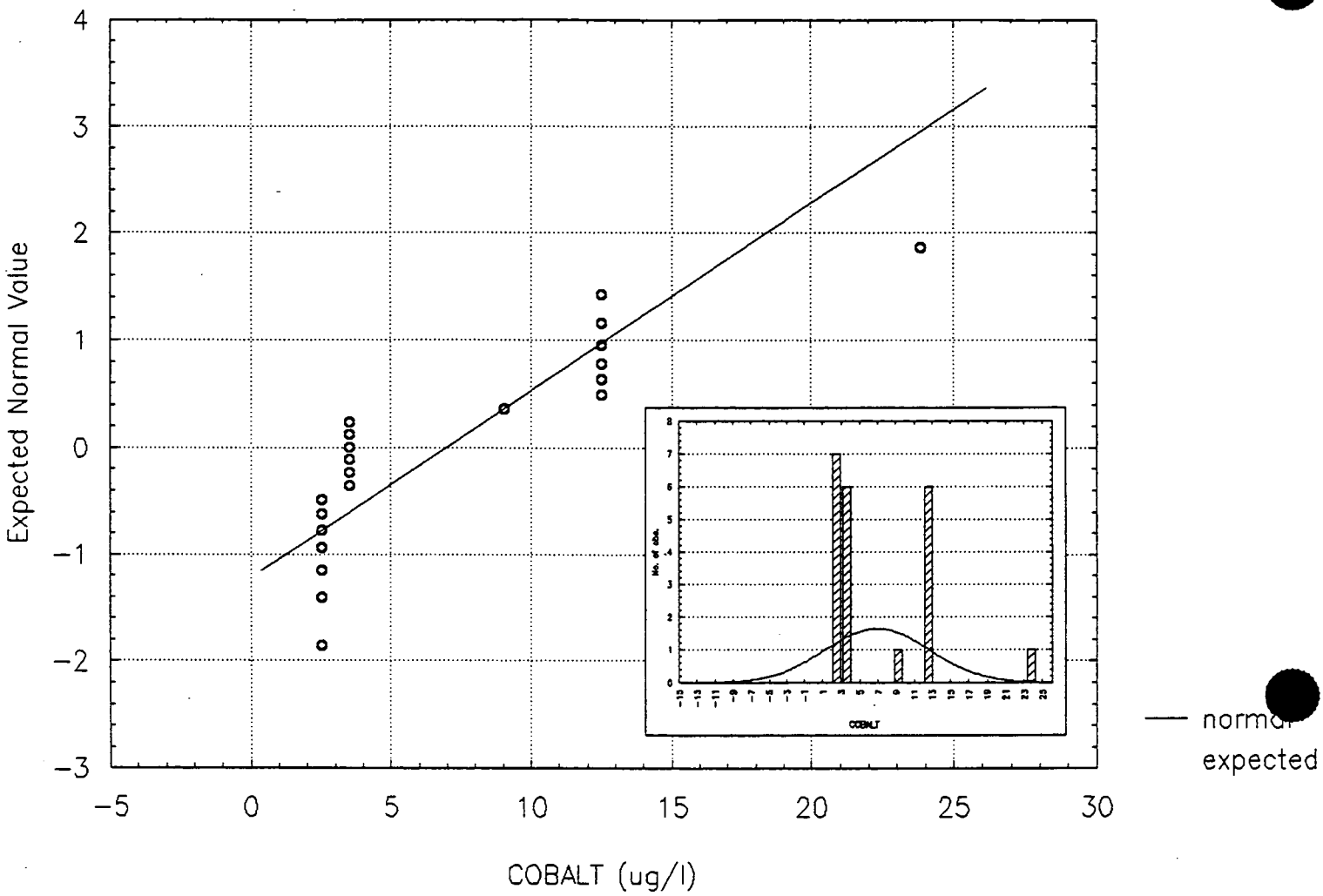


000611

Normal Probablility Plot for the Log Base 10
Transform of Total Aluminum (Reduced Data Set)
in Background Groundwater

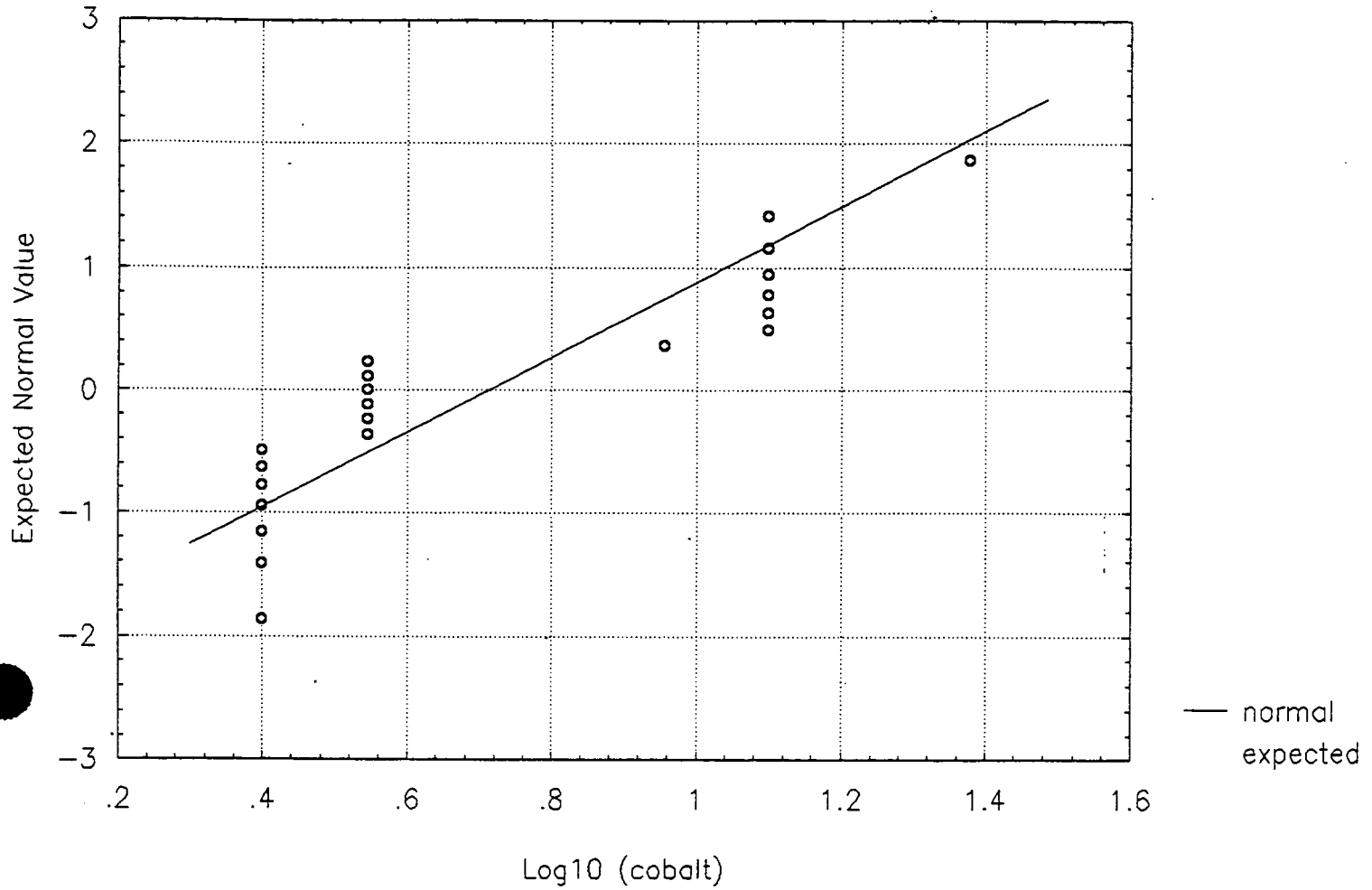


Normal Probablility Plot for Total Cobalt
(Reduced Data Set) in Background Groundwater

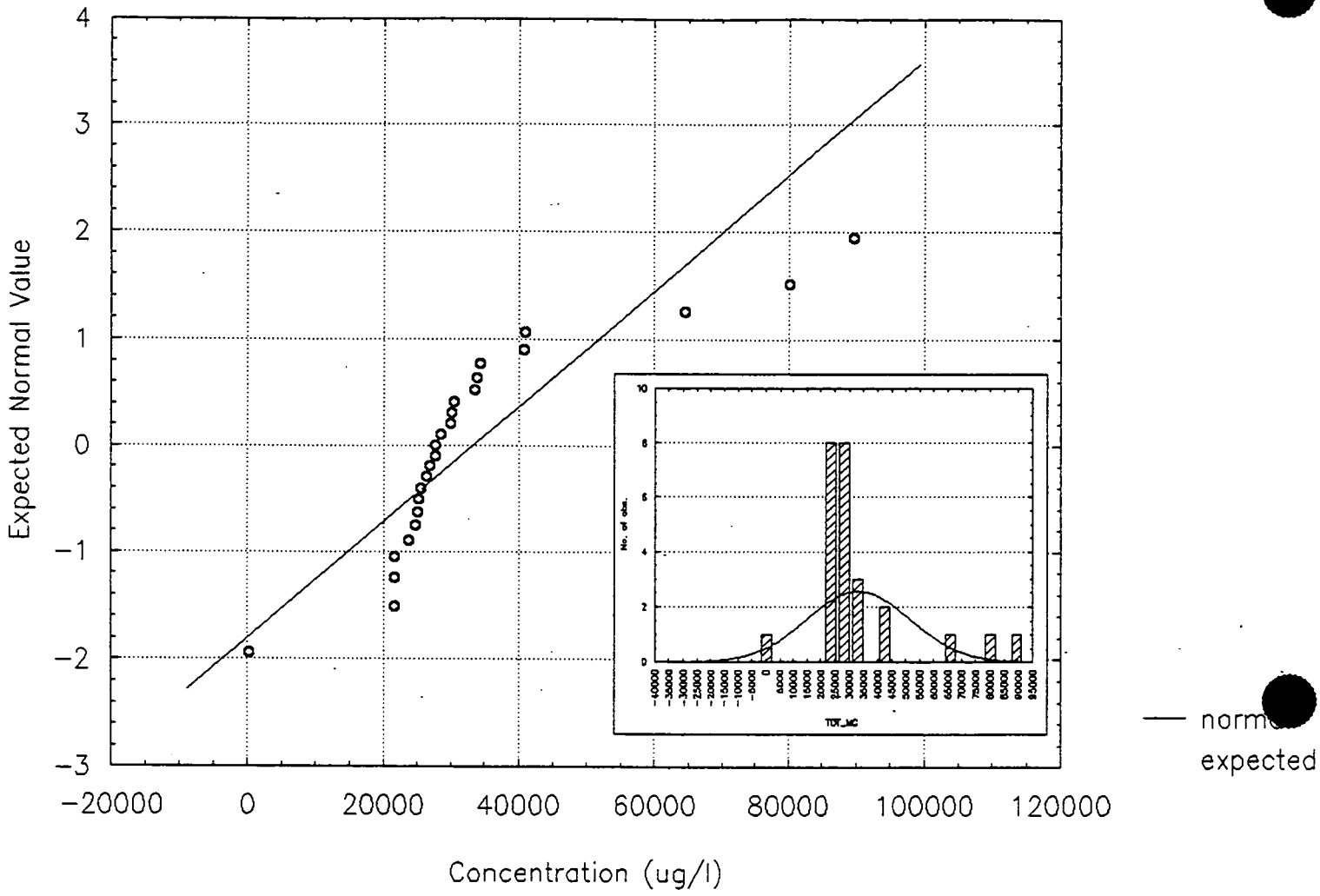


000613

Normal Probablility Plot for the Log Base 10
Transform of Total Cobalt (Reduced Data Set)
in Background Groundwater

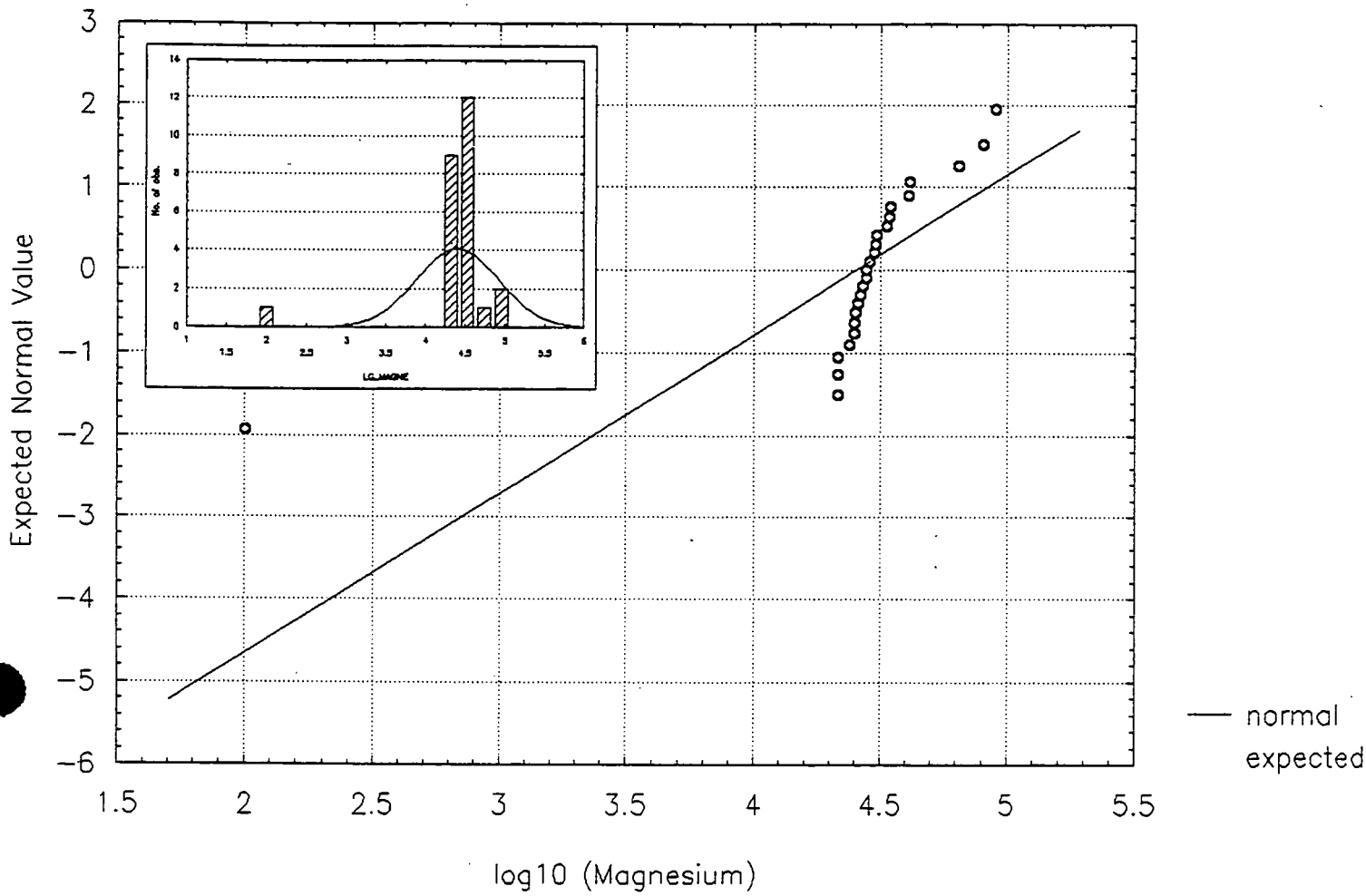


Normal Probablility Plot for Total Magnesium
(Reduced Data Set) in Background Groundwater

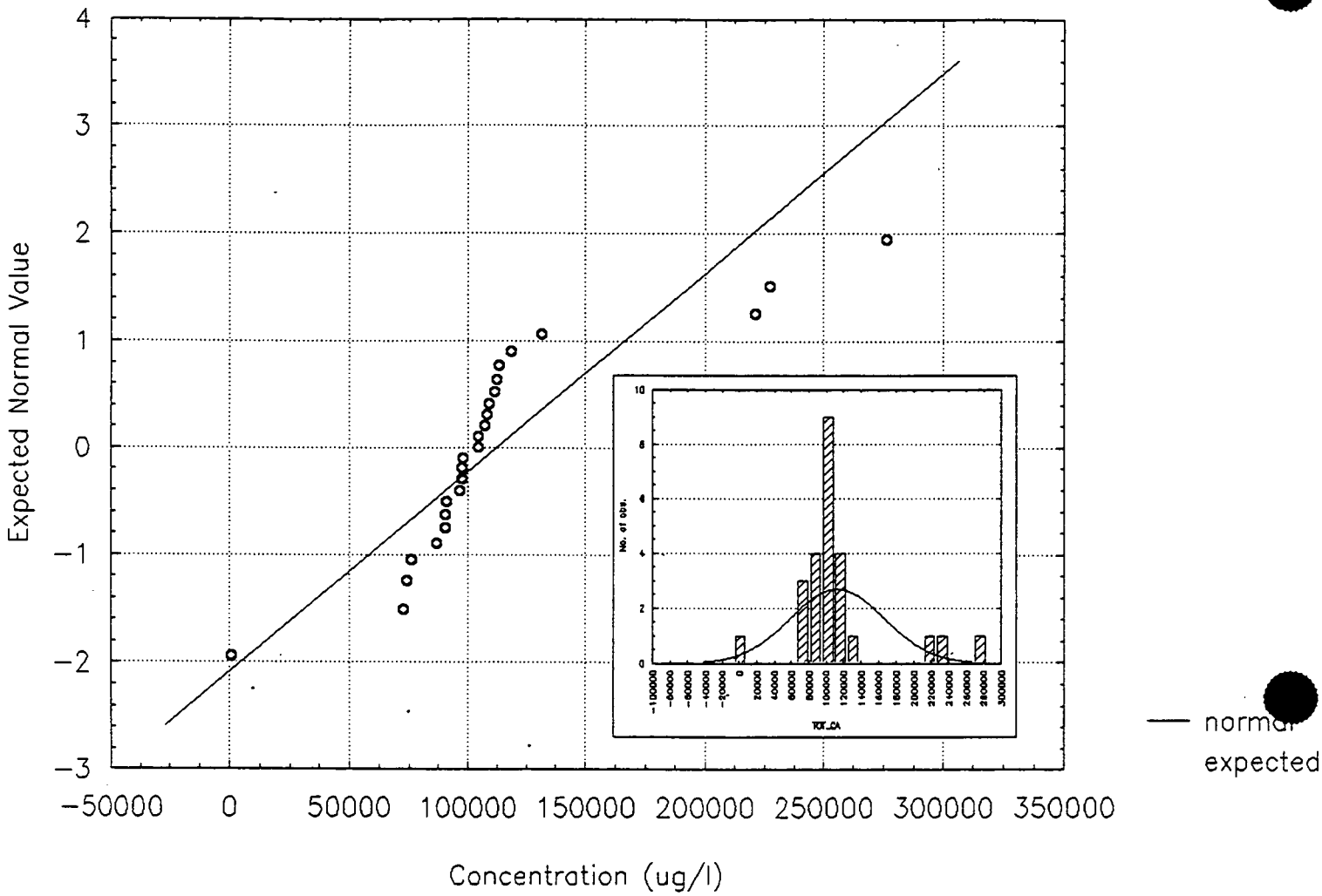


000615

Normal Probablility Plot for the Log Base 10
Transform of Magnesium (Reduced Data Set)
in Background Groundwater

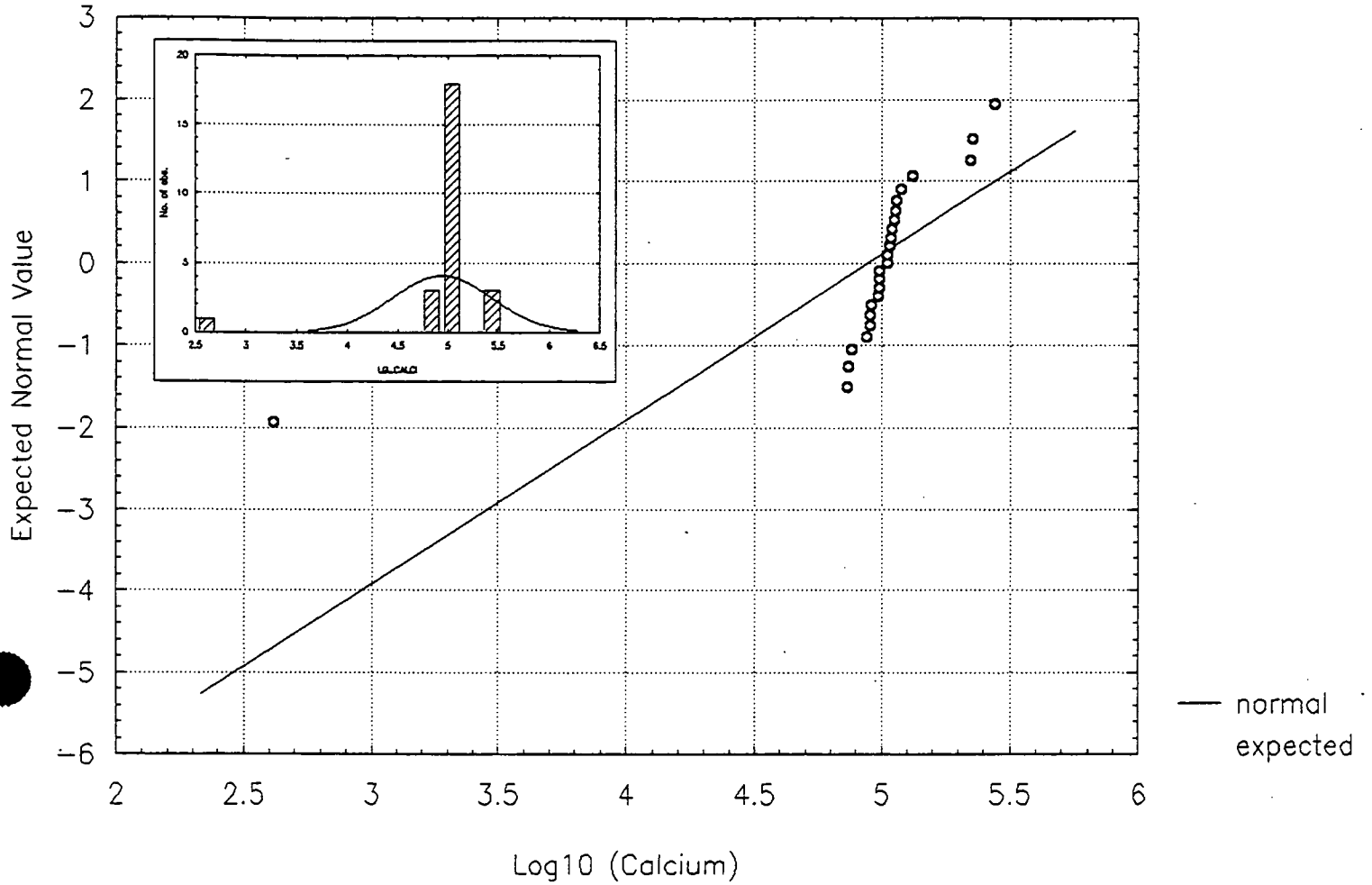


Normal Probablility Plot for Total Calcium
(Reduced Data Set) in Background Groundwater

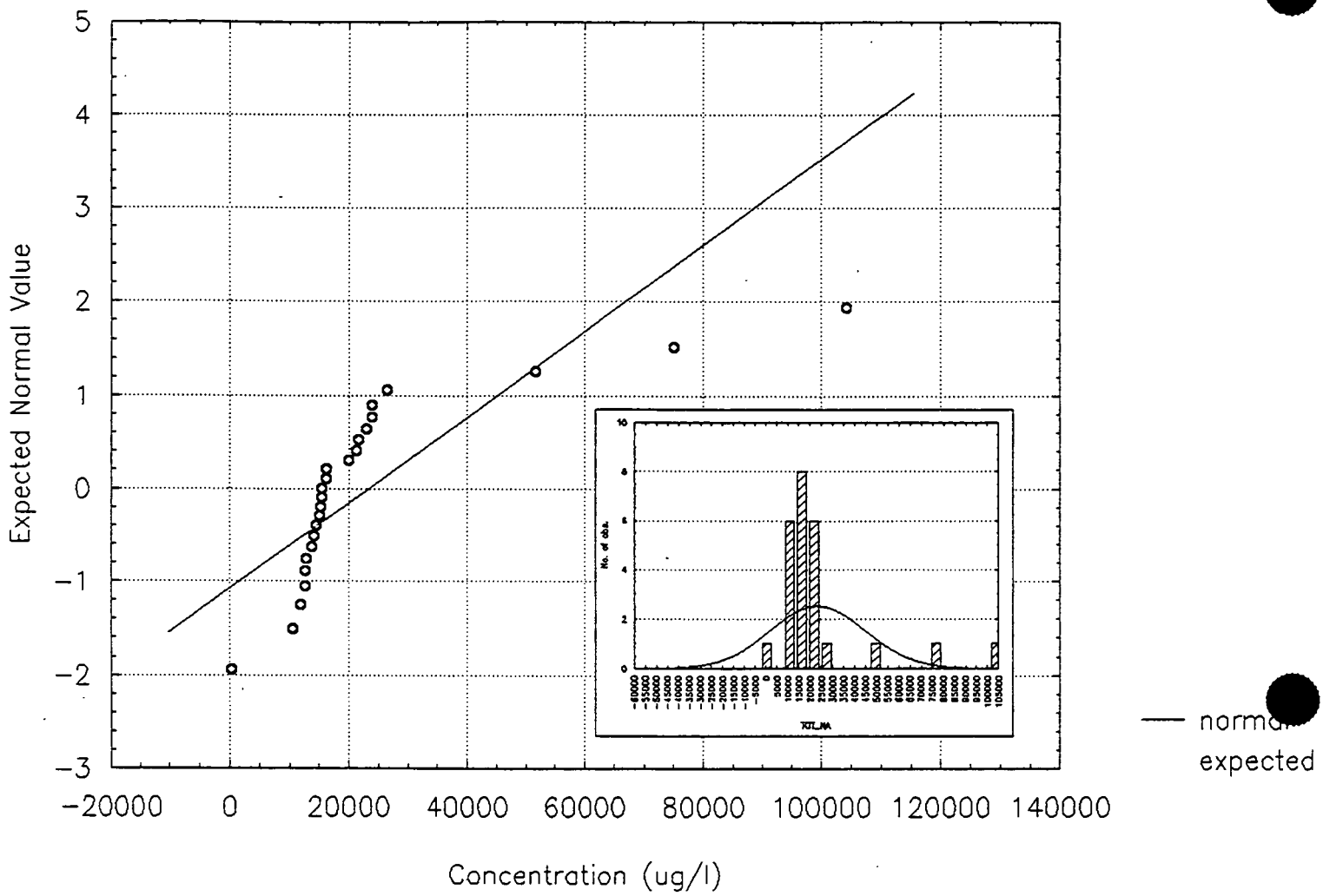


000617

Normal Probablility Plot for the Log Base 10
Transform of Total Calcium (Reduced Data Set)
in Background Groundwater

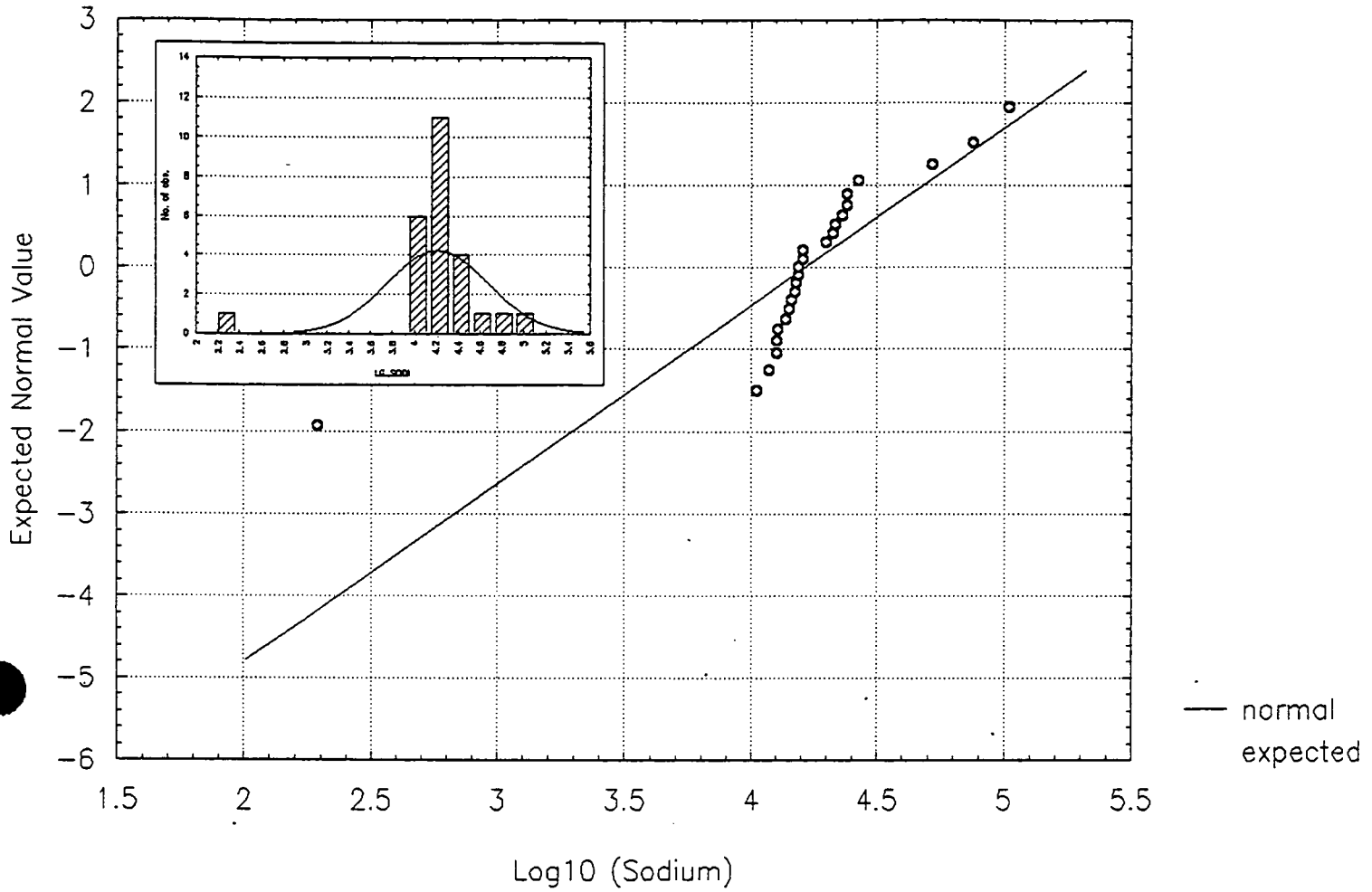


Normal Probablility Plot for Total Sodium
(Reduced Data Set) in Background Groundwater

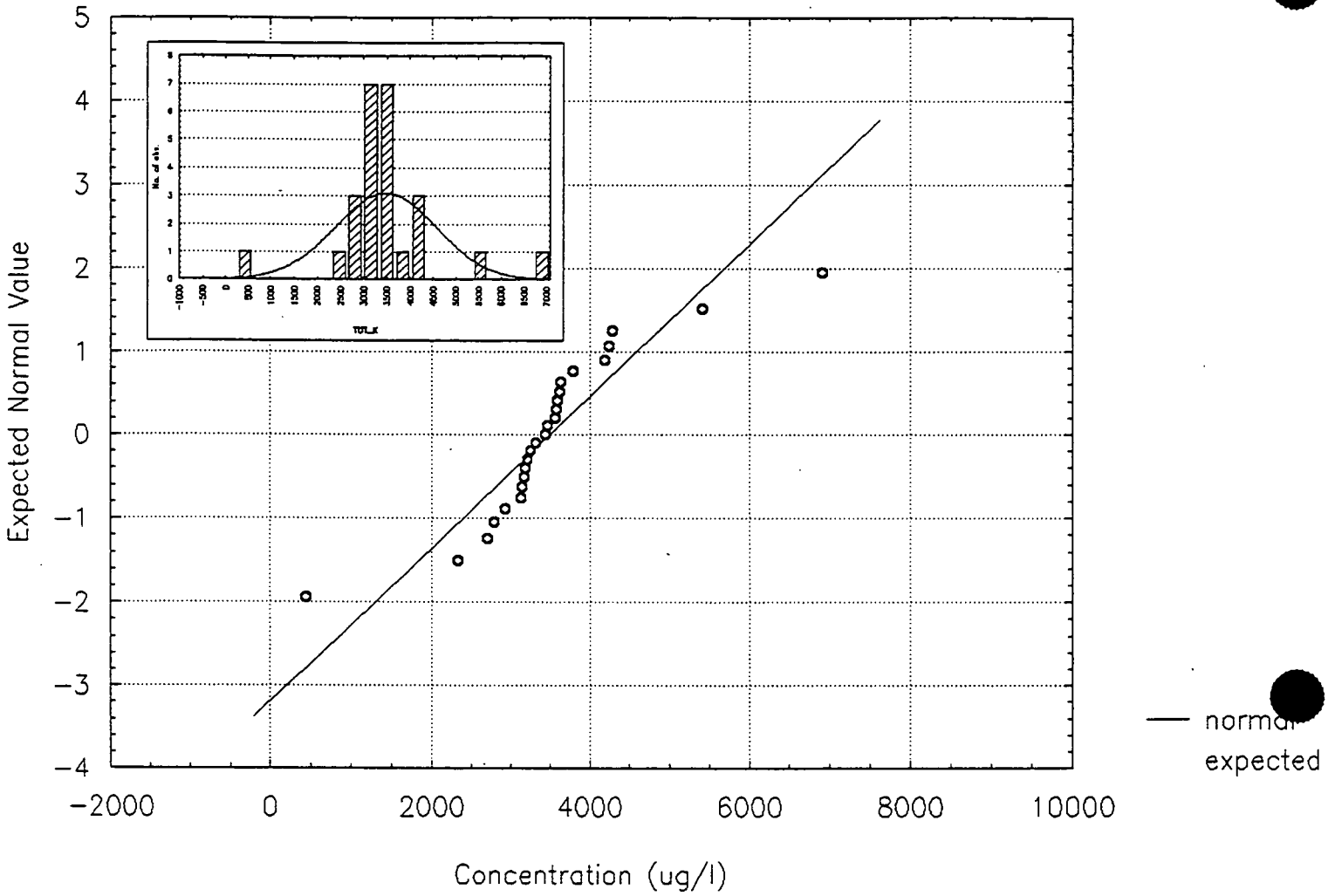


000619

Normal Probablility Plot for the Log Base 10
Transform of Total Sodium (Reduced Data Set)
in Background Groundwater

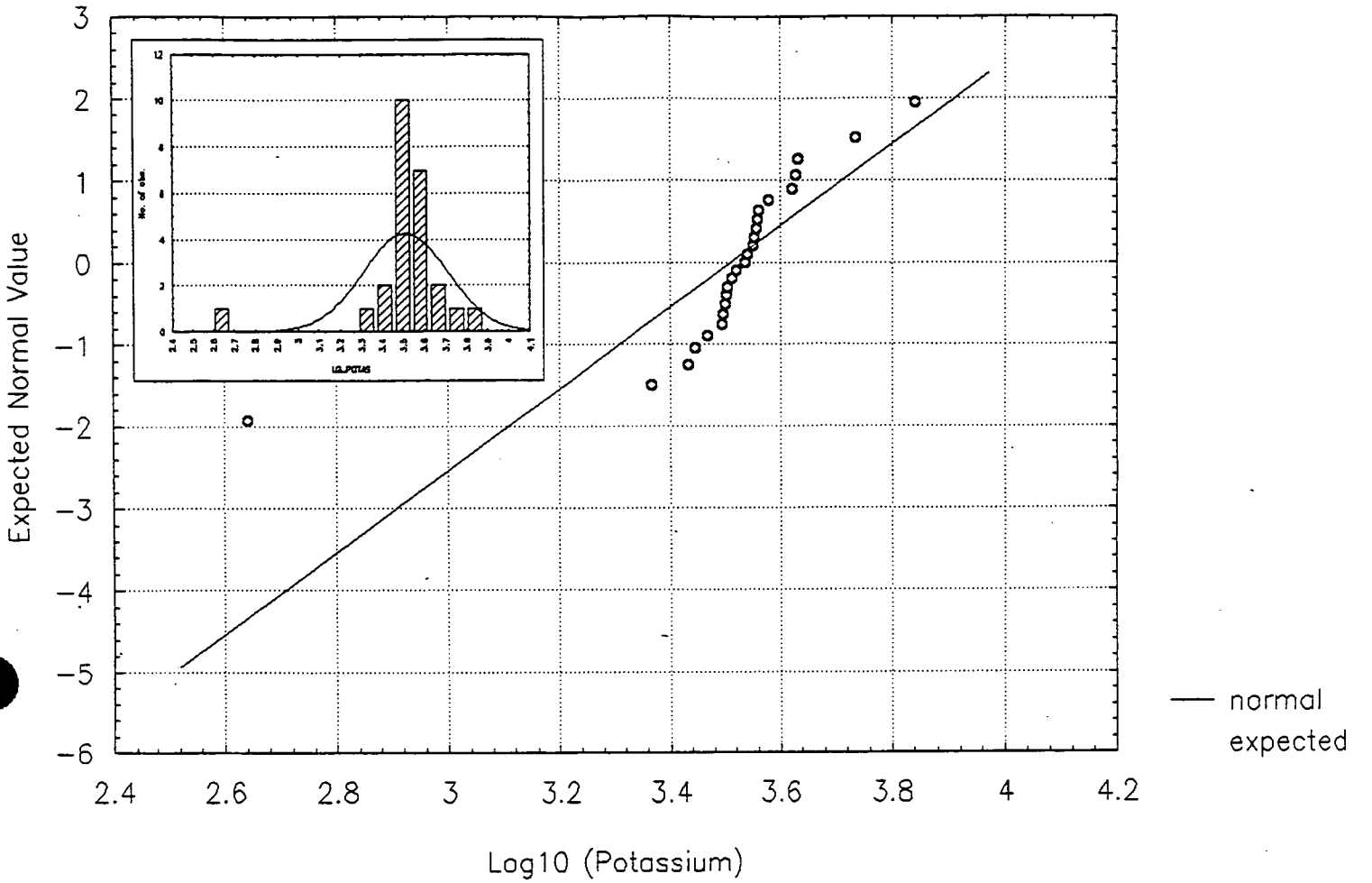


Normal Probablility Plot for Total Potassium
(Reduced Data Set) in Background Groundwater



000621

Normal Probablility Plot for the Log Base 10
Transform of Total Potassium (Reduced Data Set)
in Background Groundwater

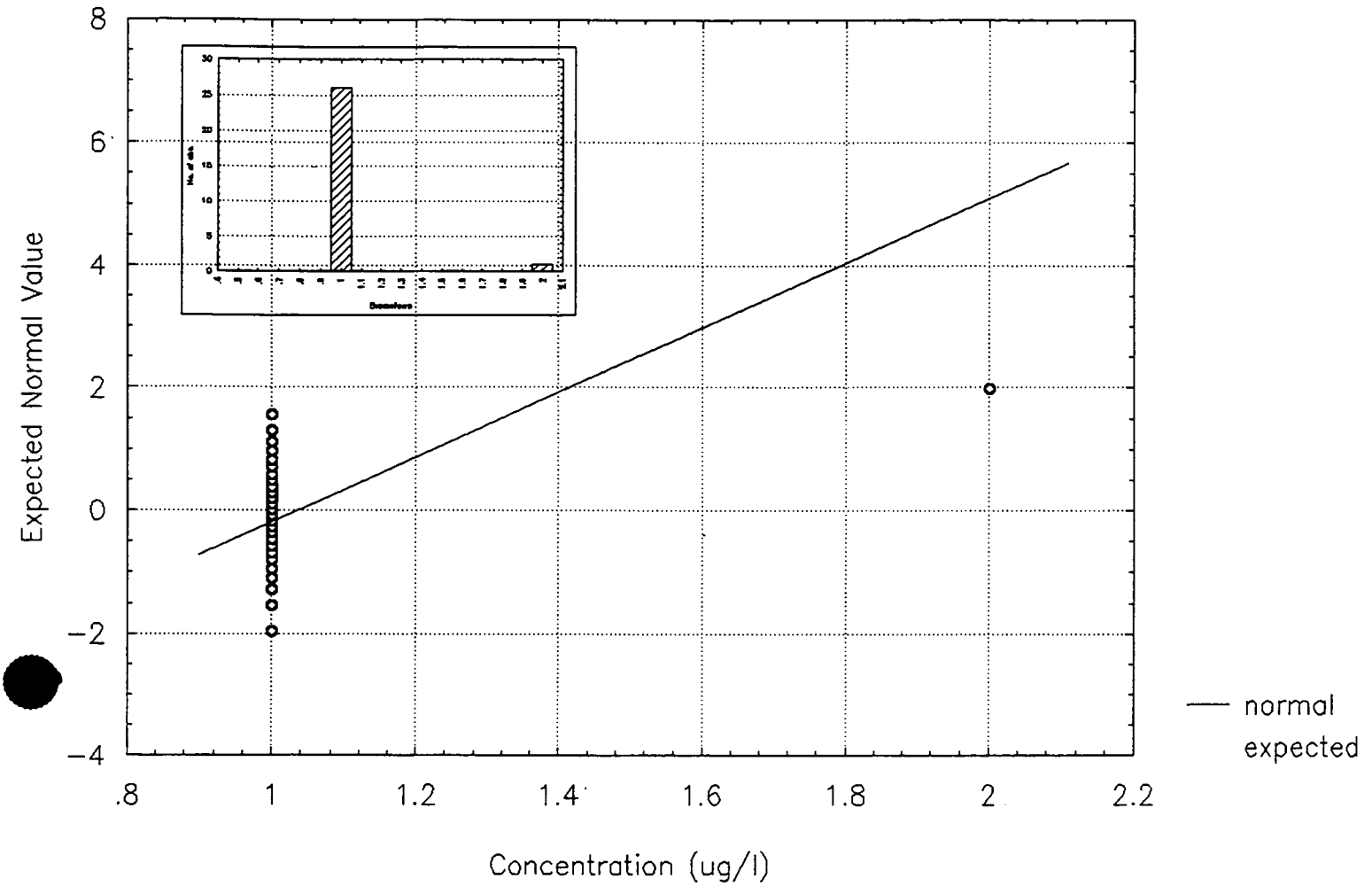


VOLATILE ORGANIC COMPOUNDS

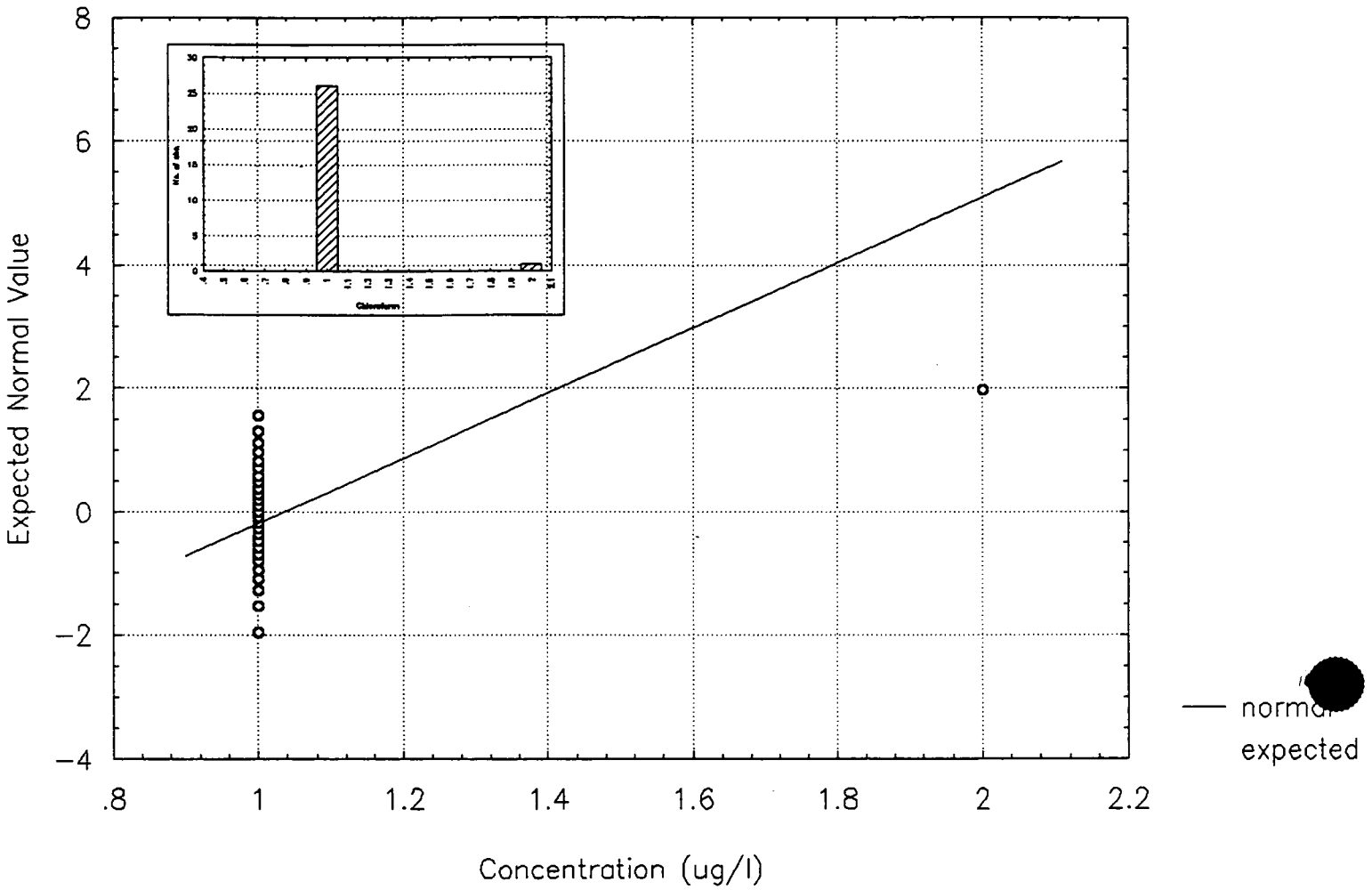
EVALUATION OF ETHYLBENZENE USING ENTIRE BACKGROUND DATA SET

STATISTICAL EVALUATION USING REDUCED DATA SET (MW1-D ROUND 4 REMOVED)

Normal Probability Plot For
Bromoform in Groundwater Background
Samples

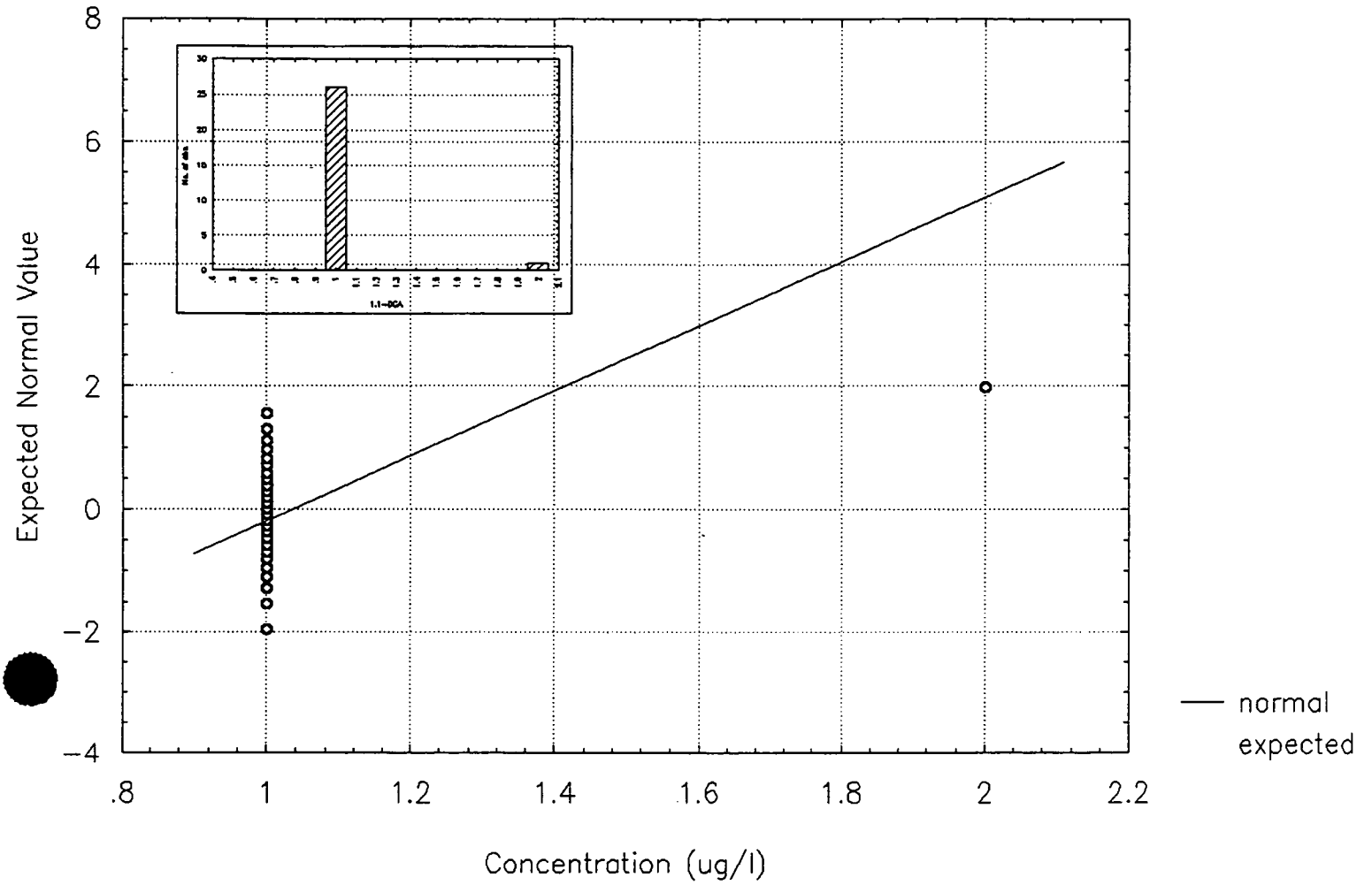


Normal Probability Plot For
Chloroform in Groundwater Background
Samples

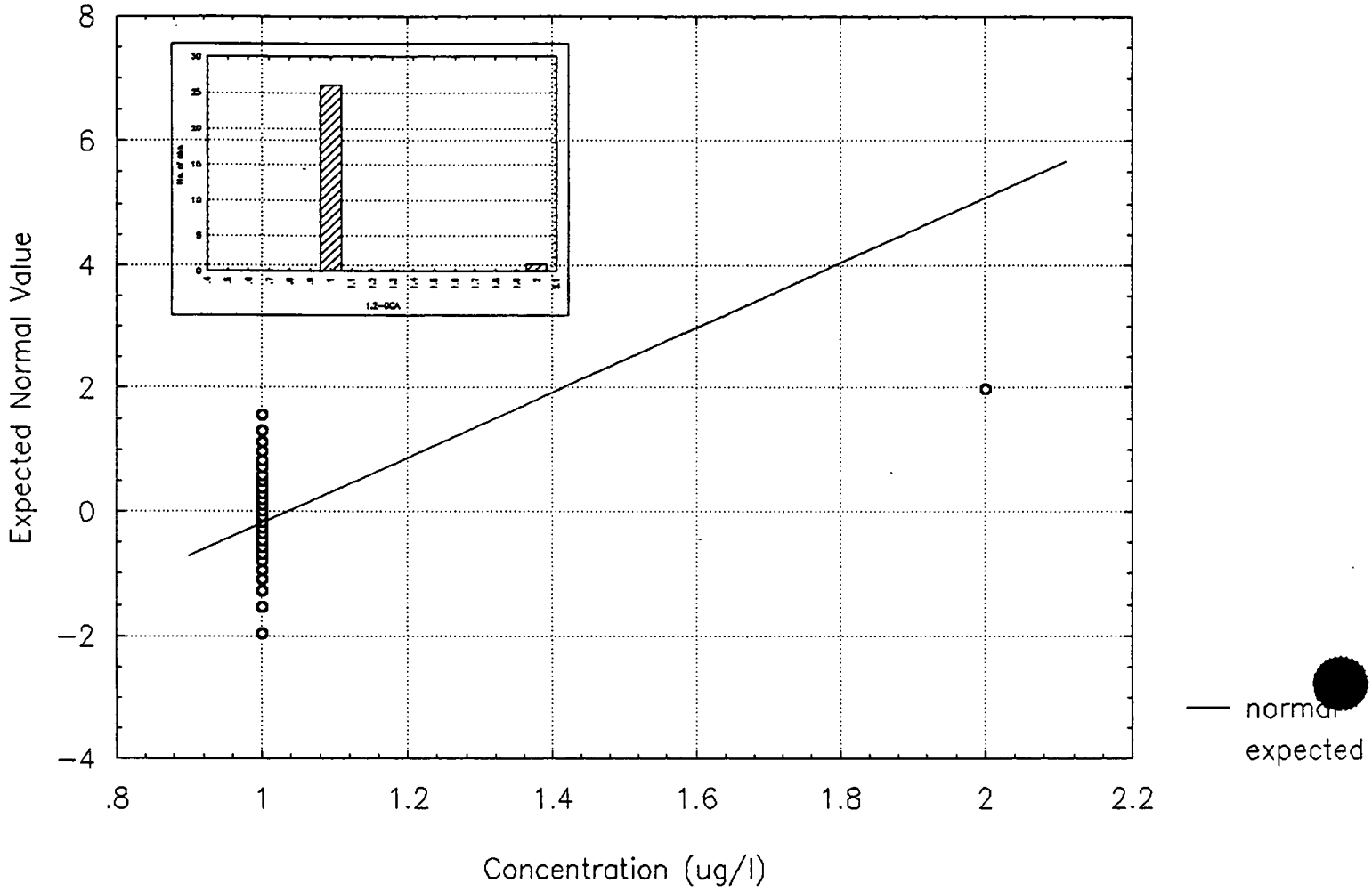


000627

Normal Probability Plot For
1,1-DCA in Groundwater Background
Samples

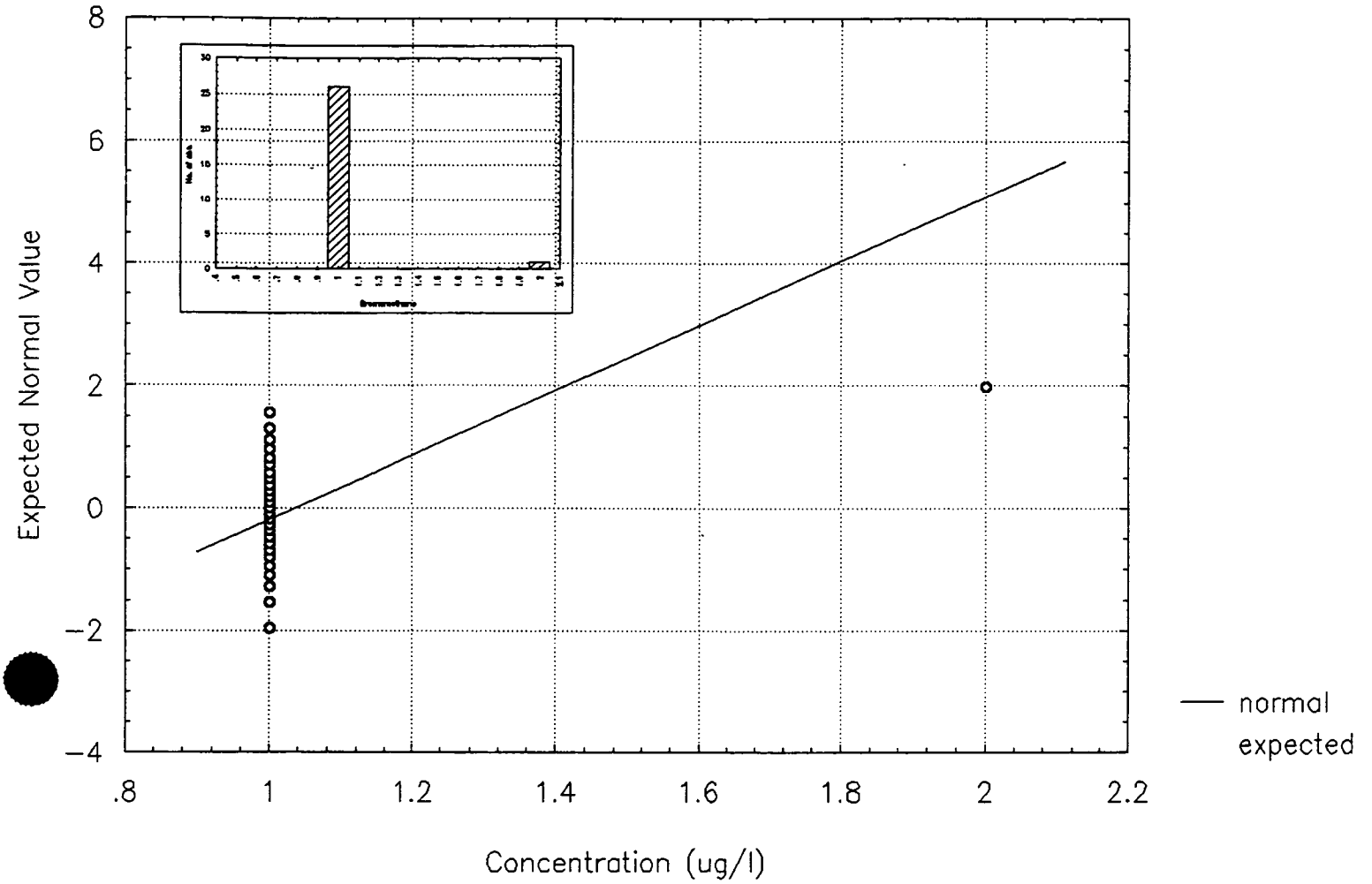


Normal Probability Plot For
1,2–DCA in Groundwater Background
Samples

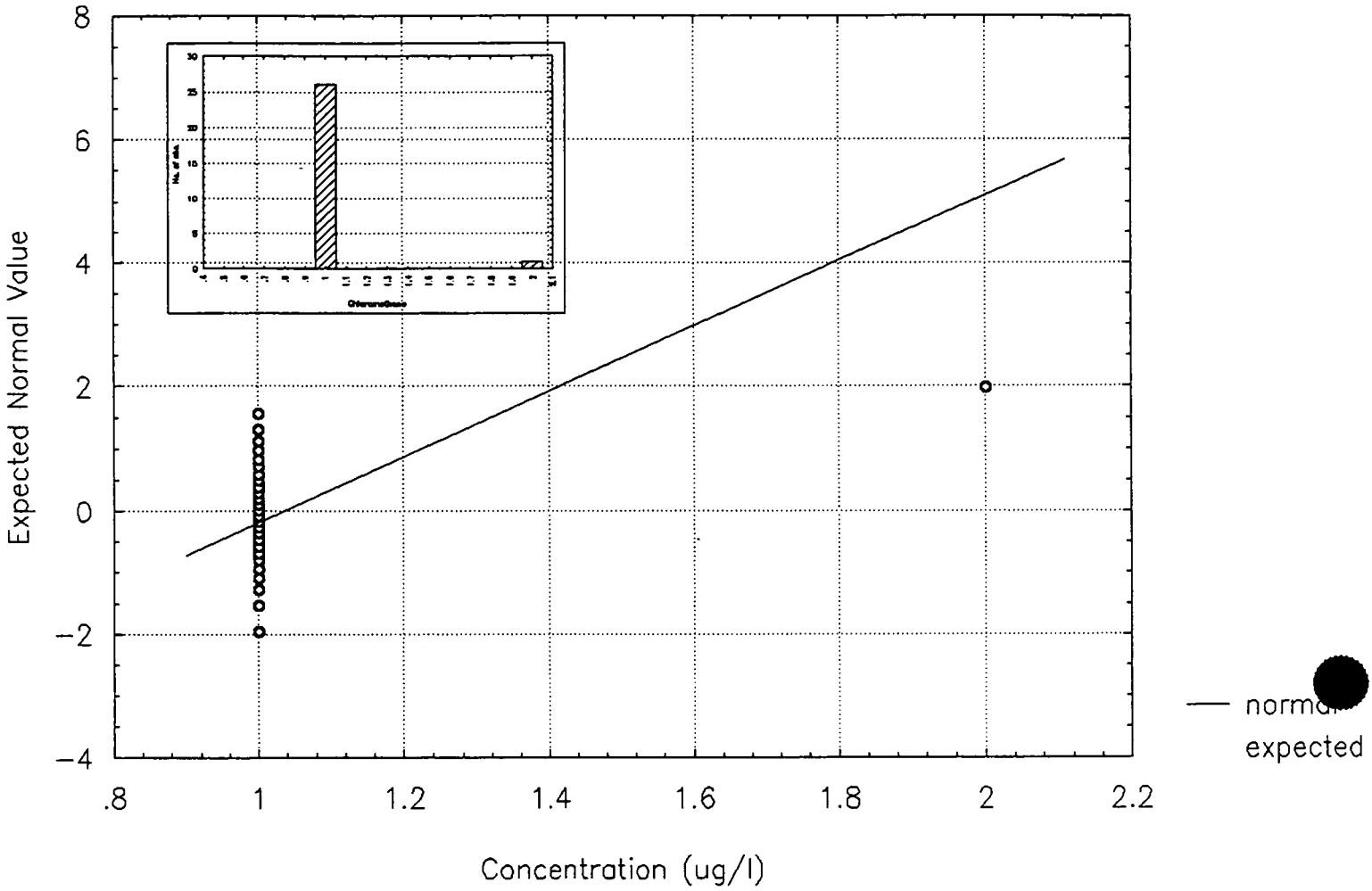


000629

Normal Probability Plot For
Bromomethane in Groundwater Background
Samples

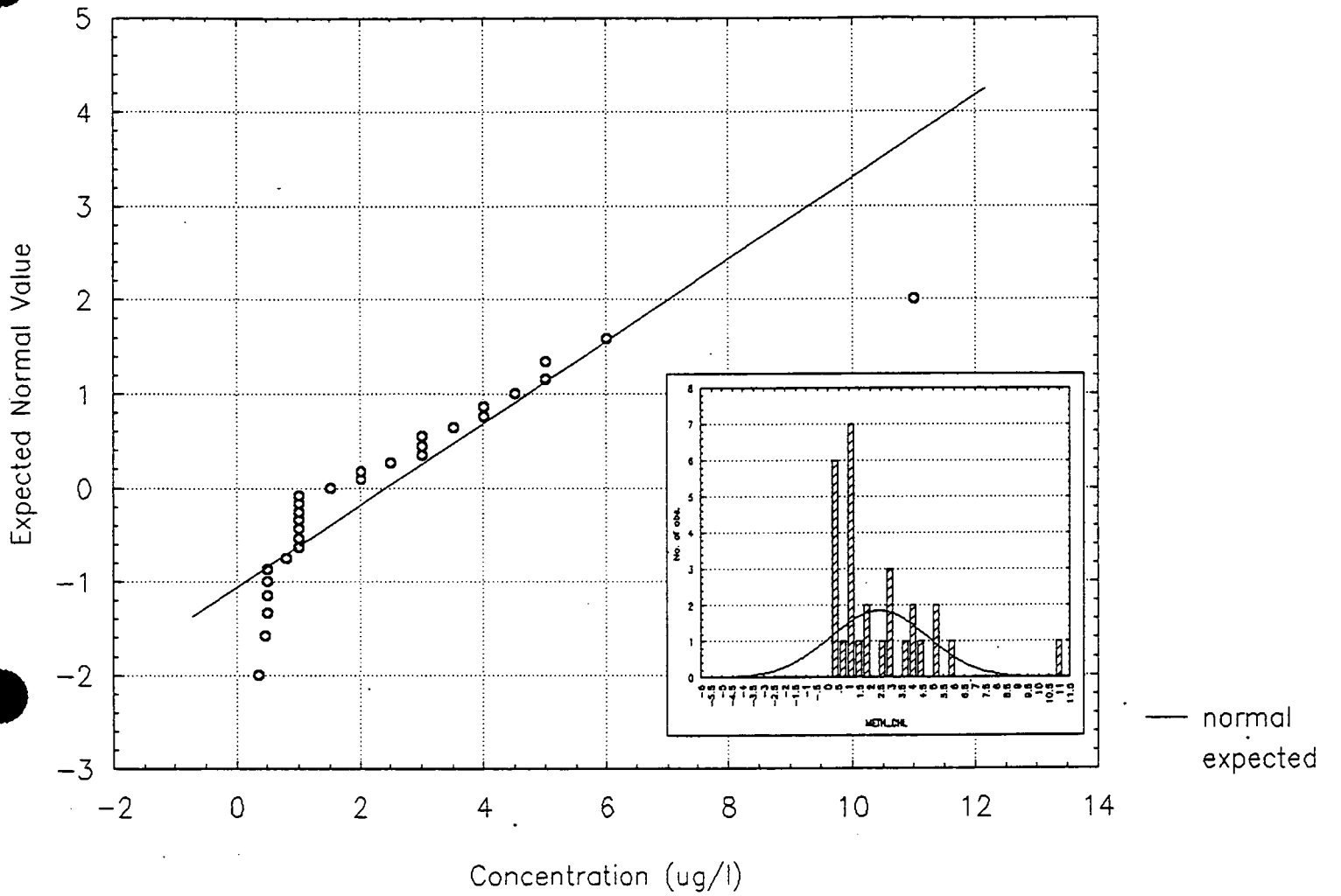


Normal Probability Plot For
Chloromethane in Groundwater Background
Samples

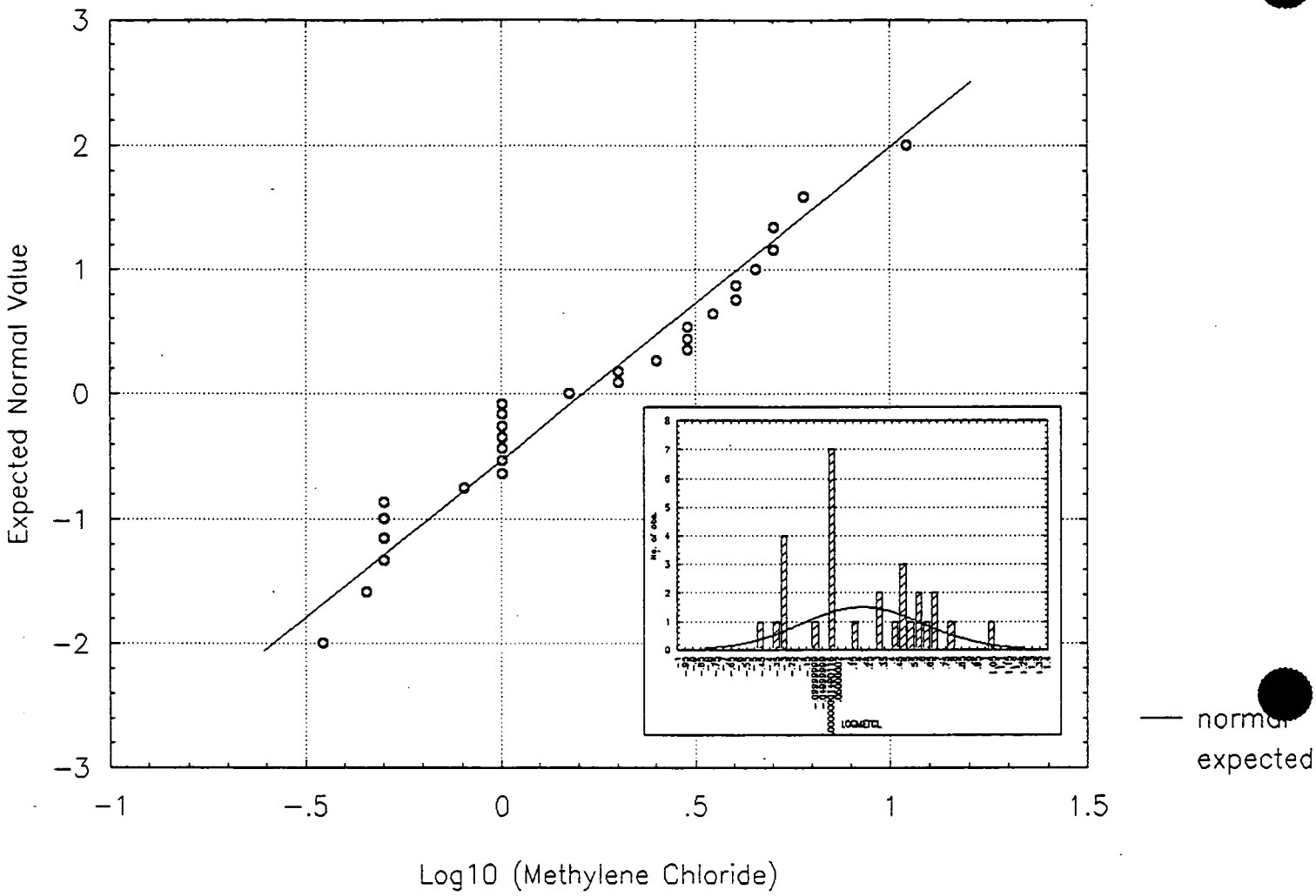


000631

Normal Probablility Plot for Methylene Chloride
in Background Groundwater

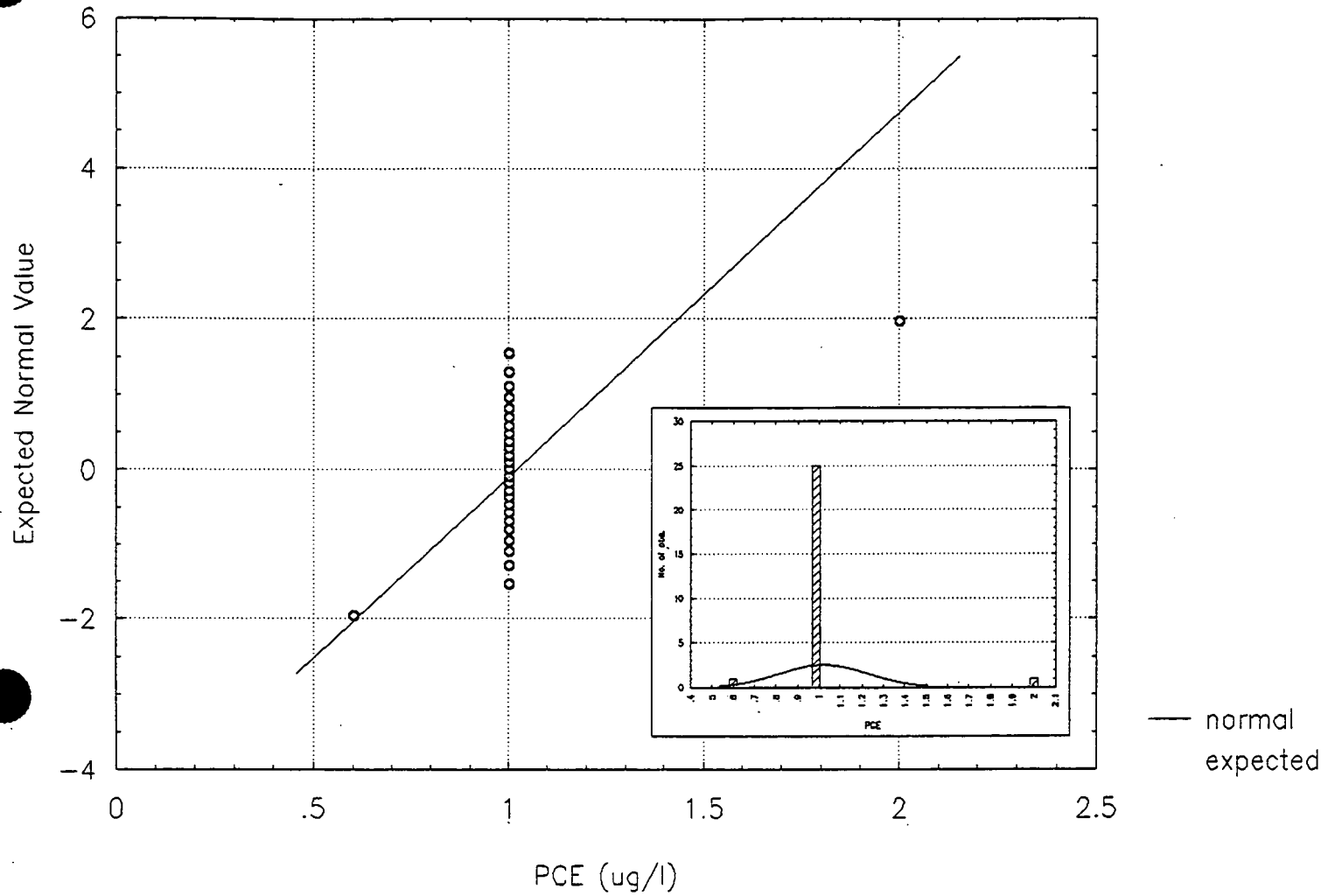


Normal Probablility Plot for the Log Base 10
Transform of Methylene Chloride in Background Groundwater

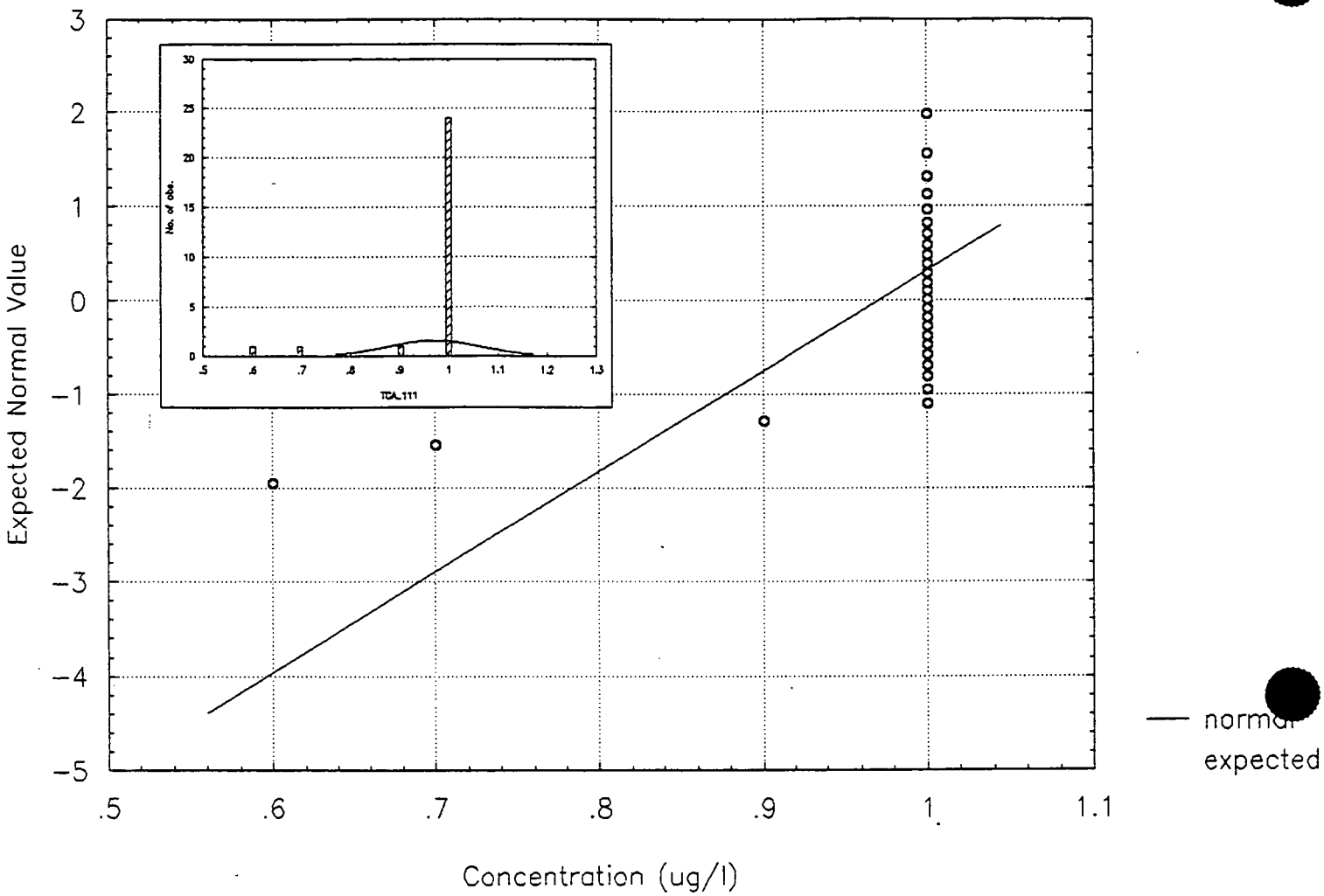


000633

Normal Probablility Plot for PCE
in Background Groundwater

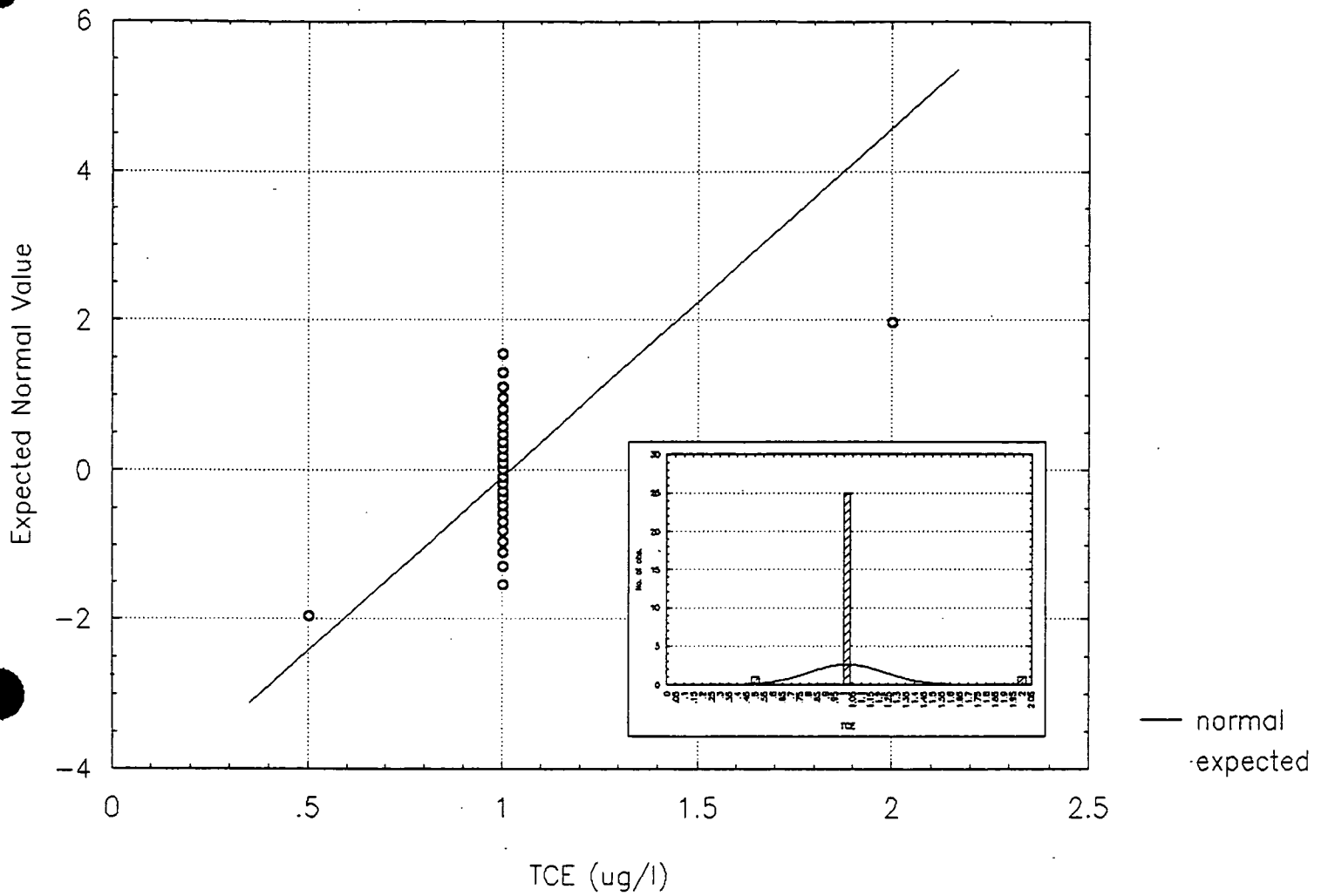


Normal Probablility Plot for 1,1,1-TCA
in Background Groundwater

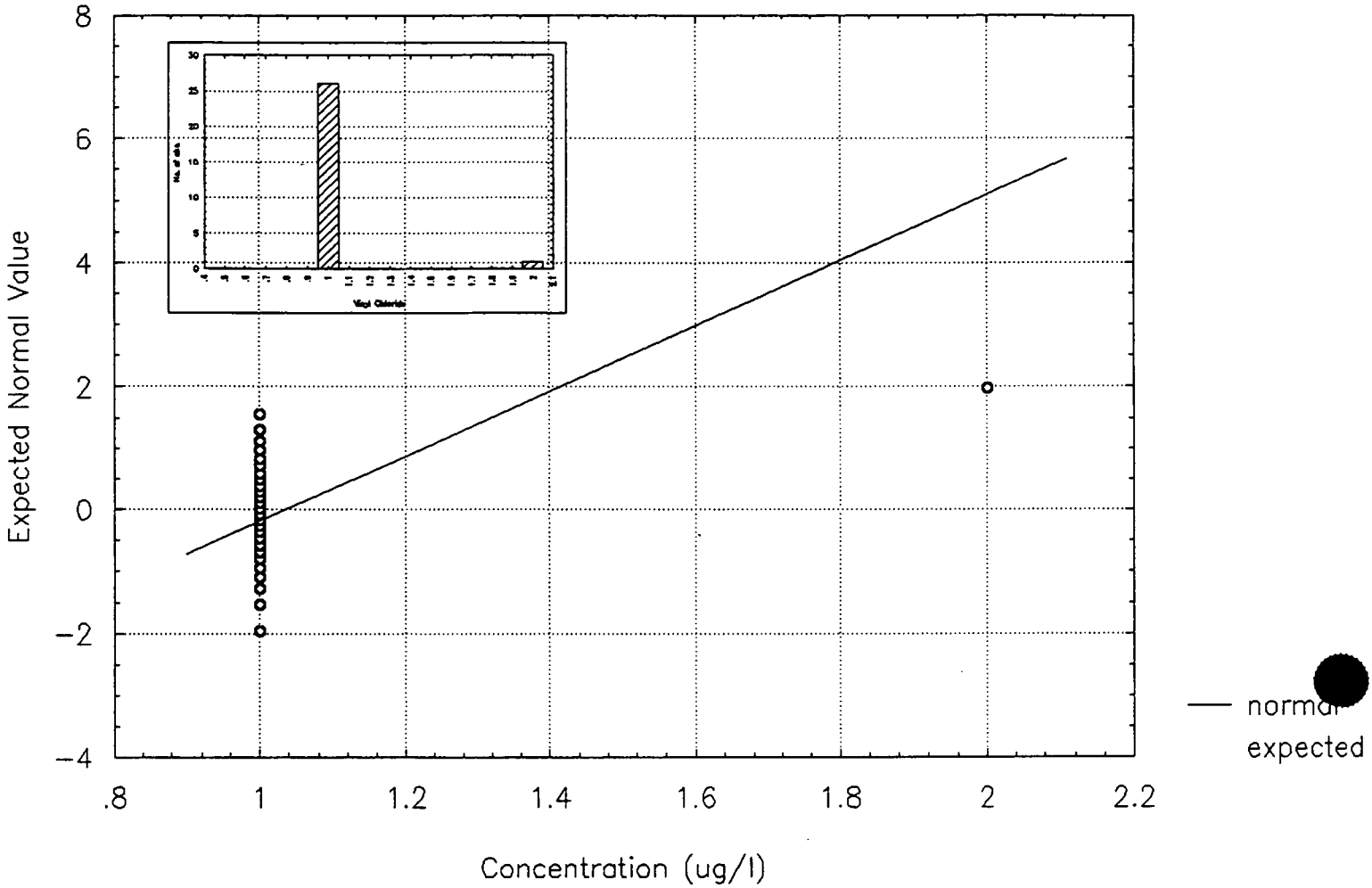


000635

Normal Probablility Plot for TCE
in Background Groundwater

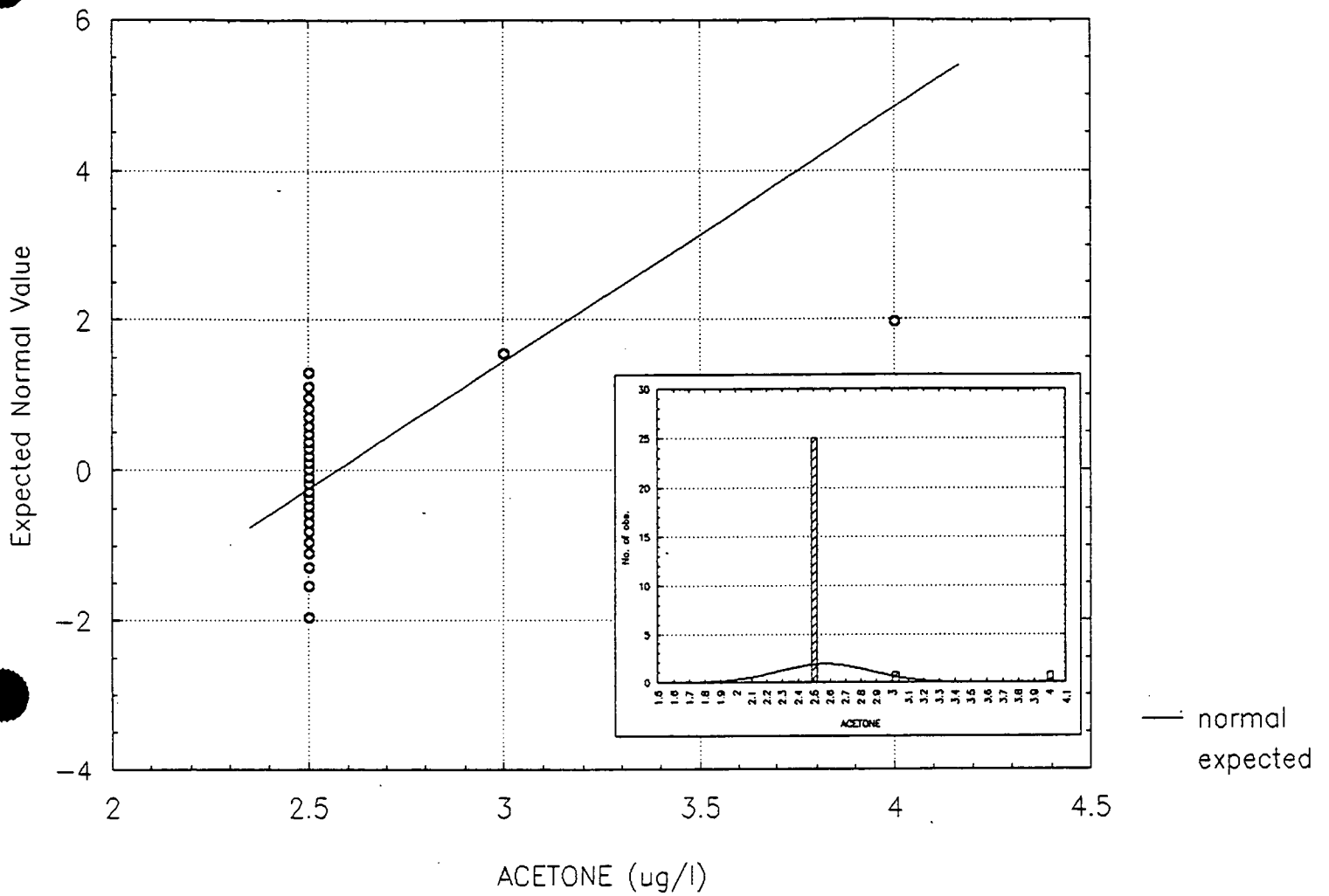


Normal Probability Plot For
Vinyl Chloride in Groundwater Background
Samples

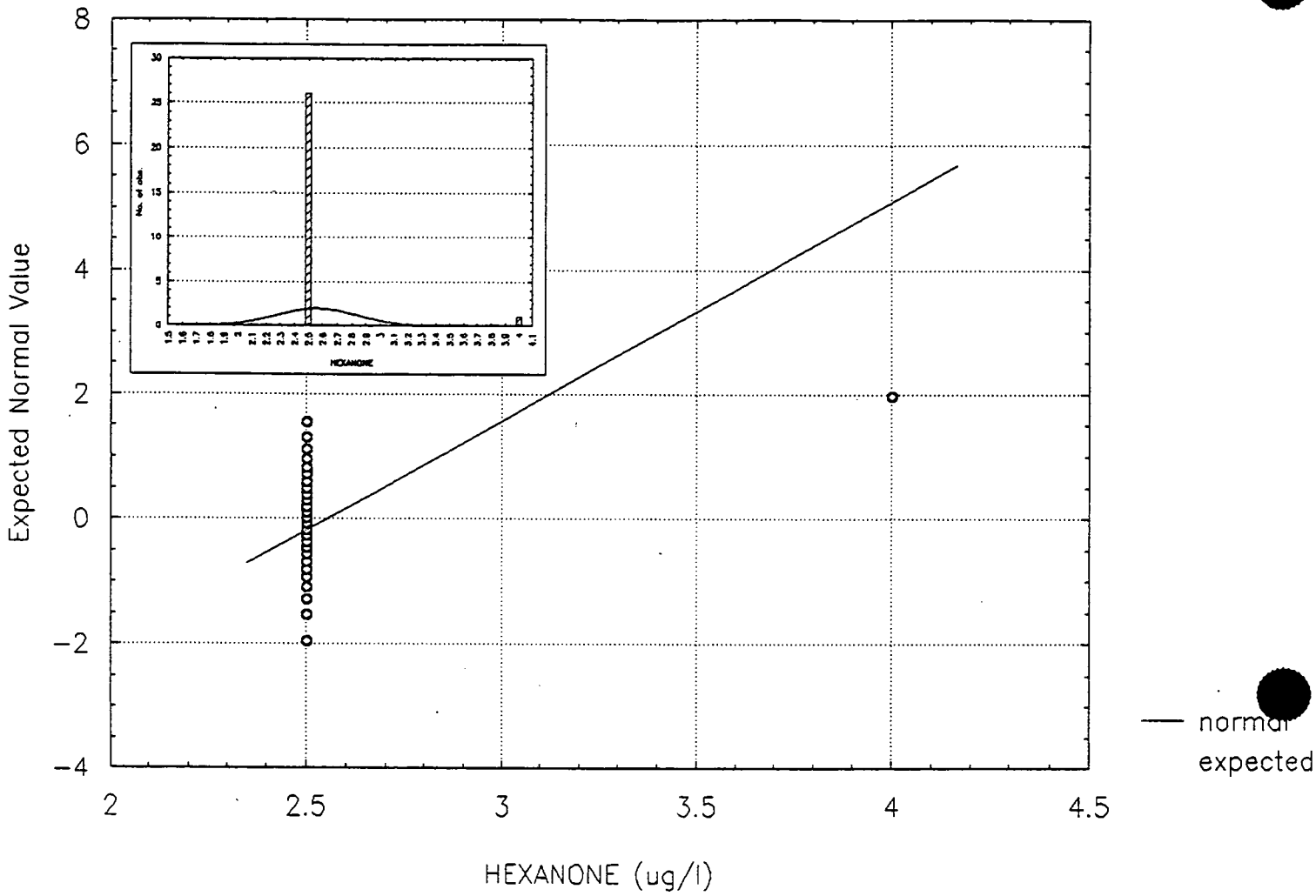


000637

Normal Probablility Plot for Acetone
in Background Groundwater

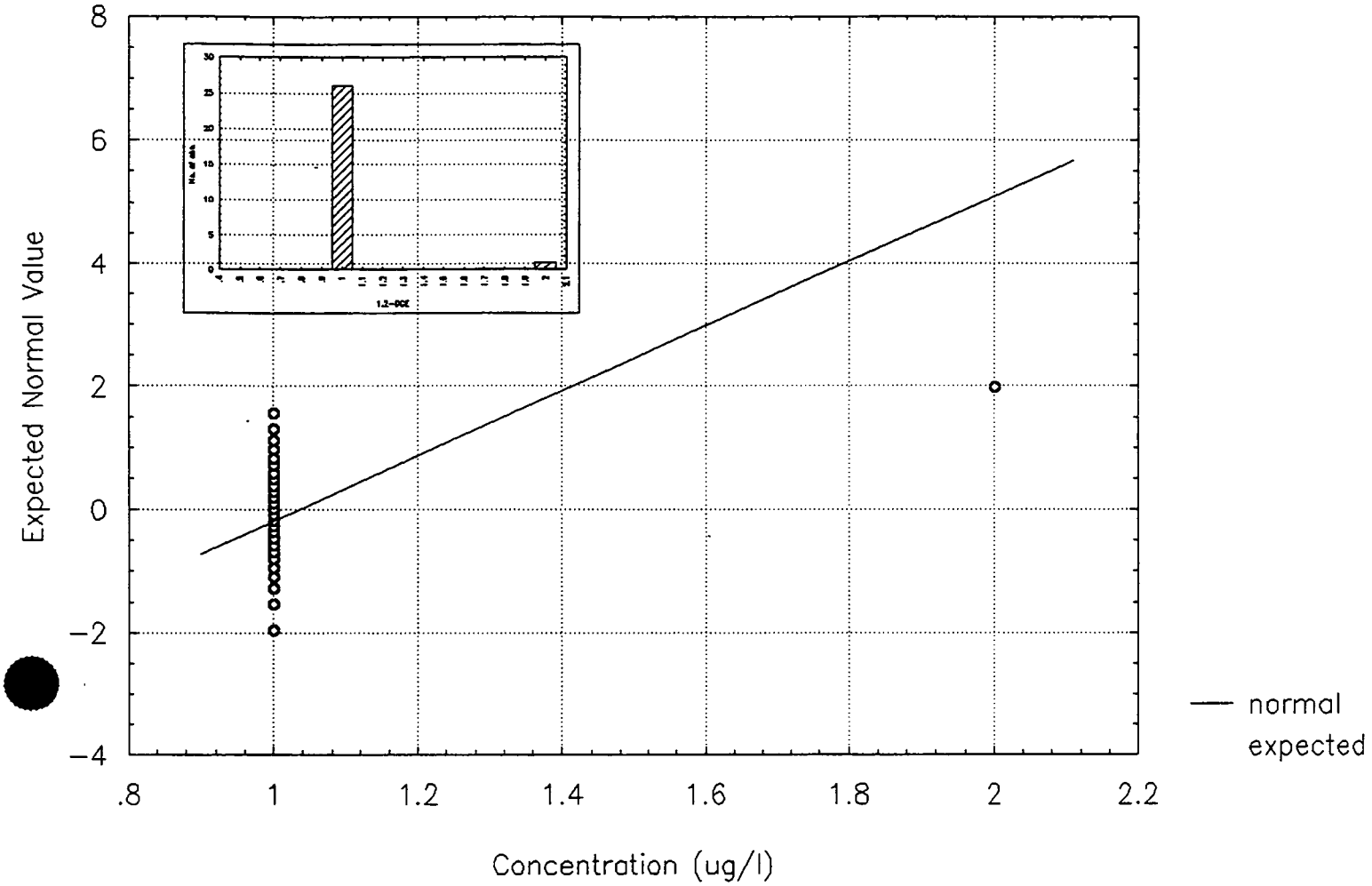


Normal Probablility Plot for Hexanone
in Background Groundwater

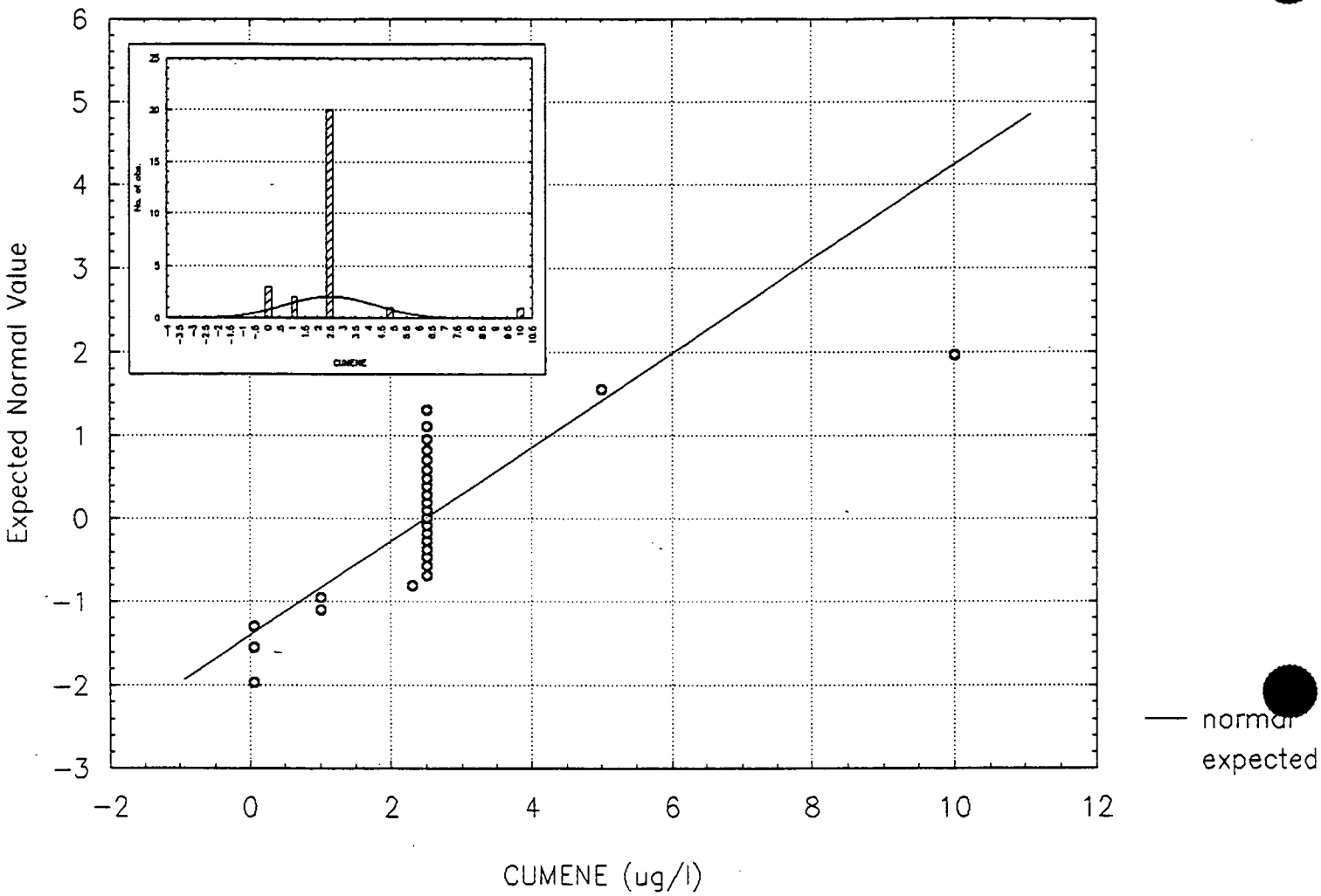


000639

Normal Probability Plot For
1,2-DCE in Groundwater background
Samples

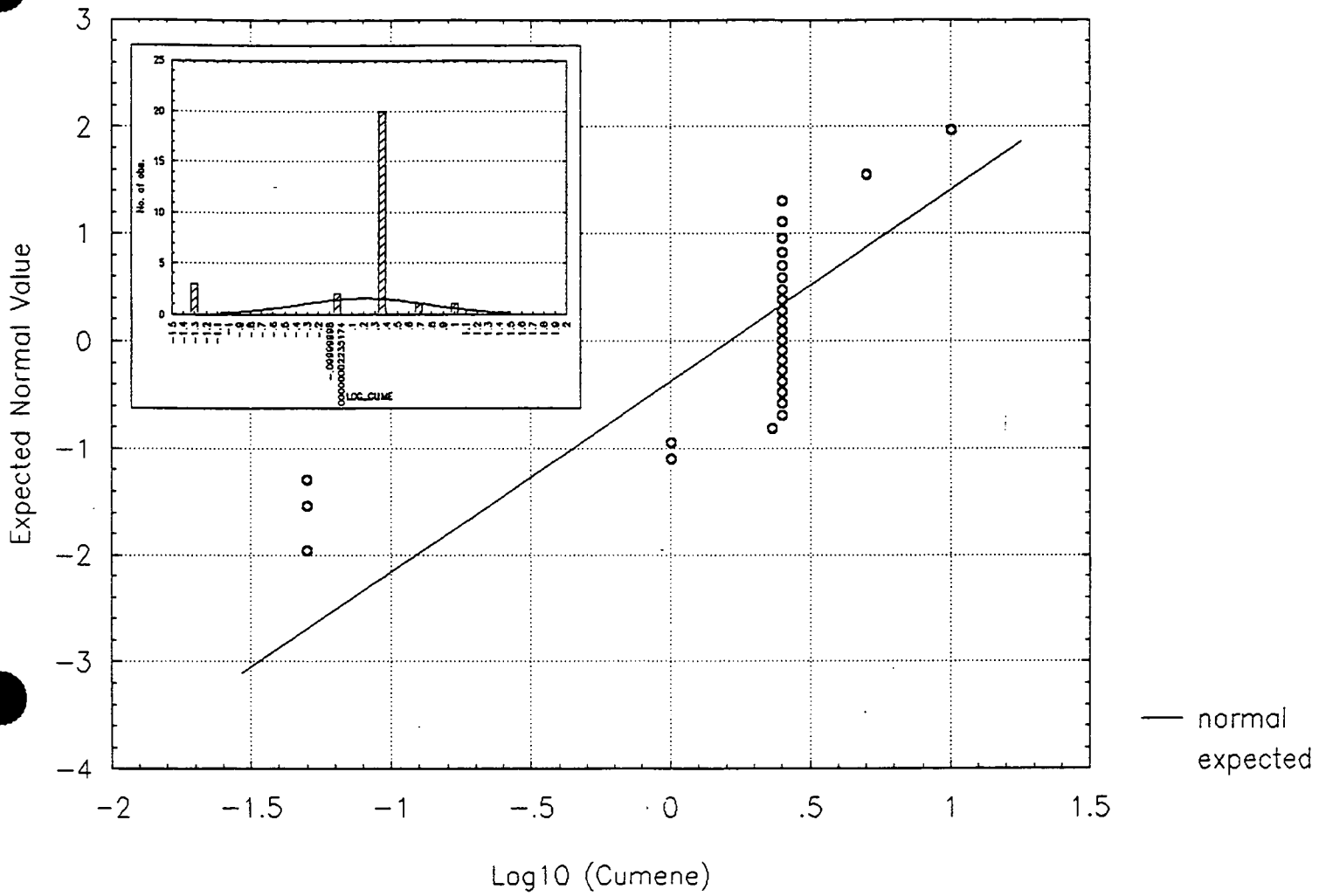


Normal Probablility Plot for Cumene
in the Background Groundwater



000641

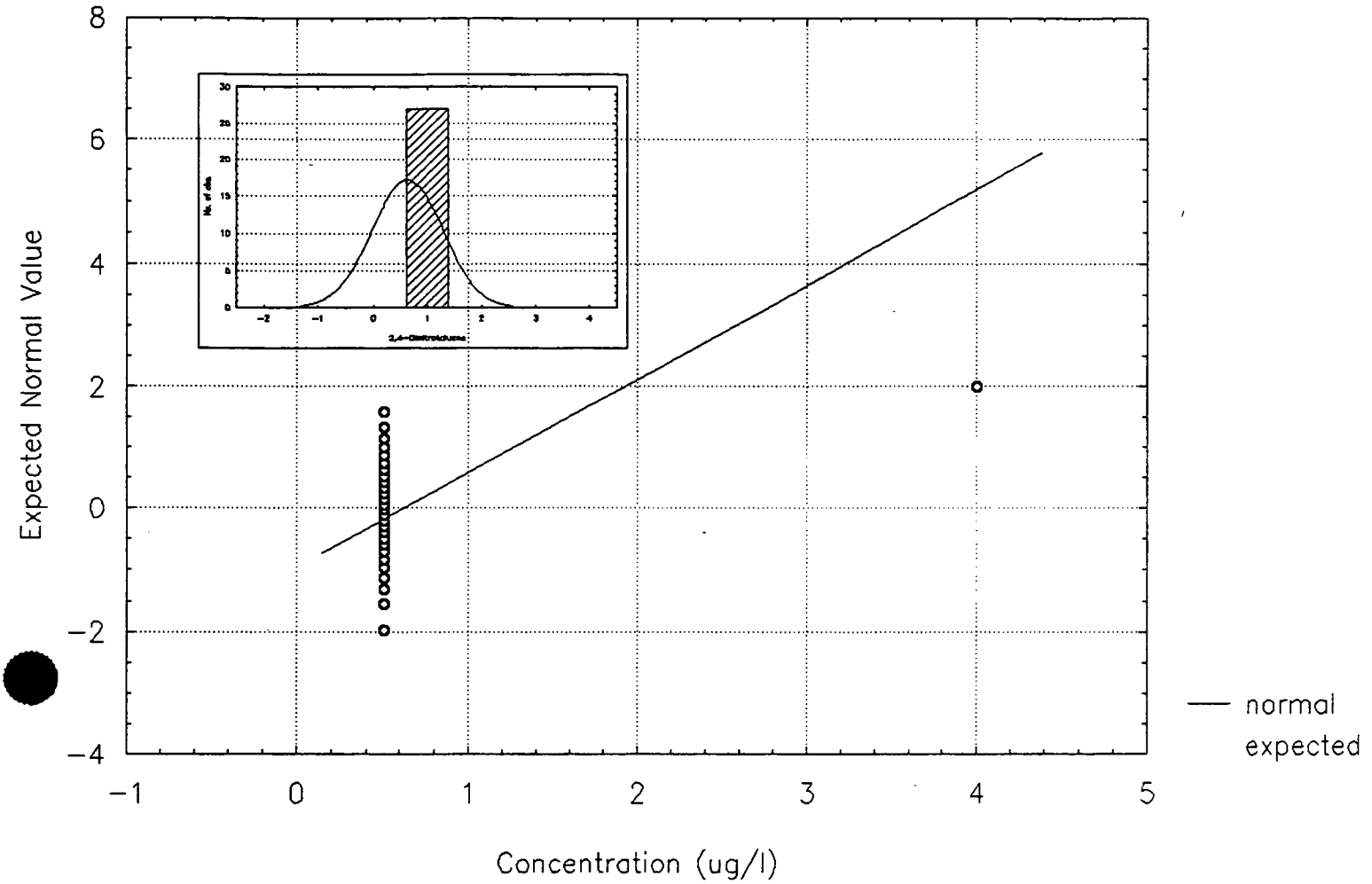
Normal Probablility Plot for the Log Base 10
Transform of Cumene in Background Groundwater



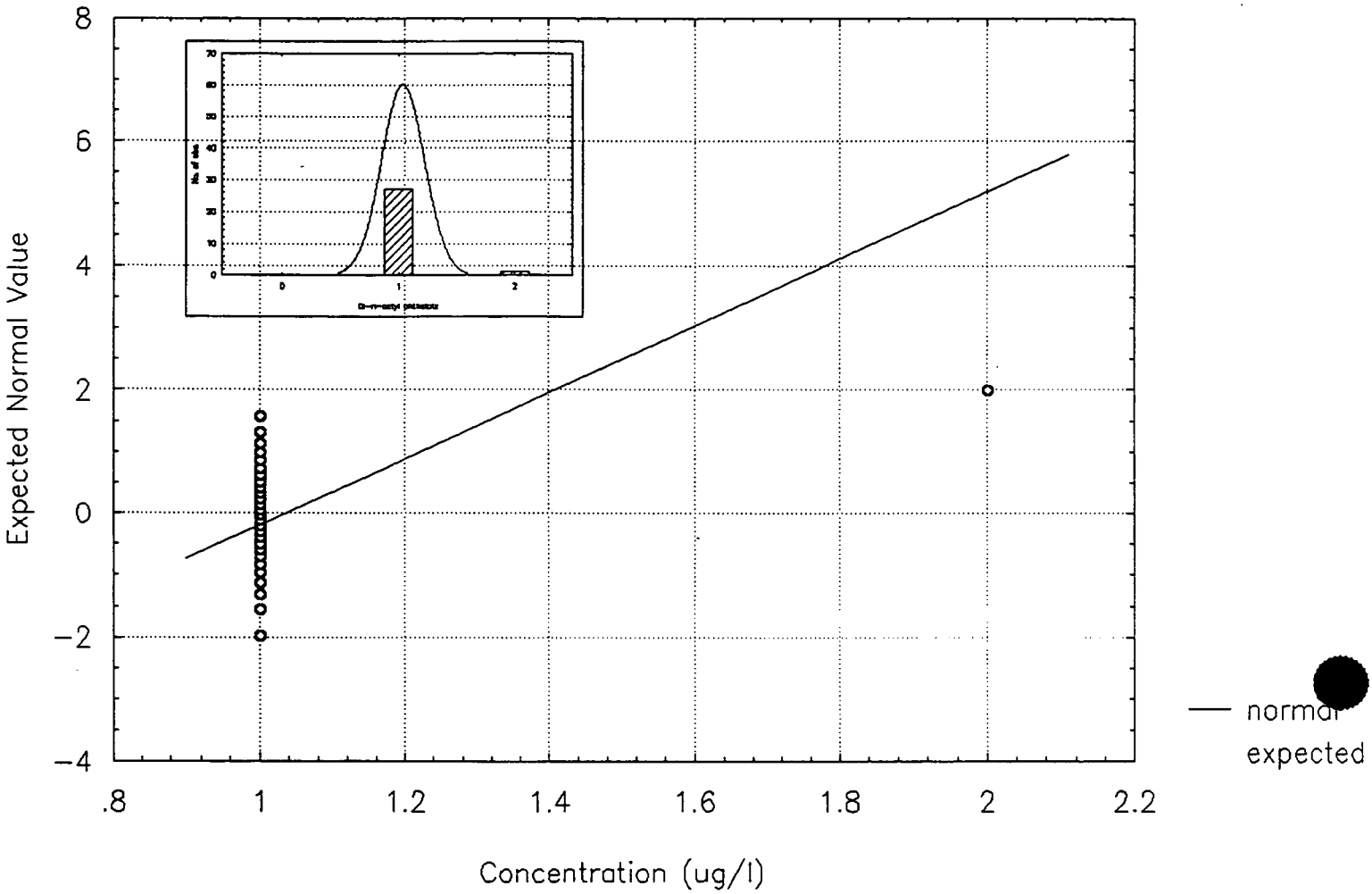
SEMIVOLATILE ORGANICS

000643

Normal Probablility Plot for
2,4-Dinitrotoluene
in Background Groundwater Samples

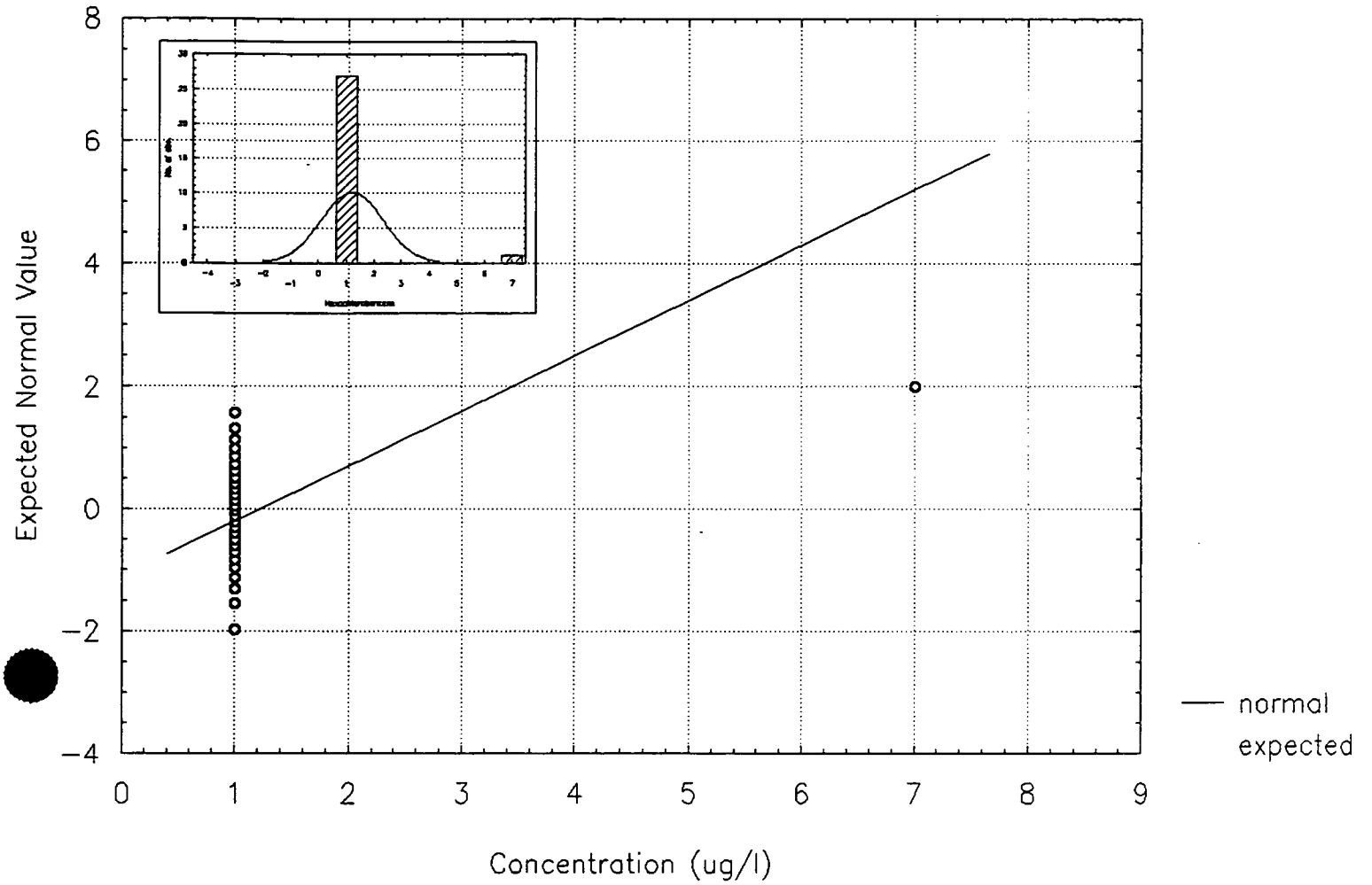


Normal Probablility Plot for
Di-n-octyl phthalate
in Background Groundwater Samples

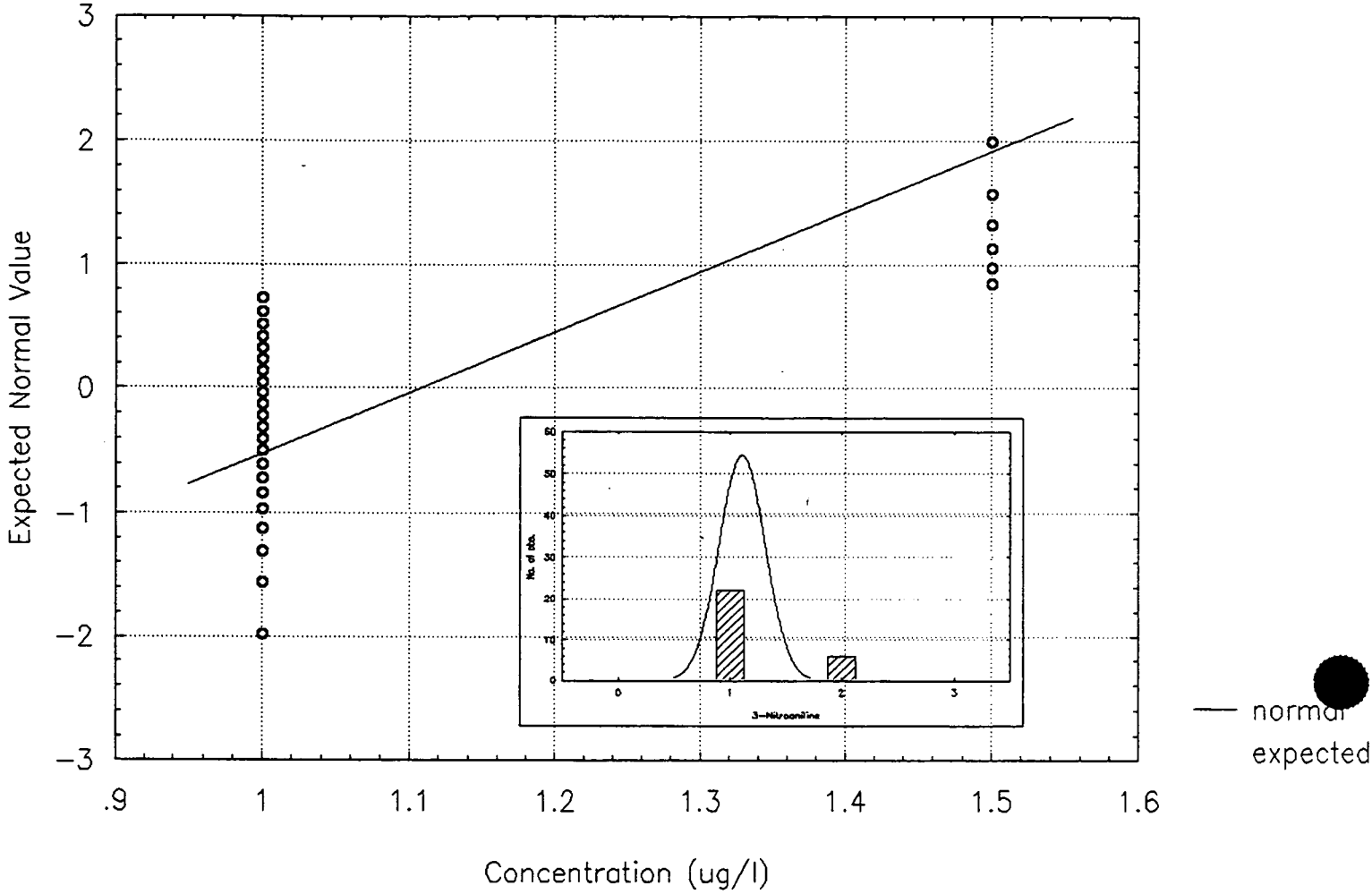


000645

Normal Probablility Plot for
Hexachlorobenzene
in Background Groundwater Samples

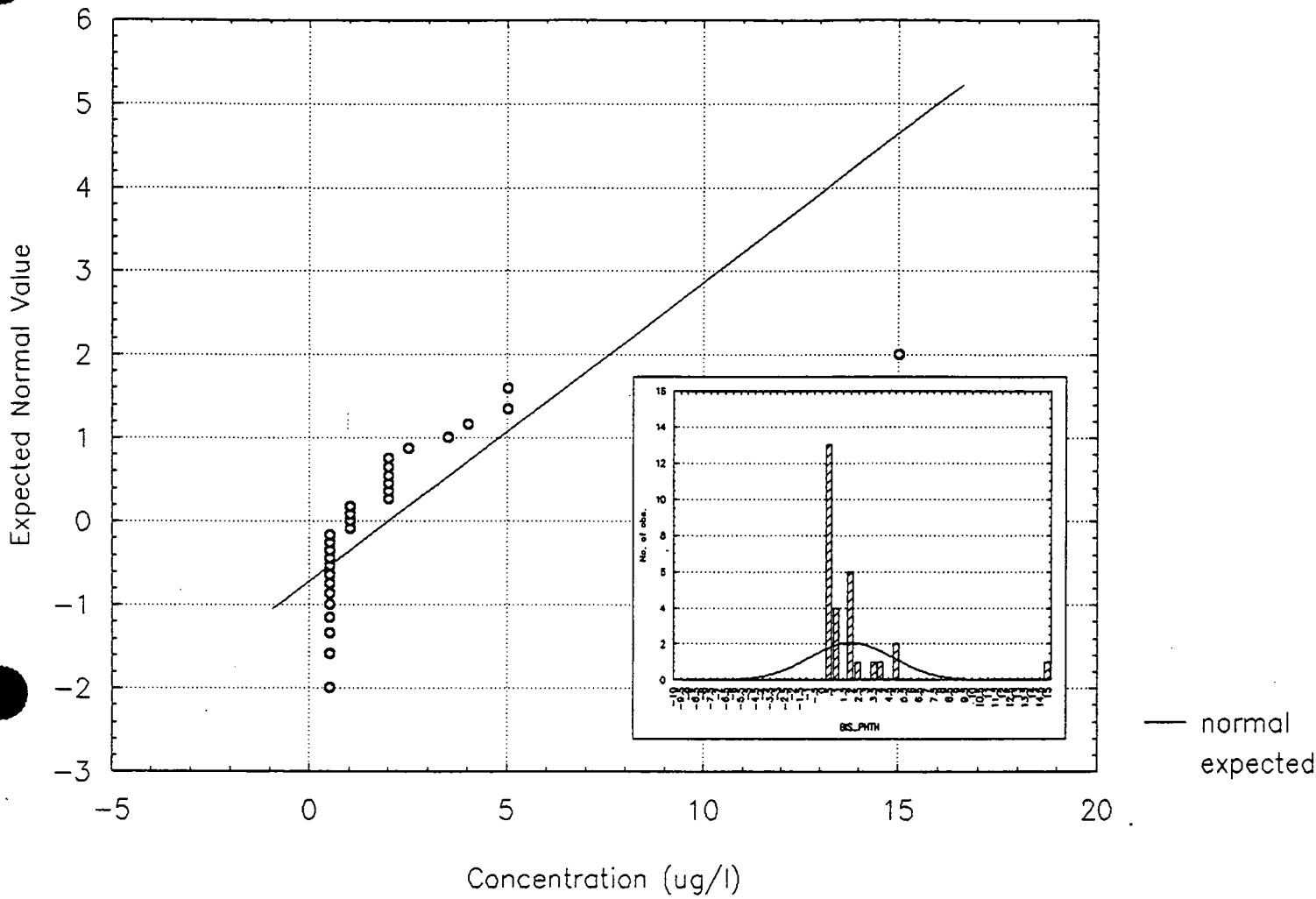


Normal Probablility Plot for
3-Nitroaniline
in Background Groundwater Samples

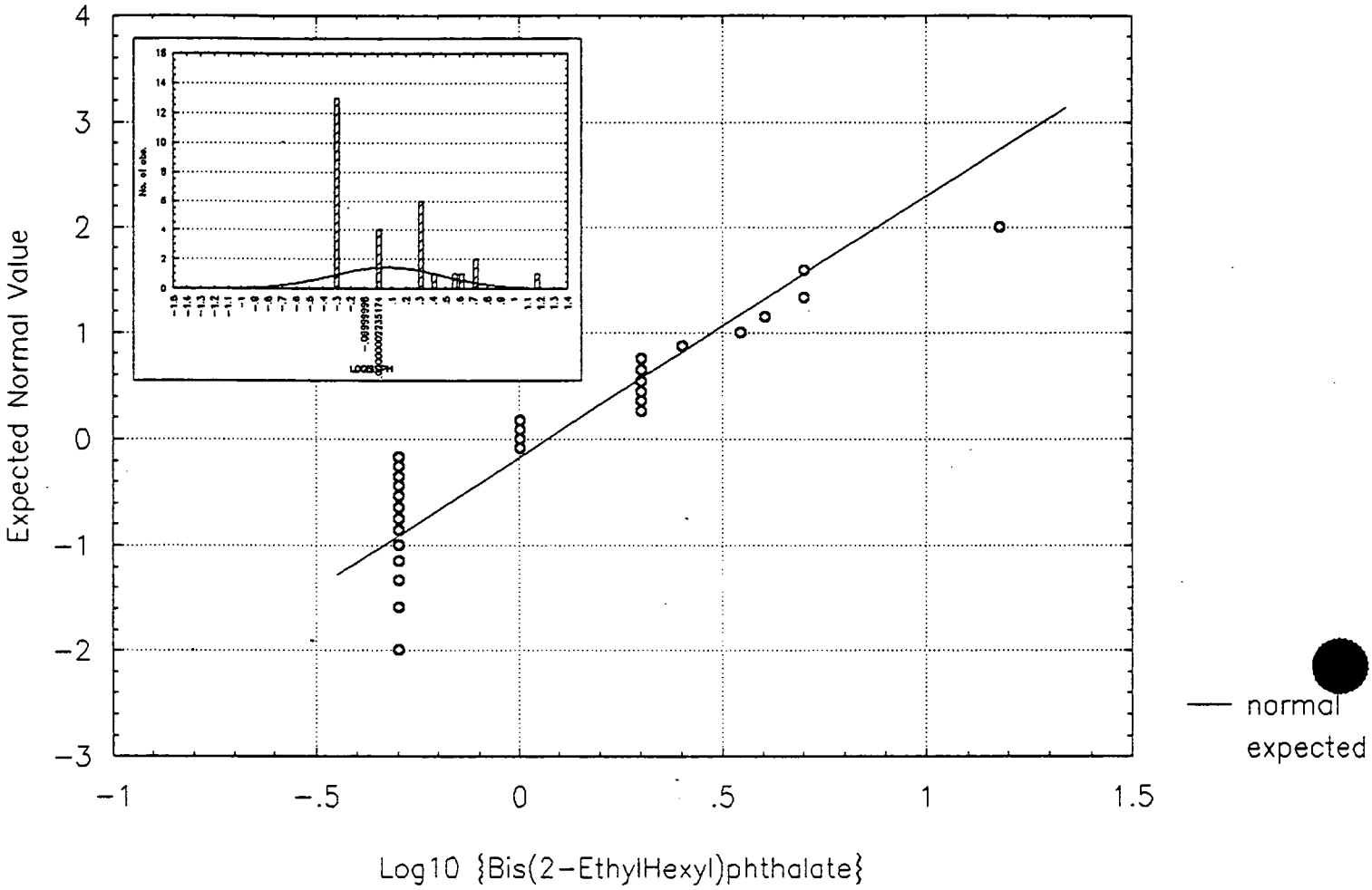


000647

Normal Probablility Plot for Bis(2-Ethylhexyl)Phthalate
in the Background Groundwater



Normal Probablility Plot for the Log Base 10
Transform of Bis(2-EthylHexyl)phthalate
in Background Groundwater



000649

007359

PESTICIDES

000650

NO DISTRIBUTIONS
EVALUATED

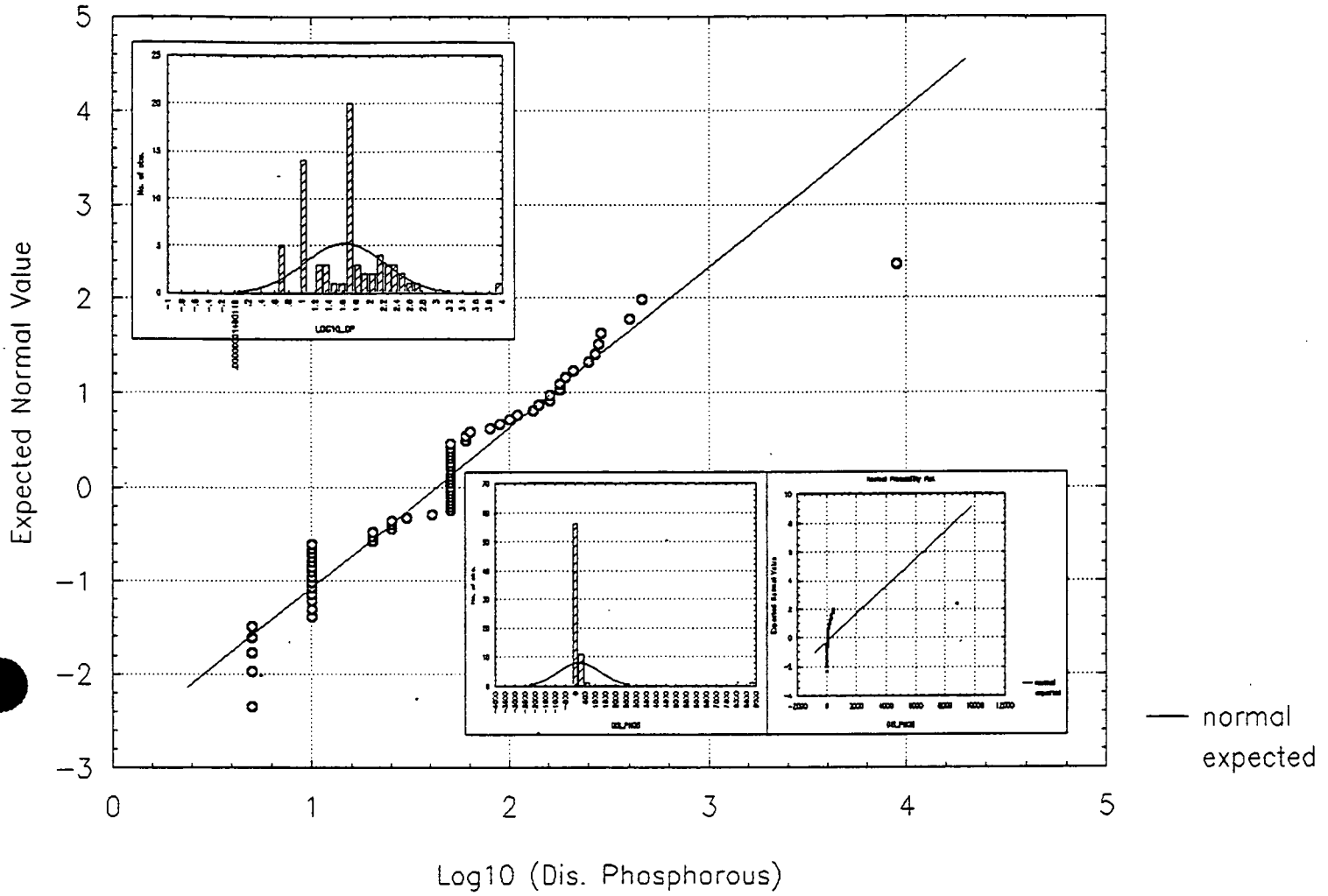
007359

GENERAL PARAMETERS

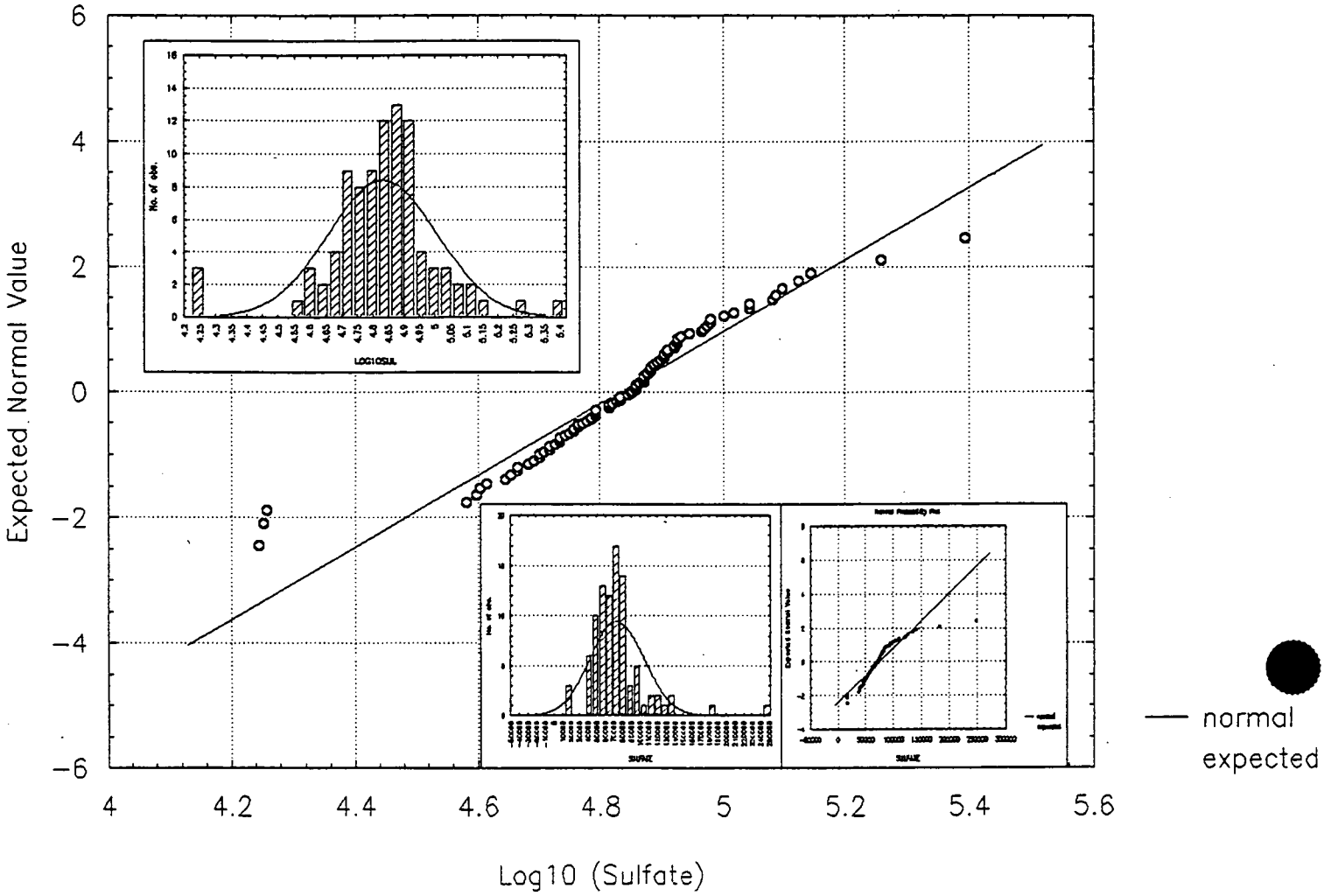
000652

EVALUATION OF SELECT CHEMICALS USING ENTIRE BACKGROUND DATA SET

Normal Probablility Plot for Dissolved Phosphorous
in the Background Groundwater (Original Data Set)



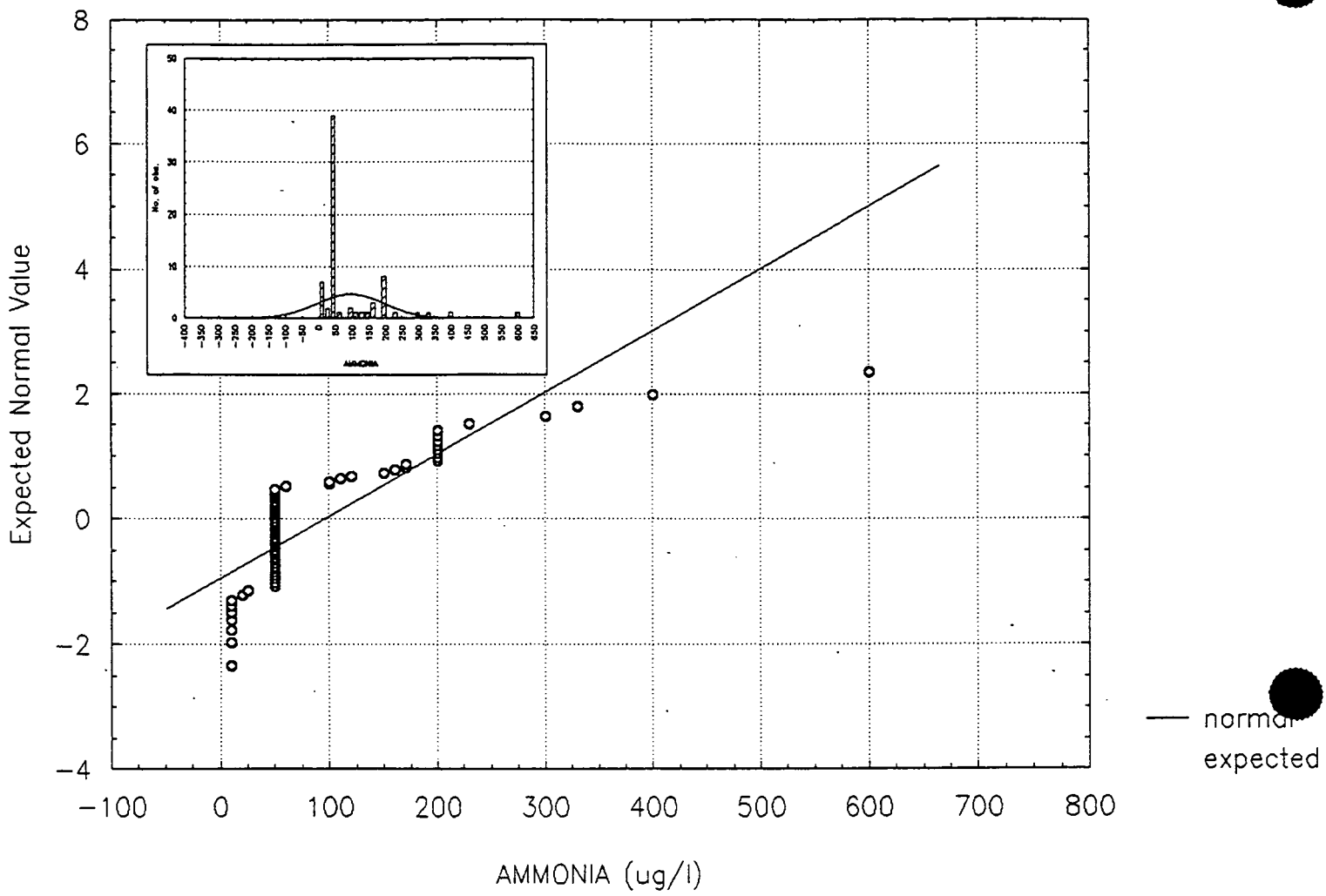
Normal Probablility Plots for Sulfate in the Background Groundwater (Original Data Set)



000655

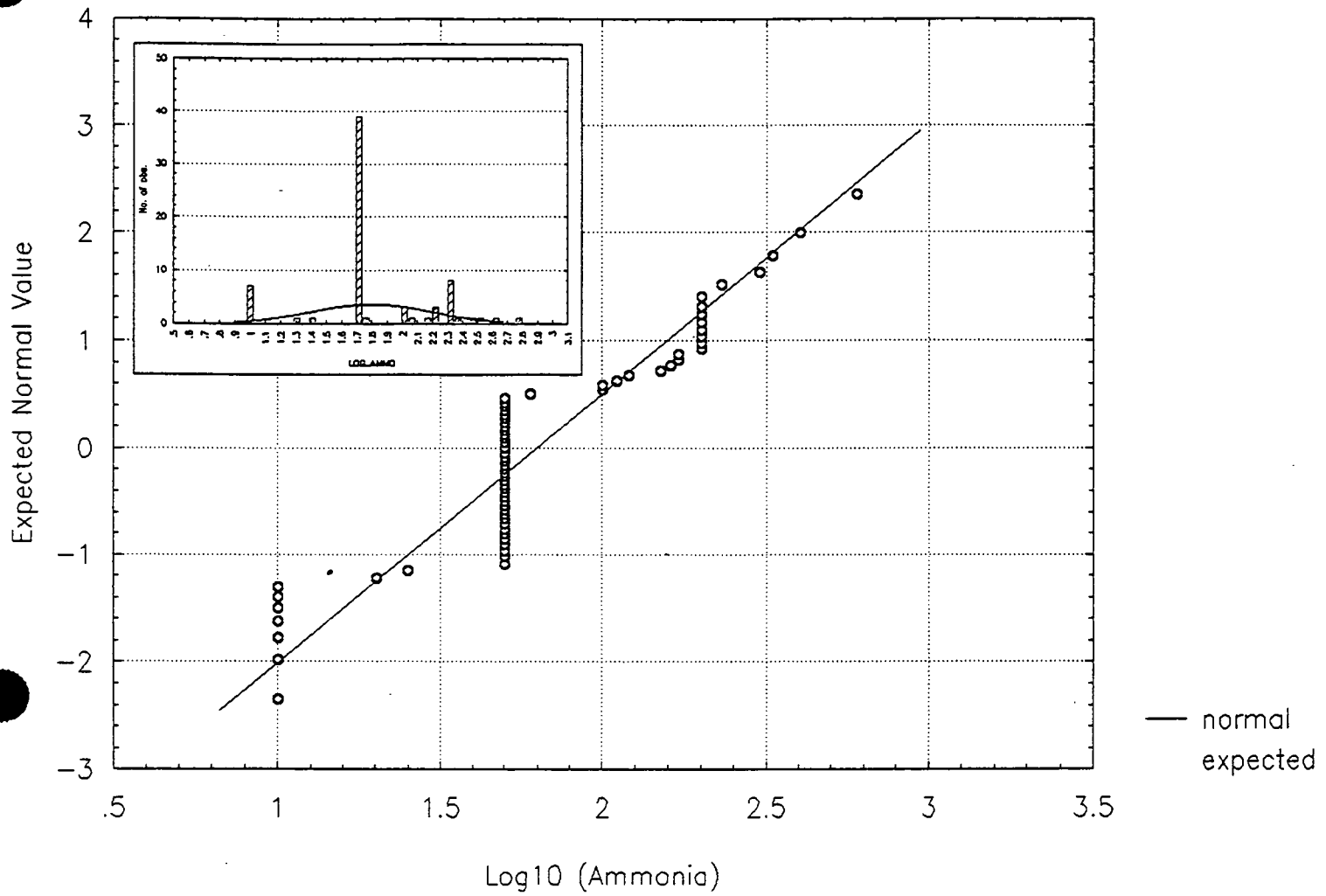
STATISTICAL EVALUATION USING REDUCED DATA SET (11-01 DOE #2096 AND 11-90 DOE #2125 REMOVED)

Normal Probablility Plot for Ammonia in the Background Groundwater (Reduced Data Set)

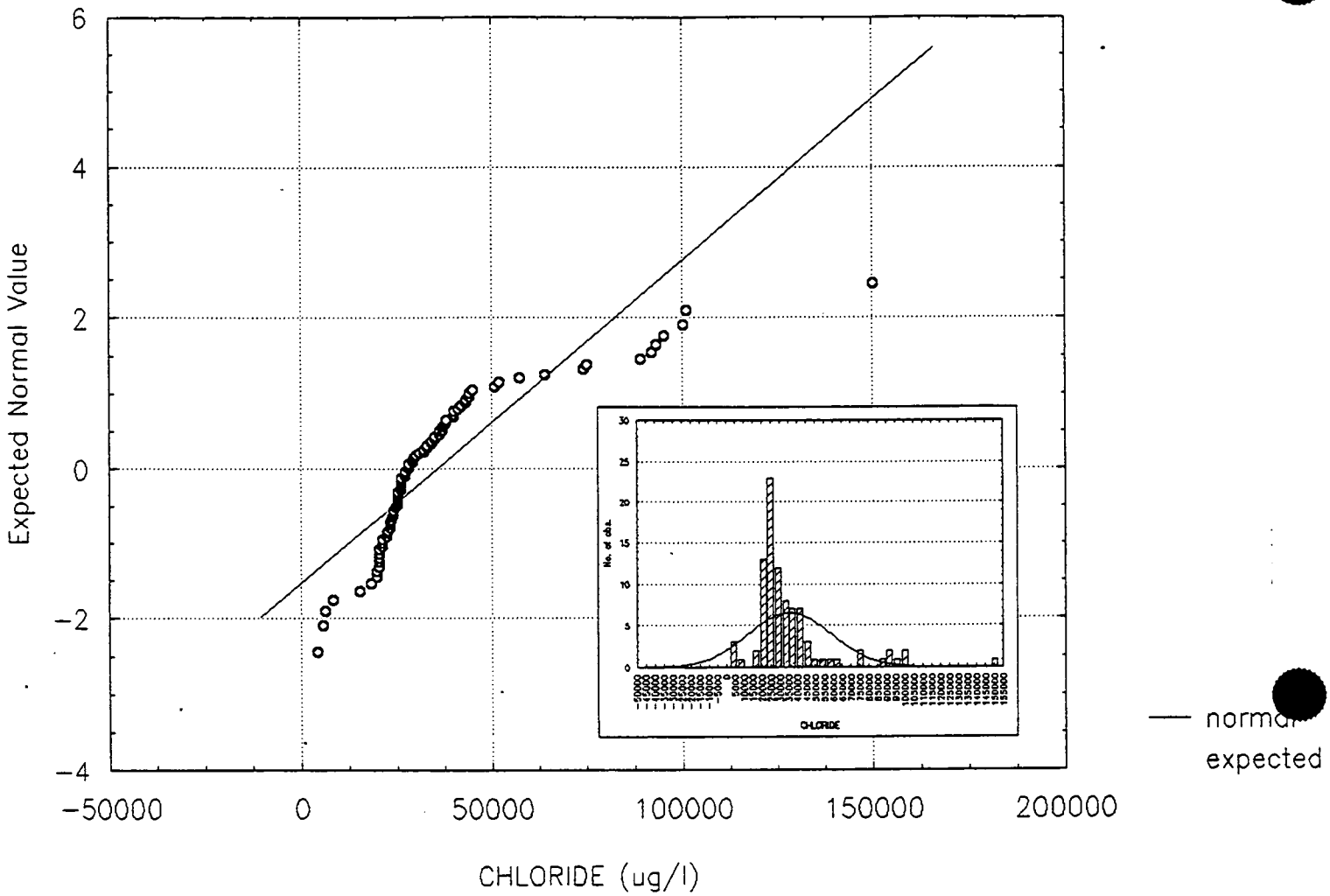


000657

Normal Probablility Plot for the Log Base 10
Transform of Ammonia in Background Groundwater

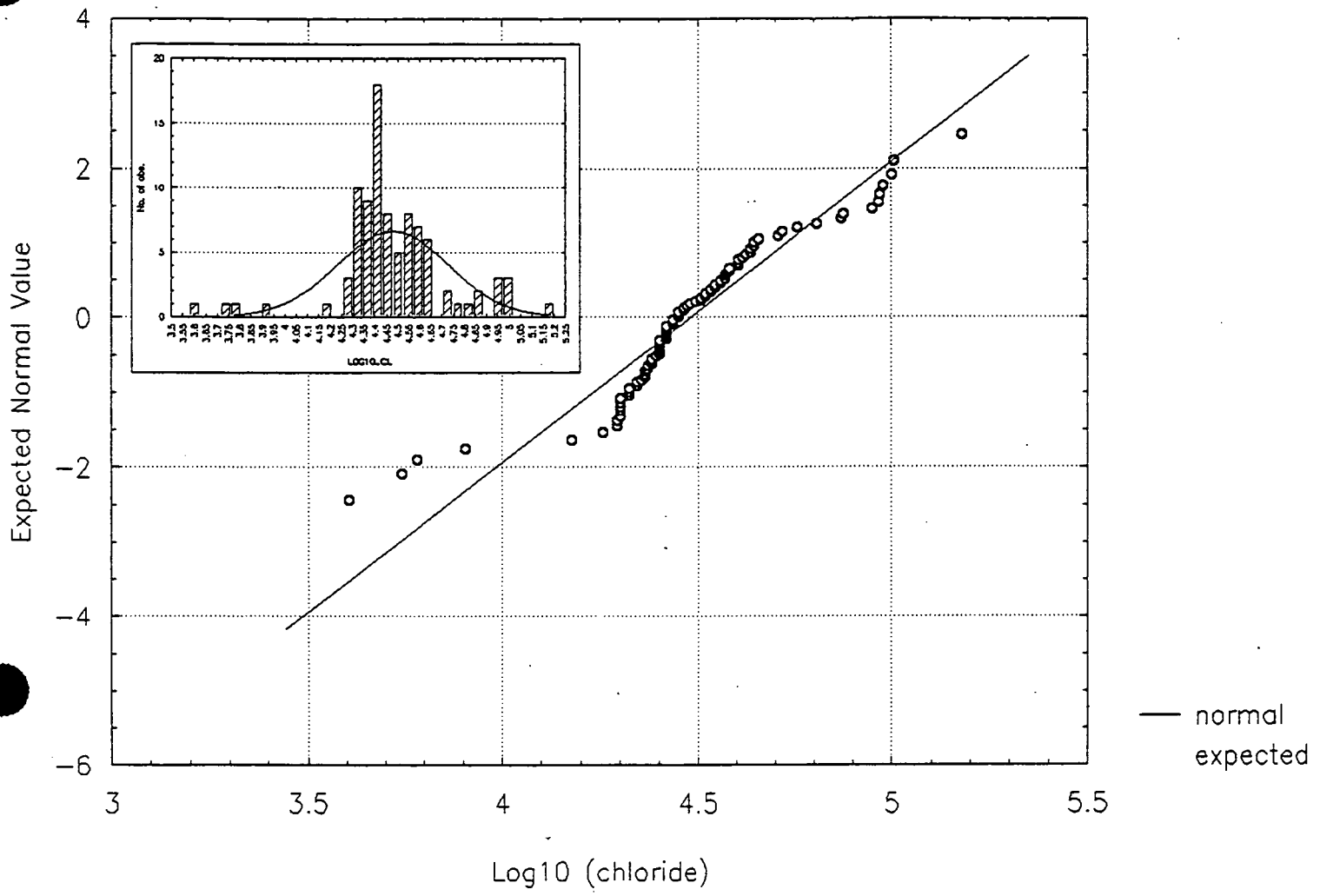


Normal Probablility Plot for Chloride in the Background Groundwater (Reduced Data Set)

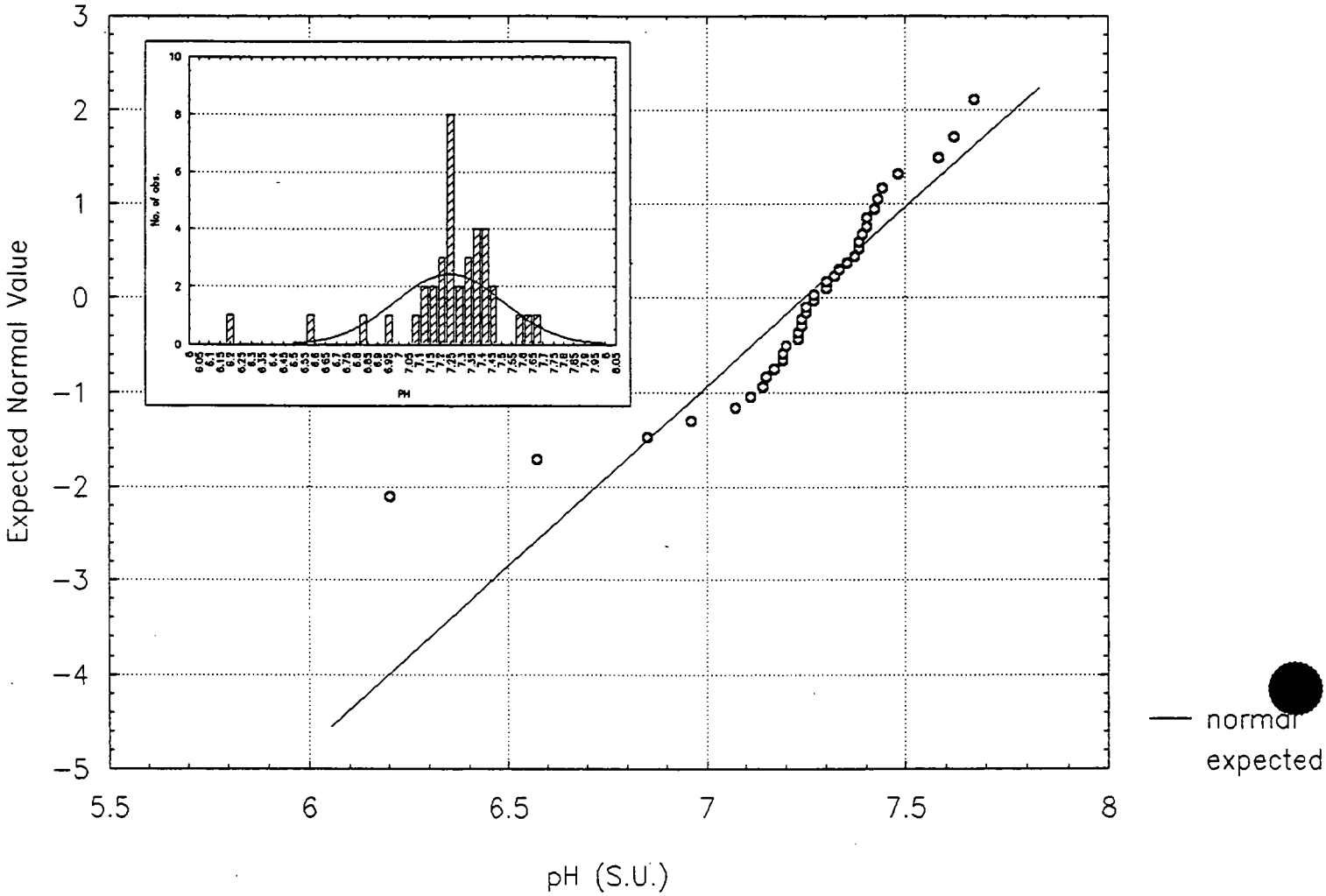


000659

Normal Probablility Plot for the Log Base 10
Transform of Chloride in Background Groundwater

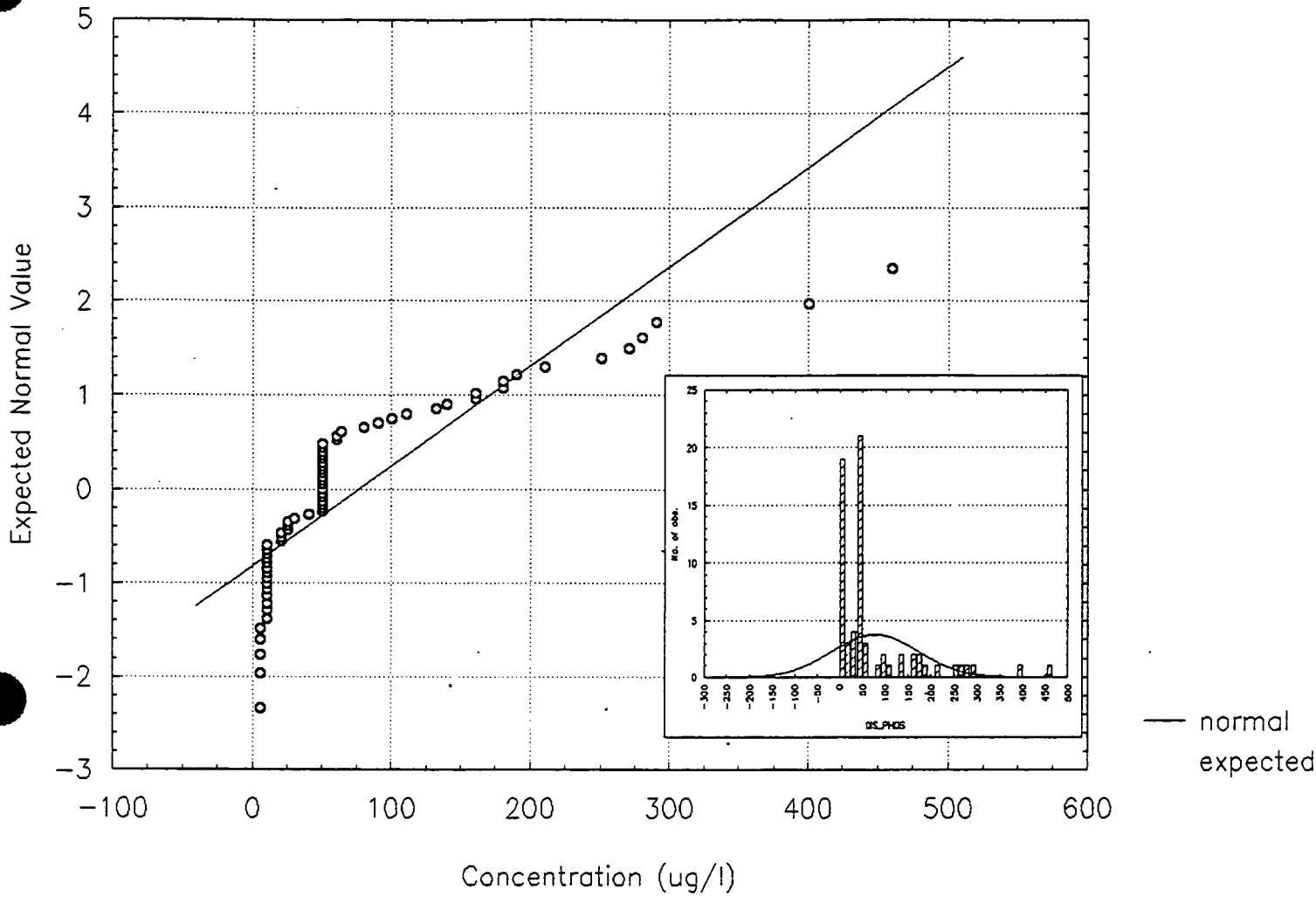


Normal Probablility Plot for pH in the
Background Groundwater (Reduced Data Set)

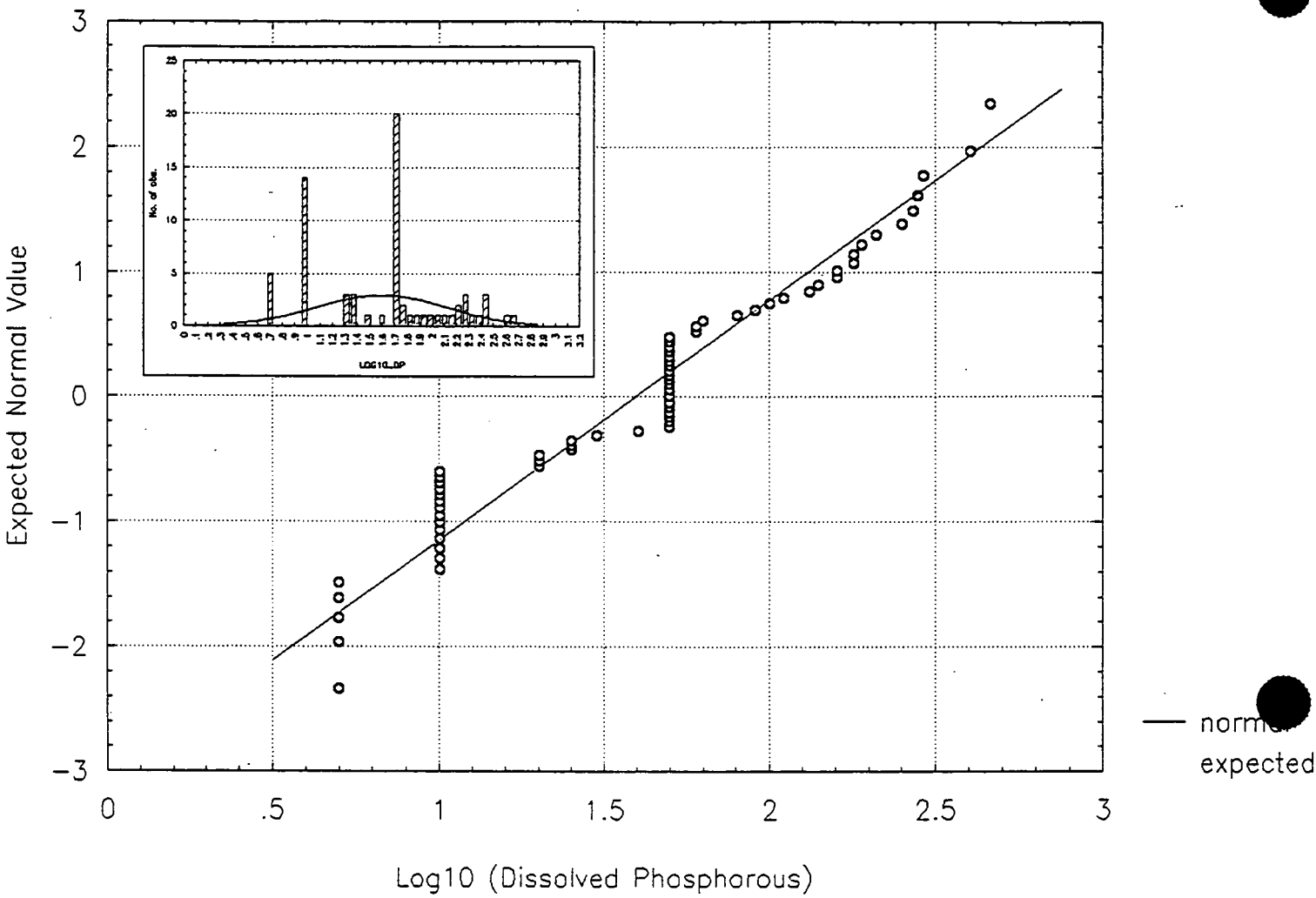


000661

Normal Probablility Plot for Dissolved Phosphoruous in the Background Groundwater (Reduced Data Set)

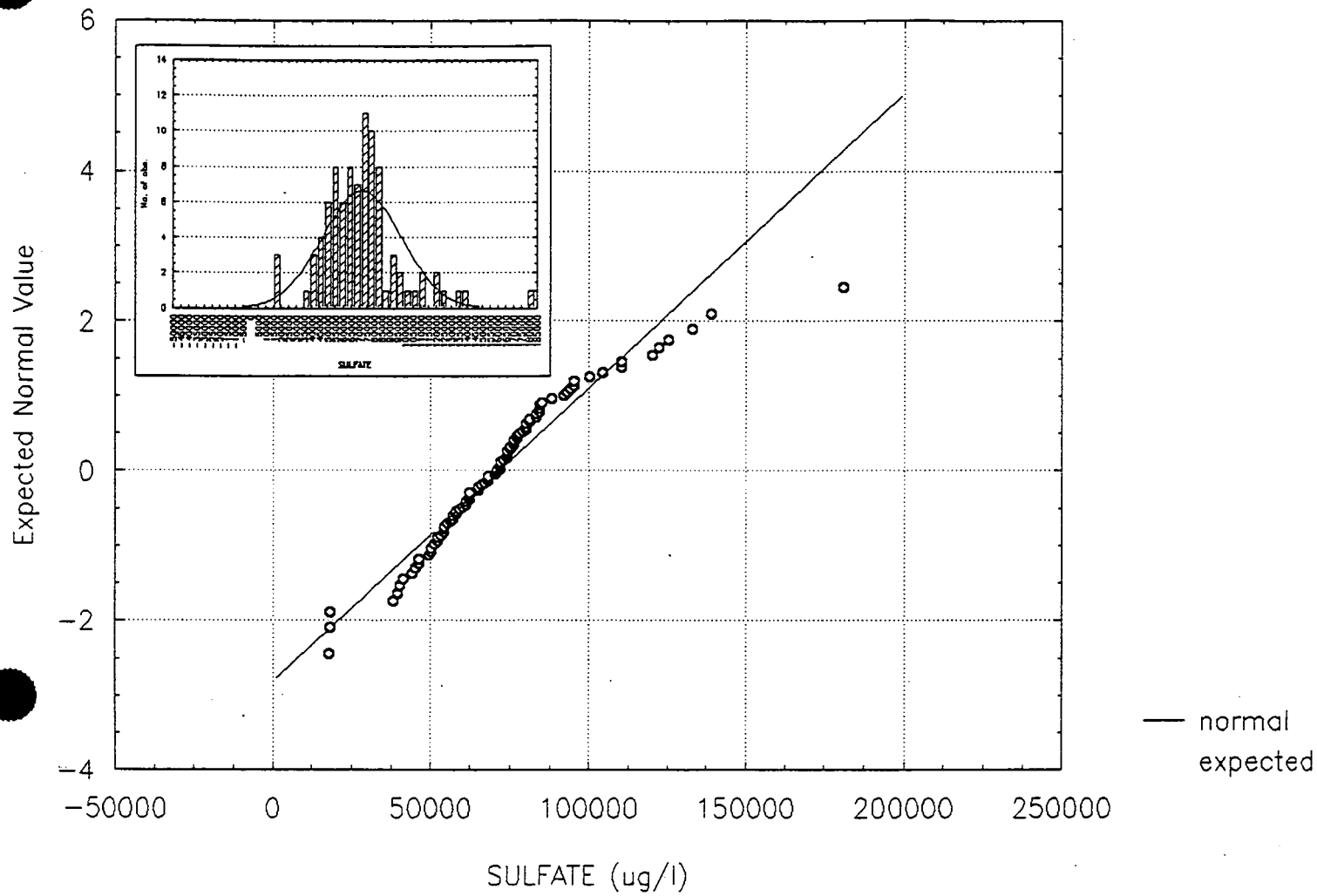


Normal Probablility Plot for the Log Base 10
Transform of Dissolved Phosphorous in Background Groundwater

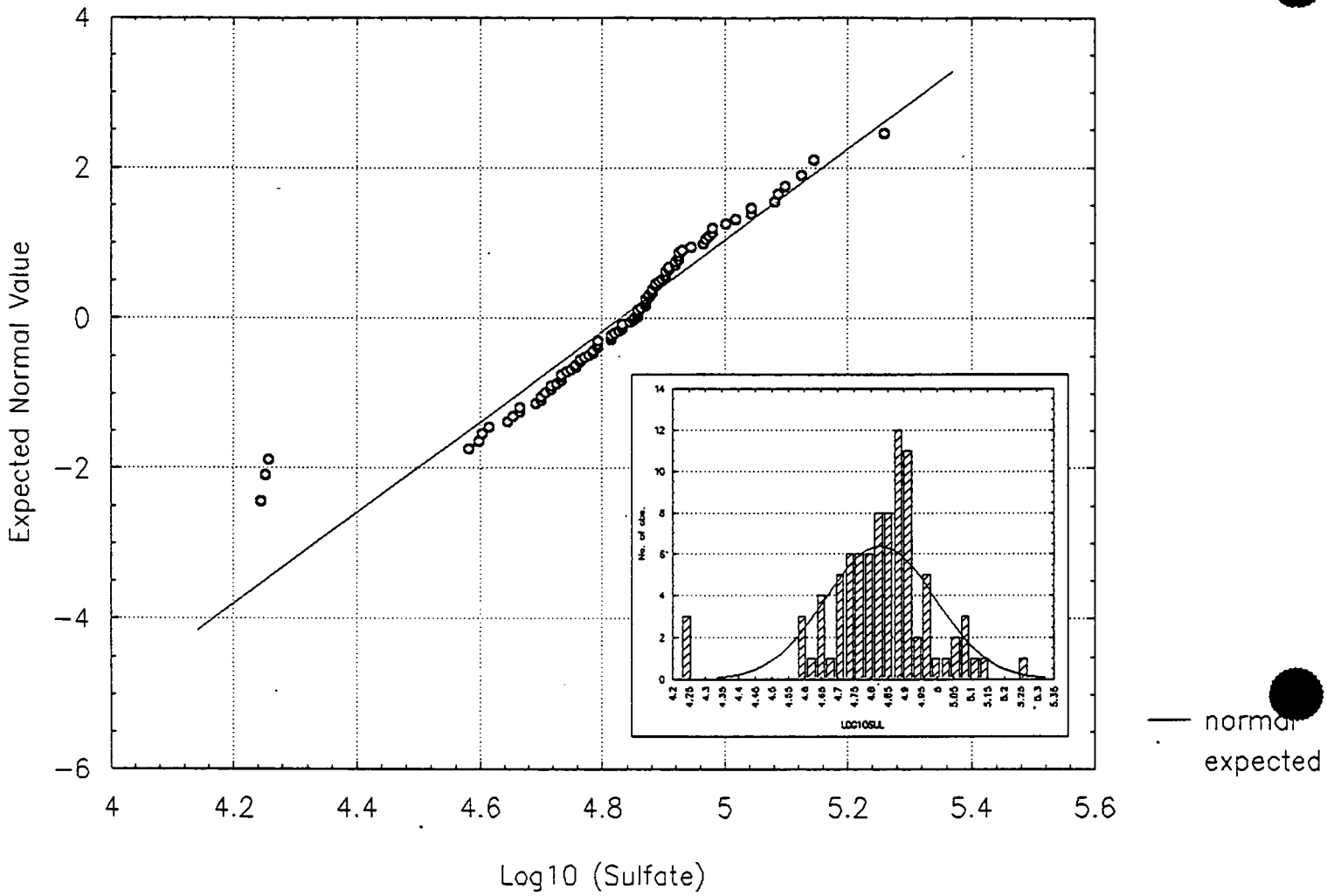


000663

Normal Probablility Plot for Sulfate in the Background Groundwater (Reduced Data Set)

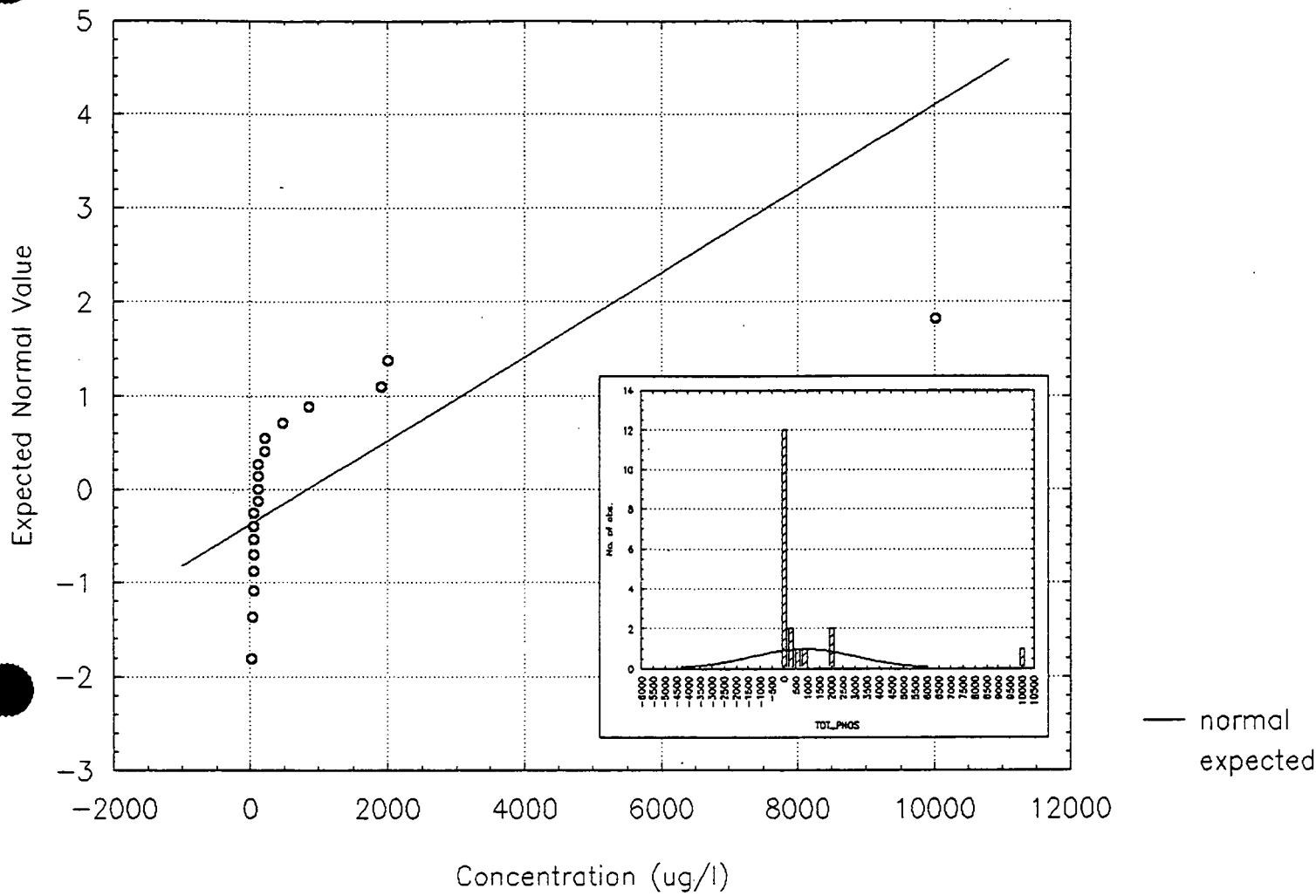


Normal Probablility Plot for the Log Base 10
Transform of Sulfate in Background Groundwater

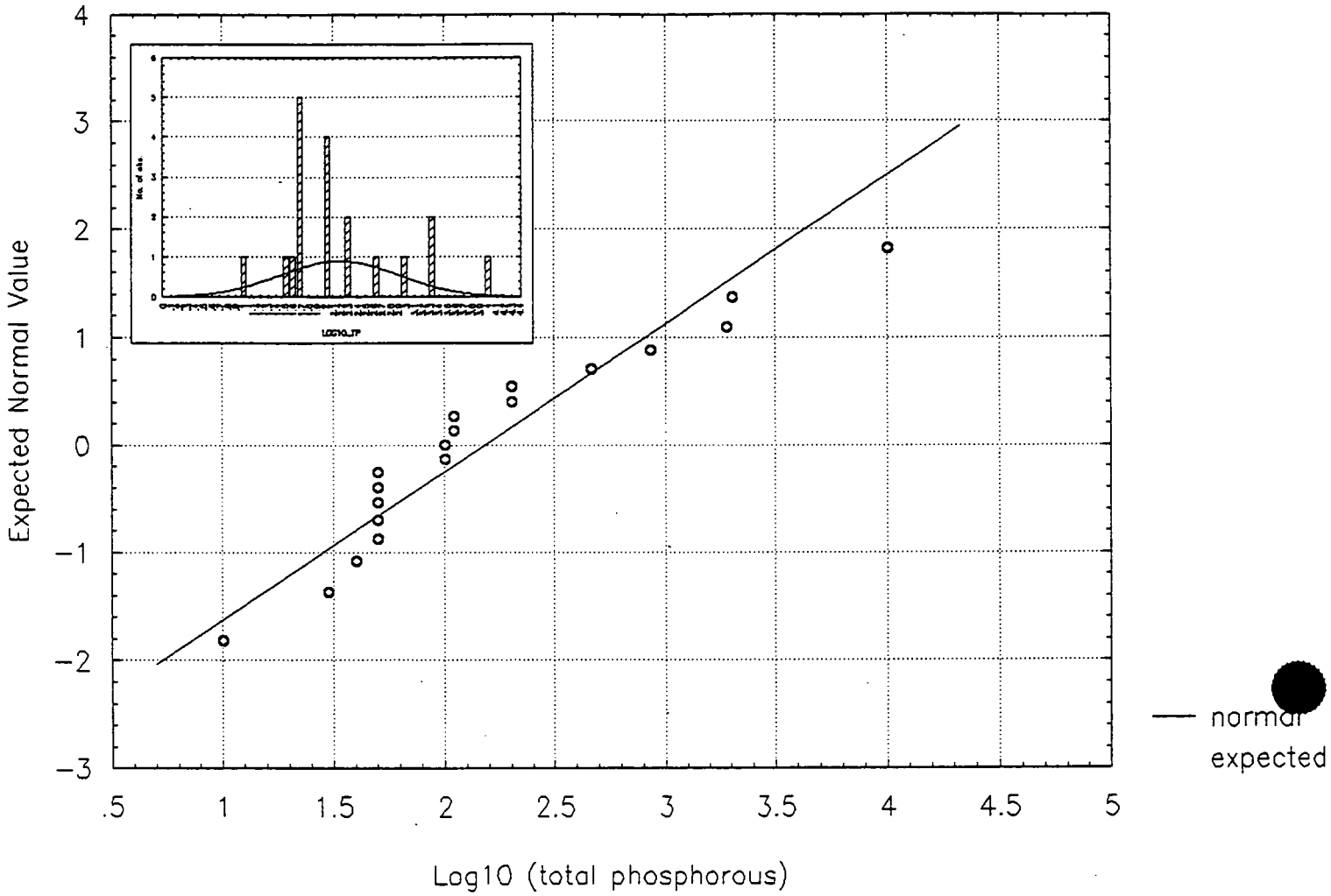


000665

Normal Probablility Plot for Total Phosphorous
in Background Groundwater (Reduced Data Set)

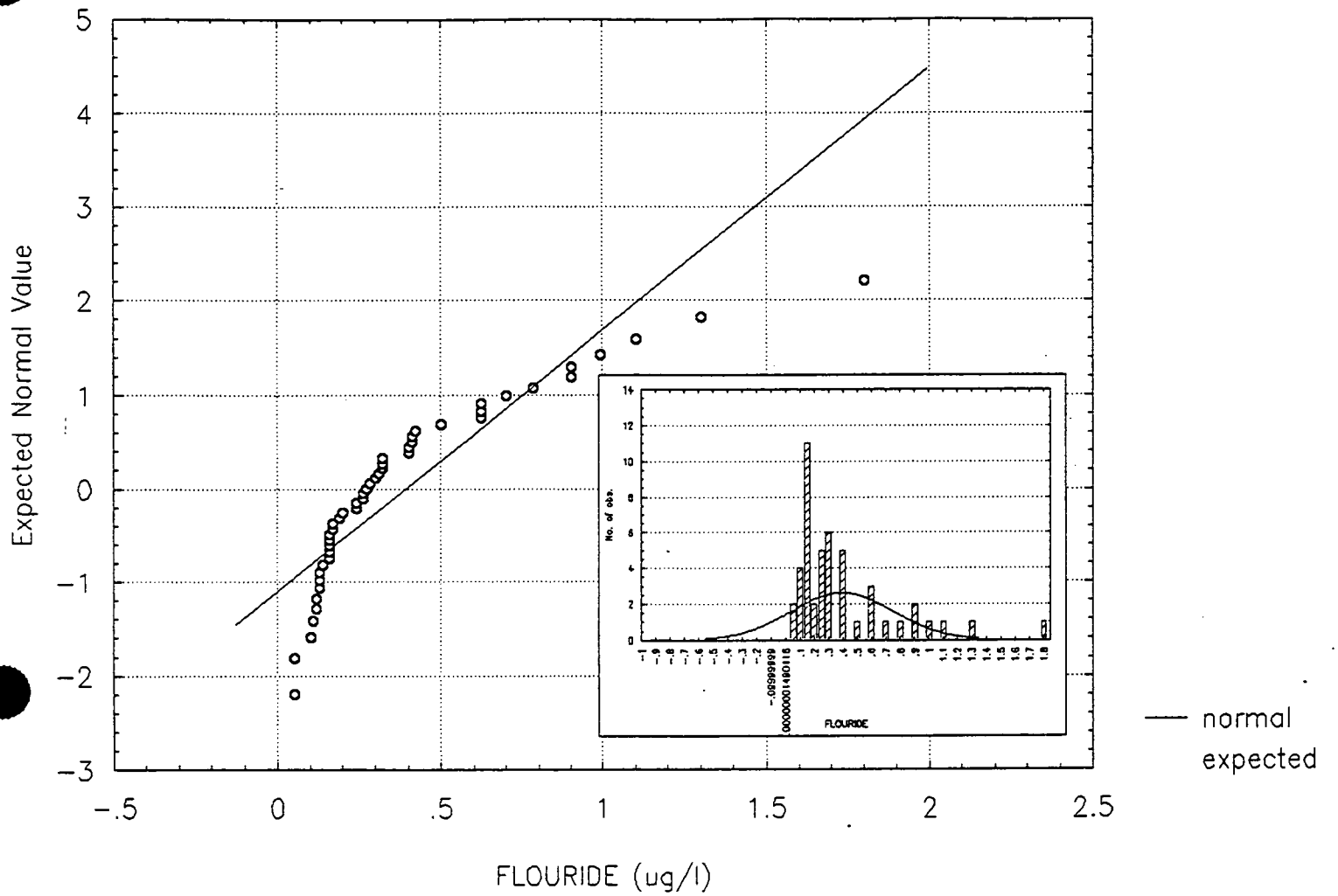


Normal Probablility Plot for the Log Base 10
Transform of Total Phosphorous in Background Groundwater

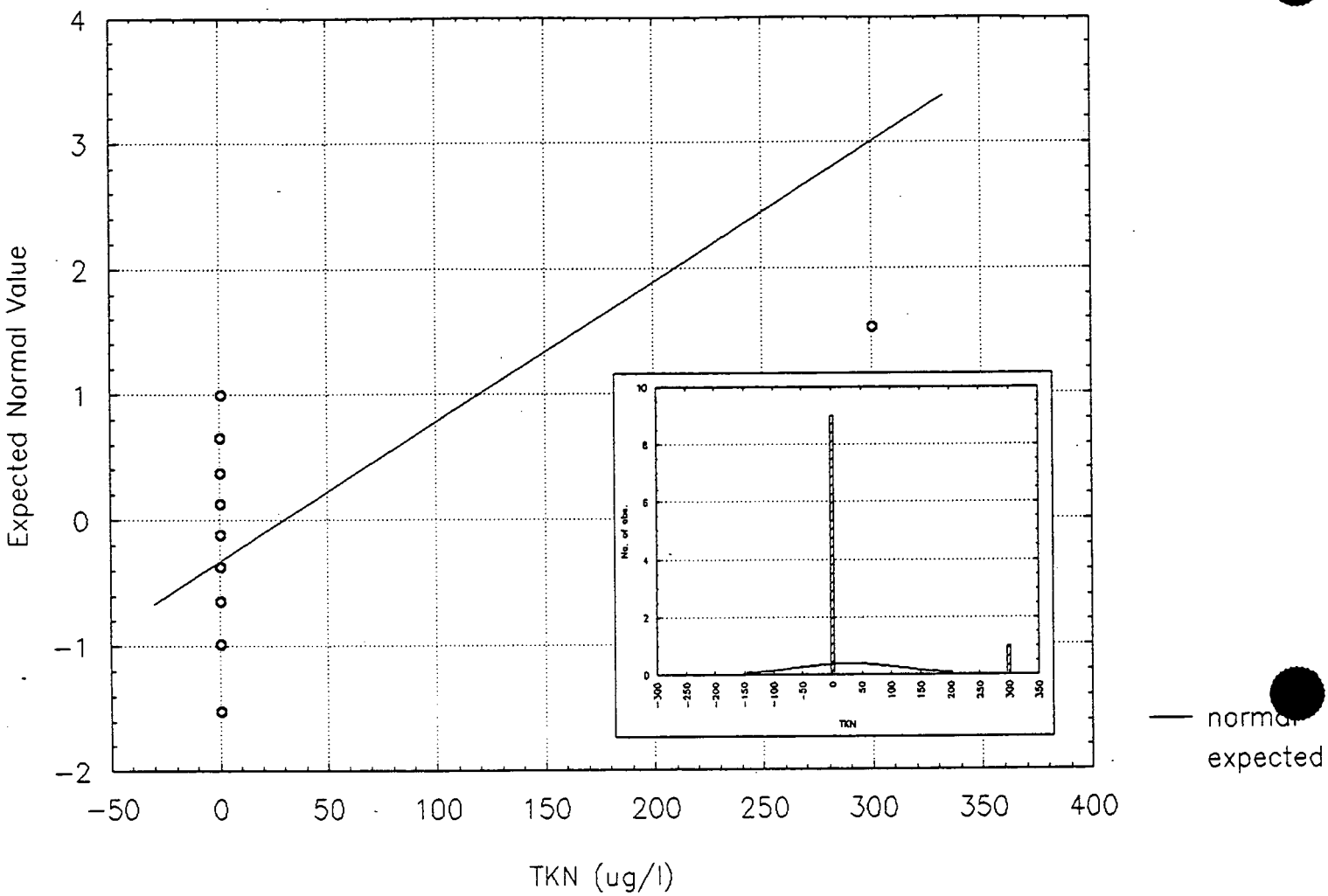


000667

Normal Probablility Plot for Flouride in the Background Groundwater (Reduced Data Set)

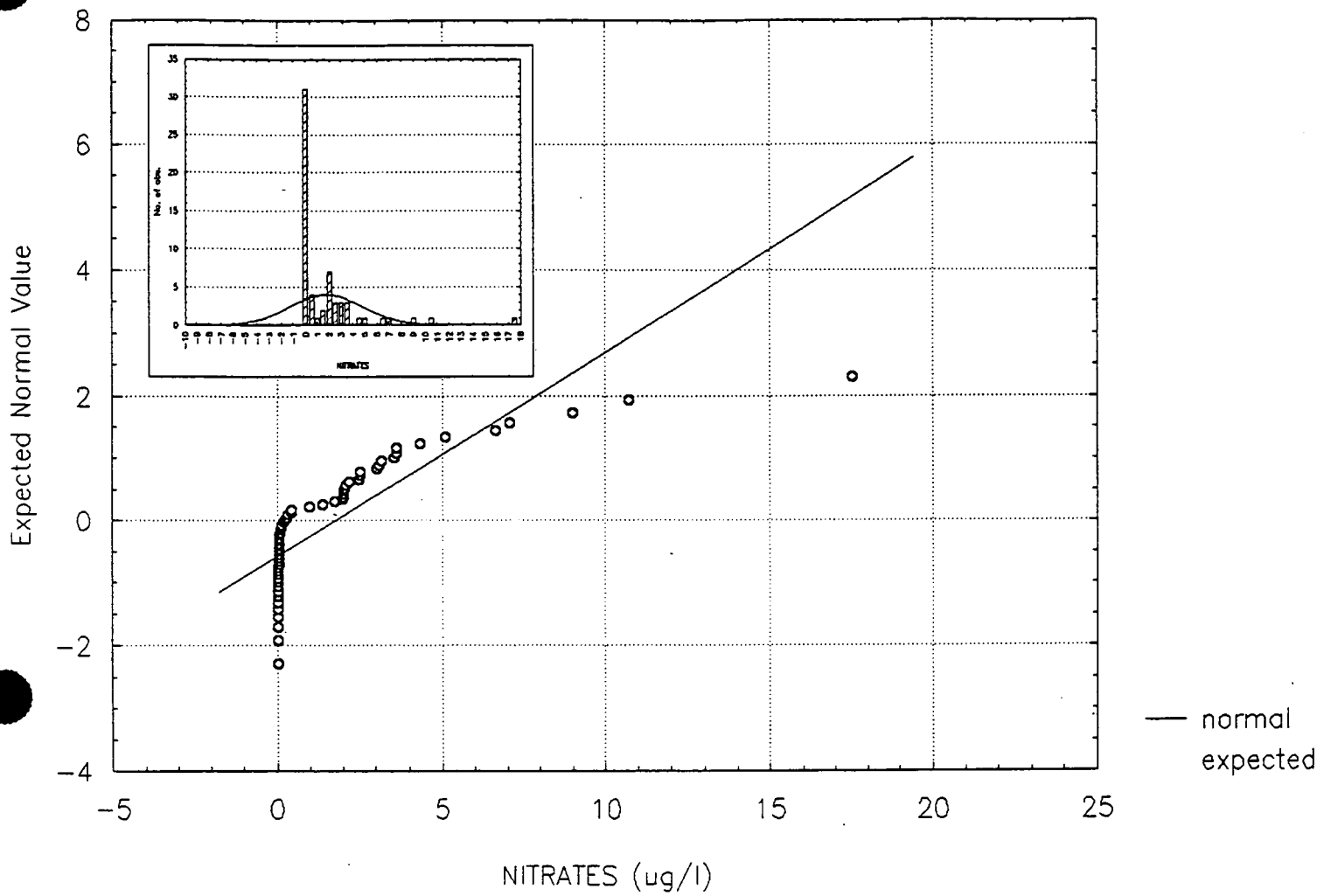


Normal Probablility Plot for TKN in the Background Groundwater

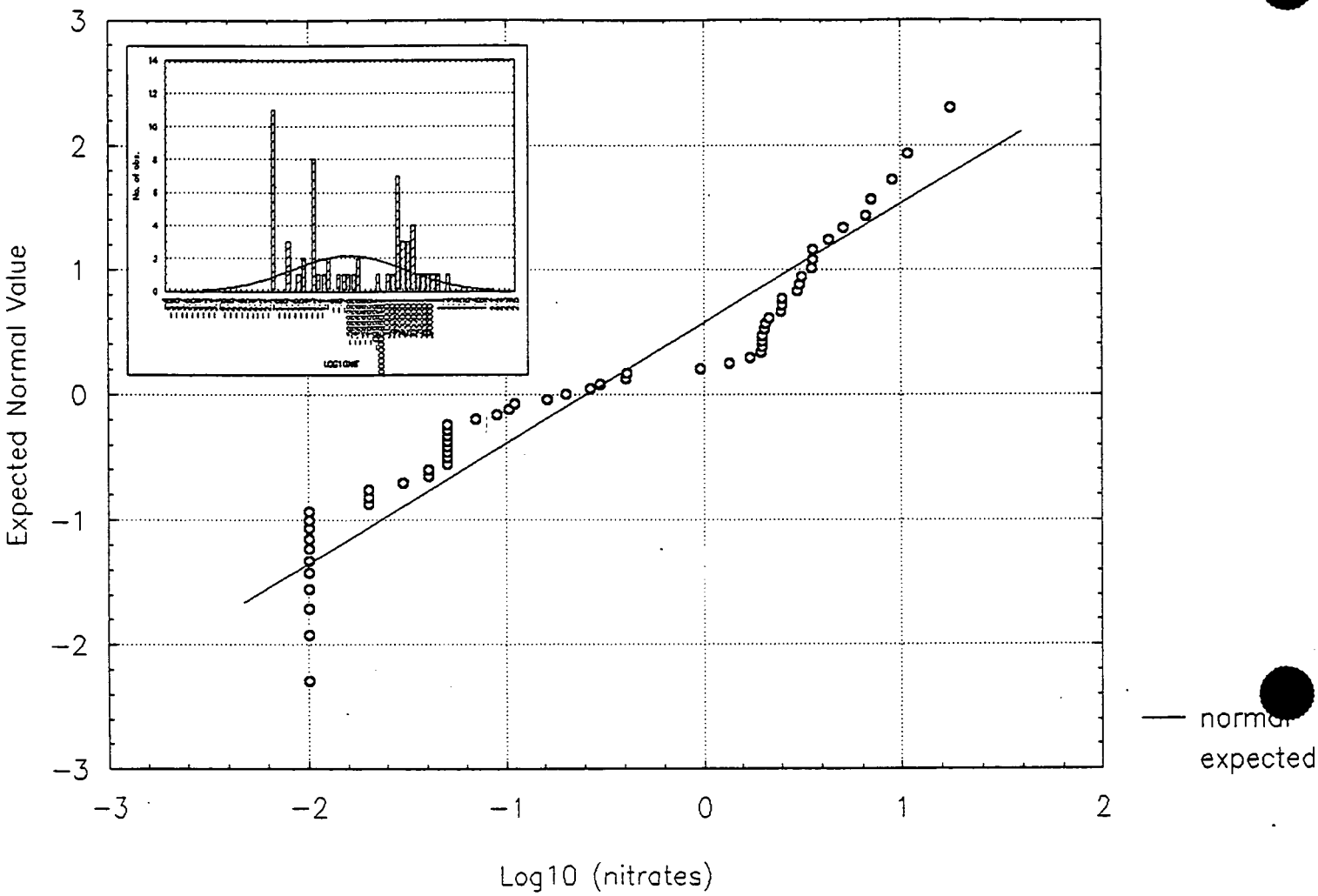


000669

Normal Probablility Plot for Nitrates in the Background Groundwater (Reduced Data Set)

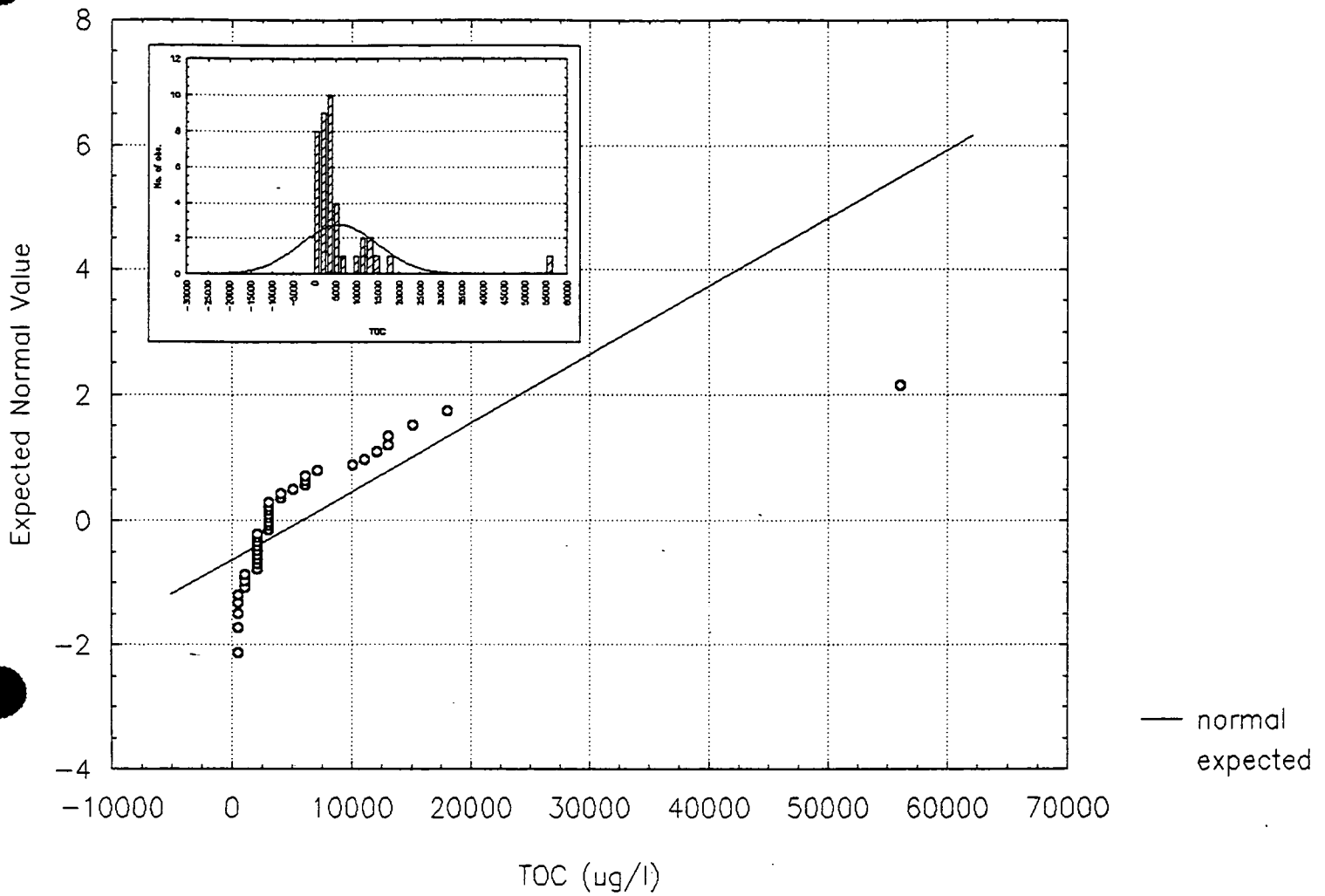


Normal Probablility Plot for the Log Base 10
Transform of Nitrates in Background Groundwater

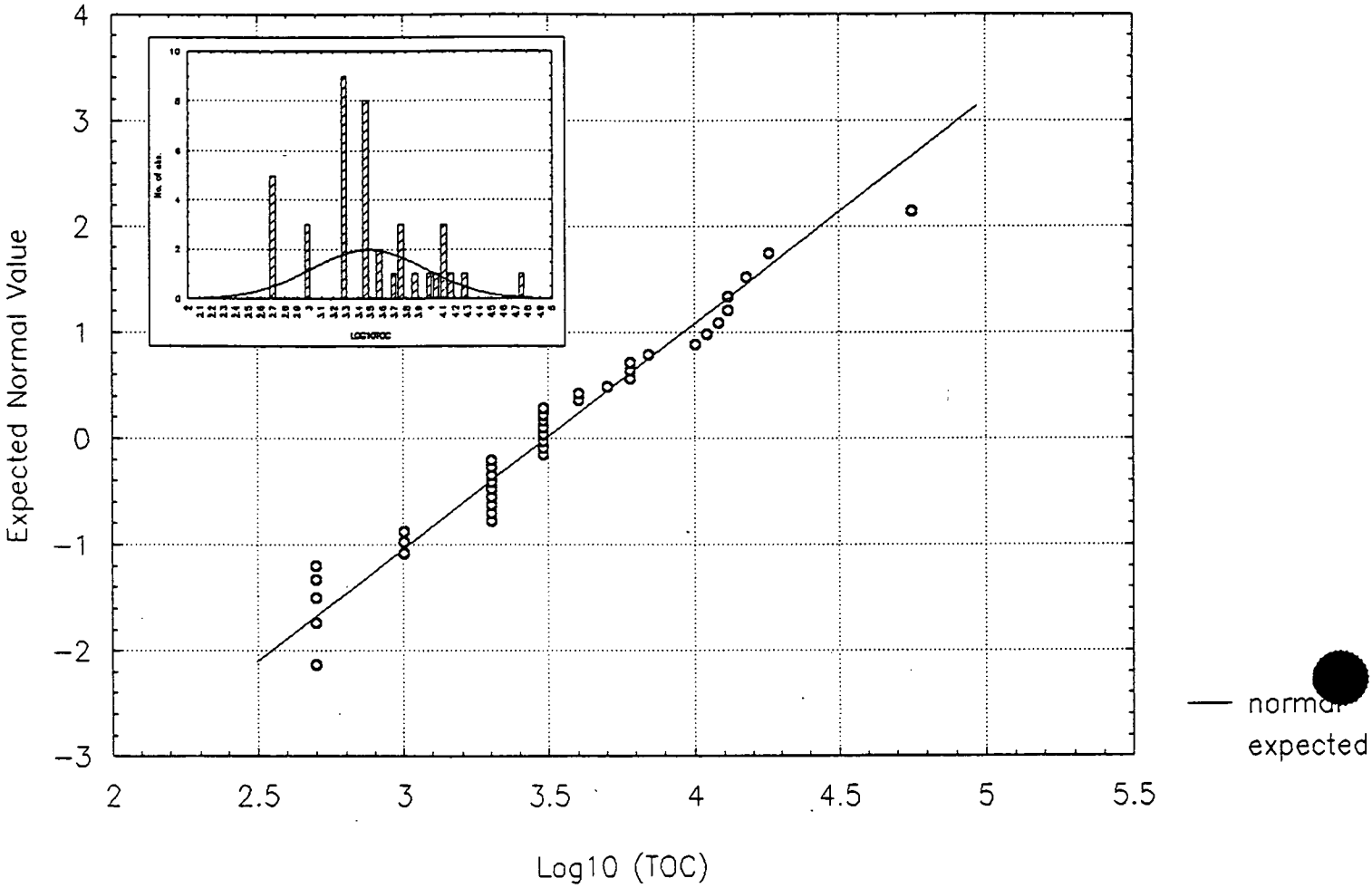


000671

Normal Probablility Plot for Total Organic Carbon
in Background Groundwater Reduced Data Set)

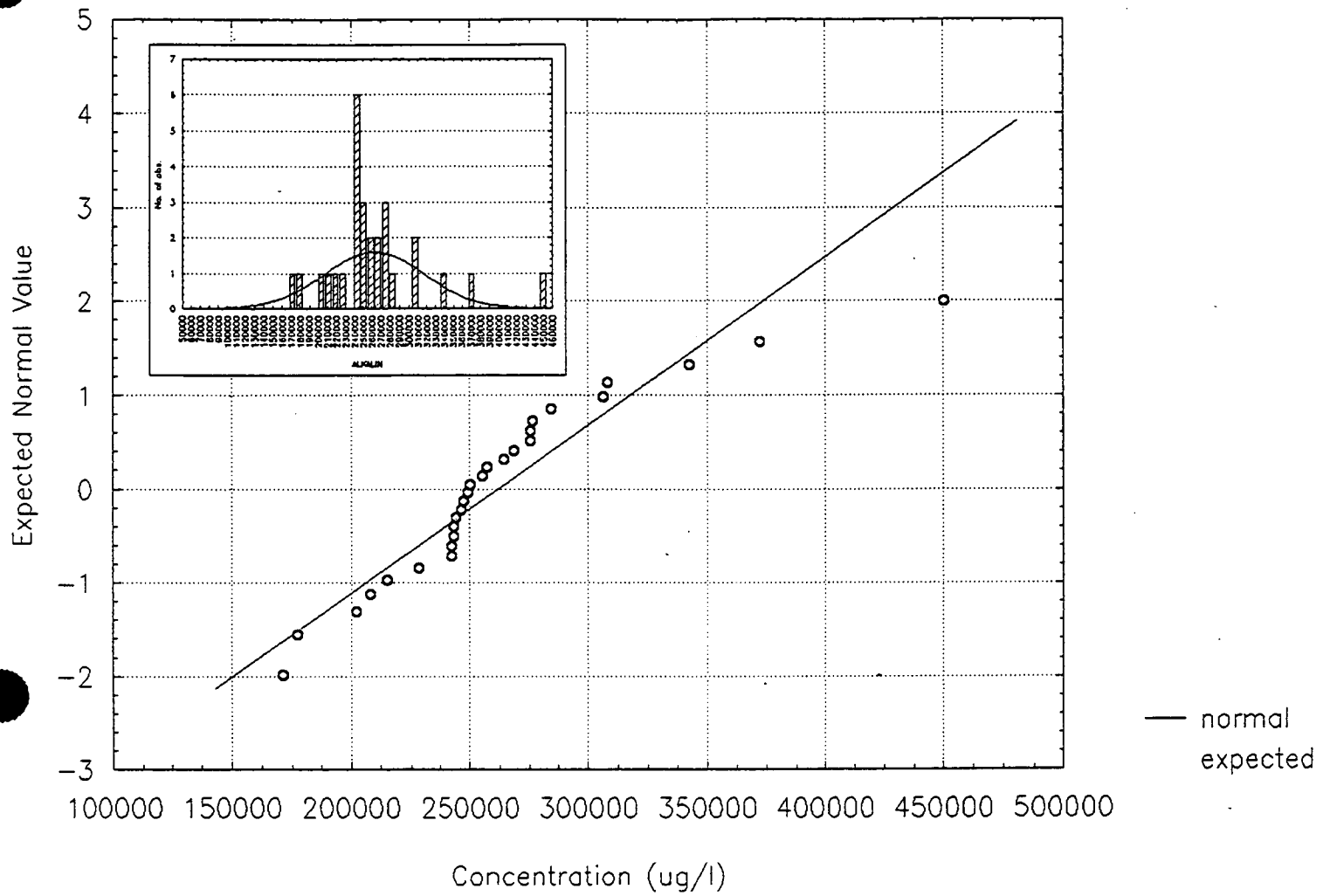


Normal Probablility Plot for the Log Base 10
Transform of Total Organic Carbon in
the Background Groundwater

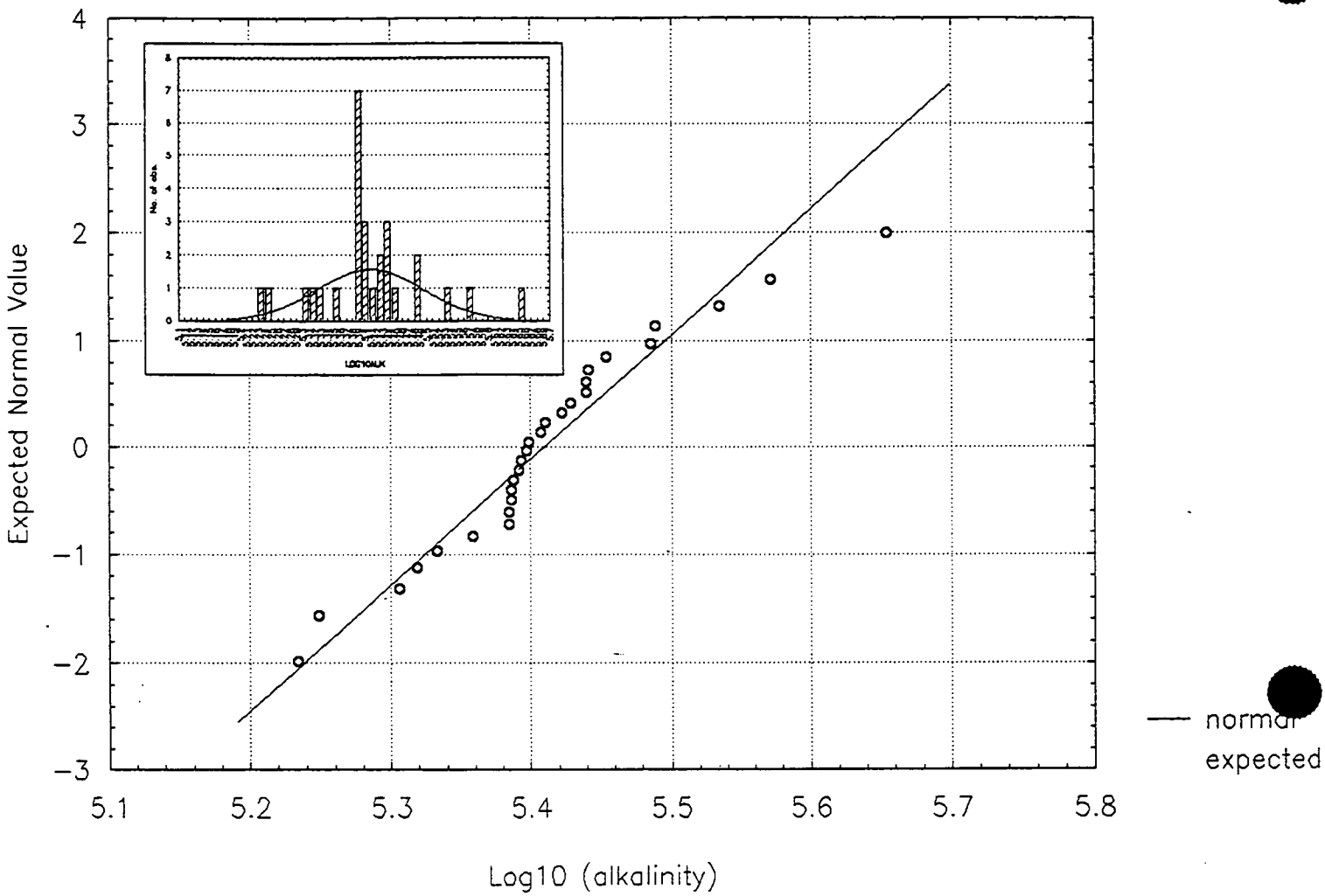


000673

Normal Probablility Plot for Alkalinity in the Background Groundwater (Reduced Data Set)

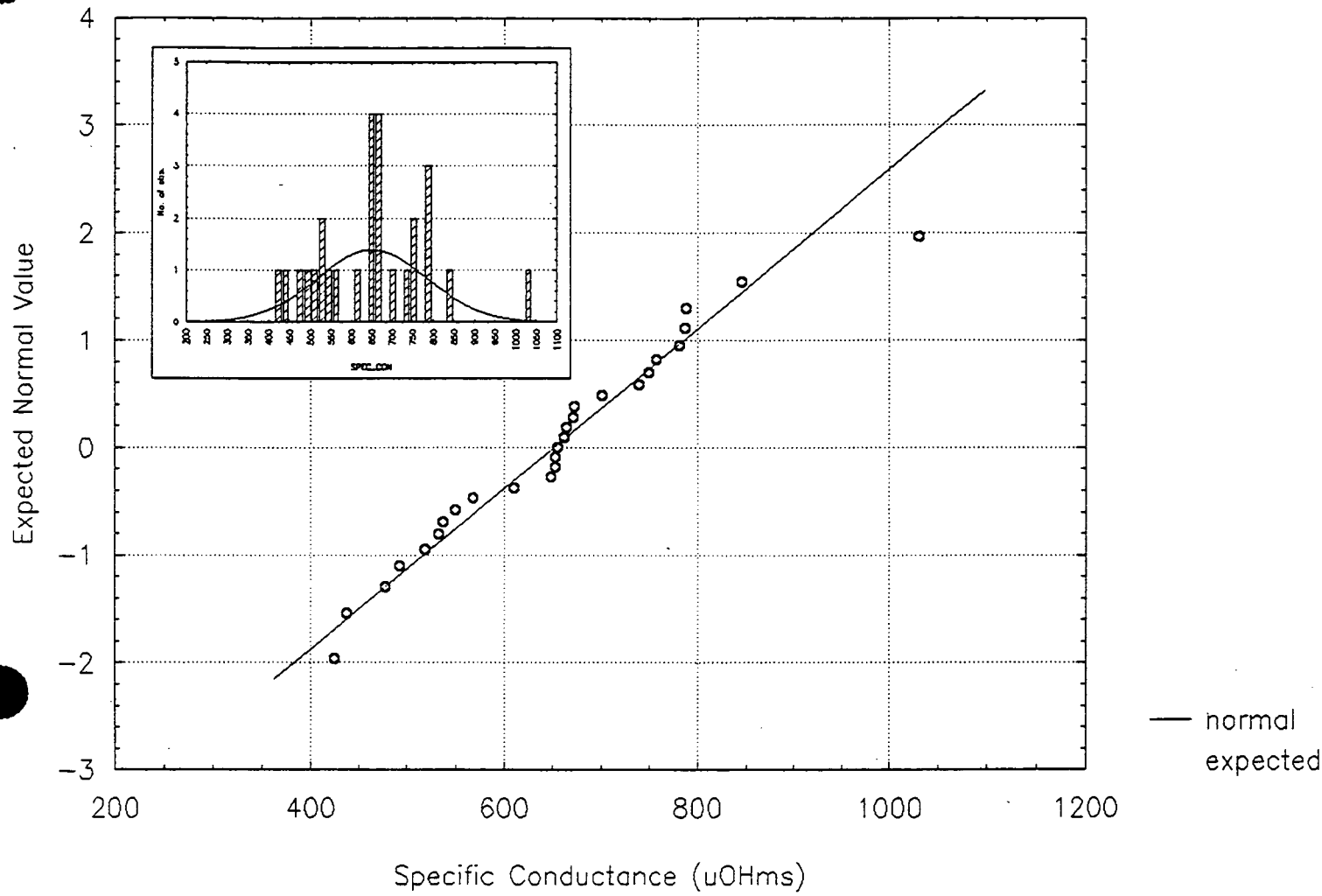


Normal Probablility Plot for the Log Base 10
Transform of Alkalinity in Background Groundwater

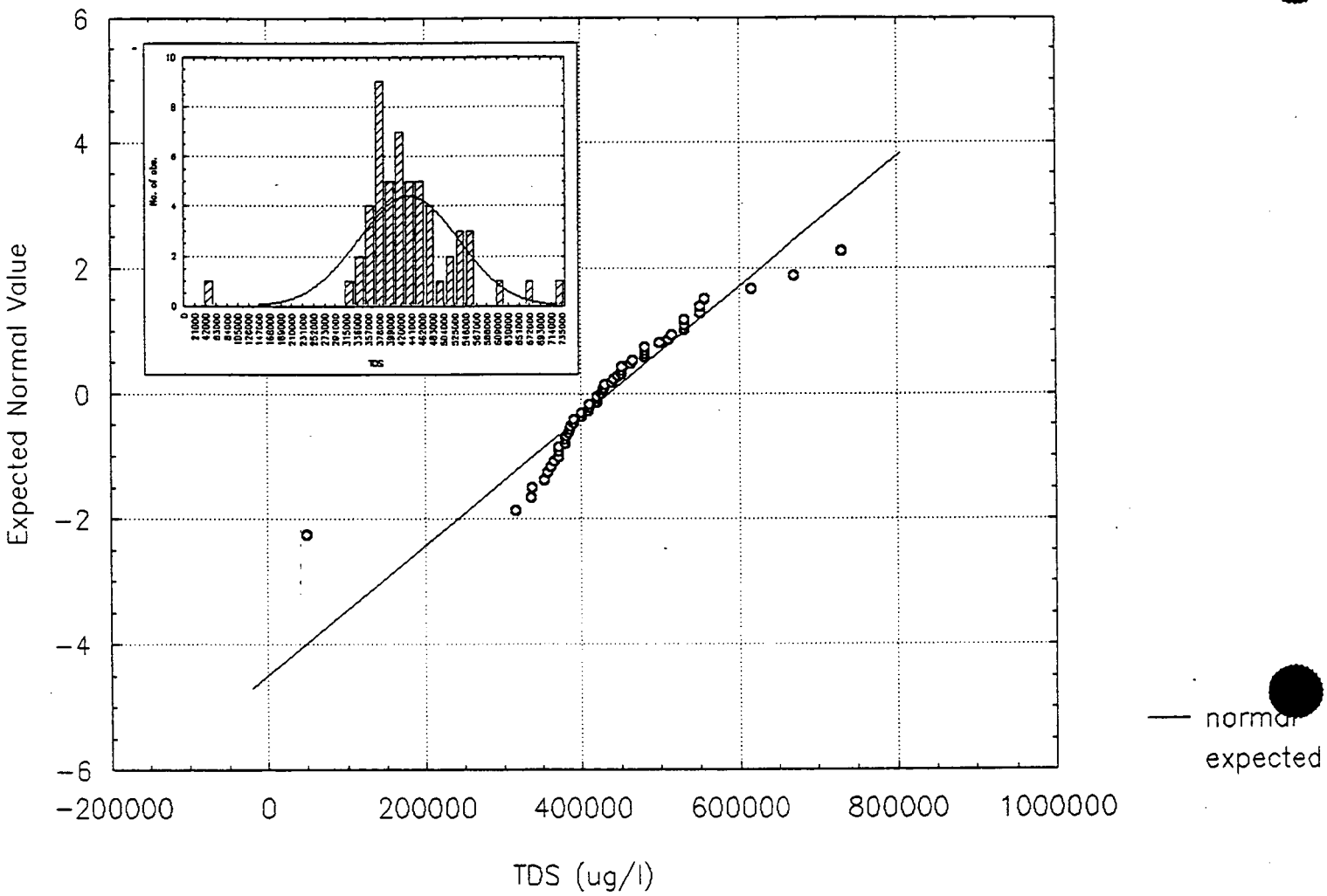


000675

Normal Probablility Plot for Specific Conductance
in Background Groundwater (Reduced Data Set)

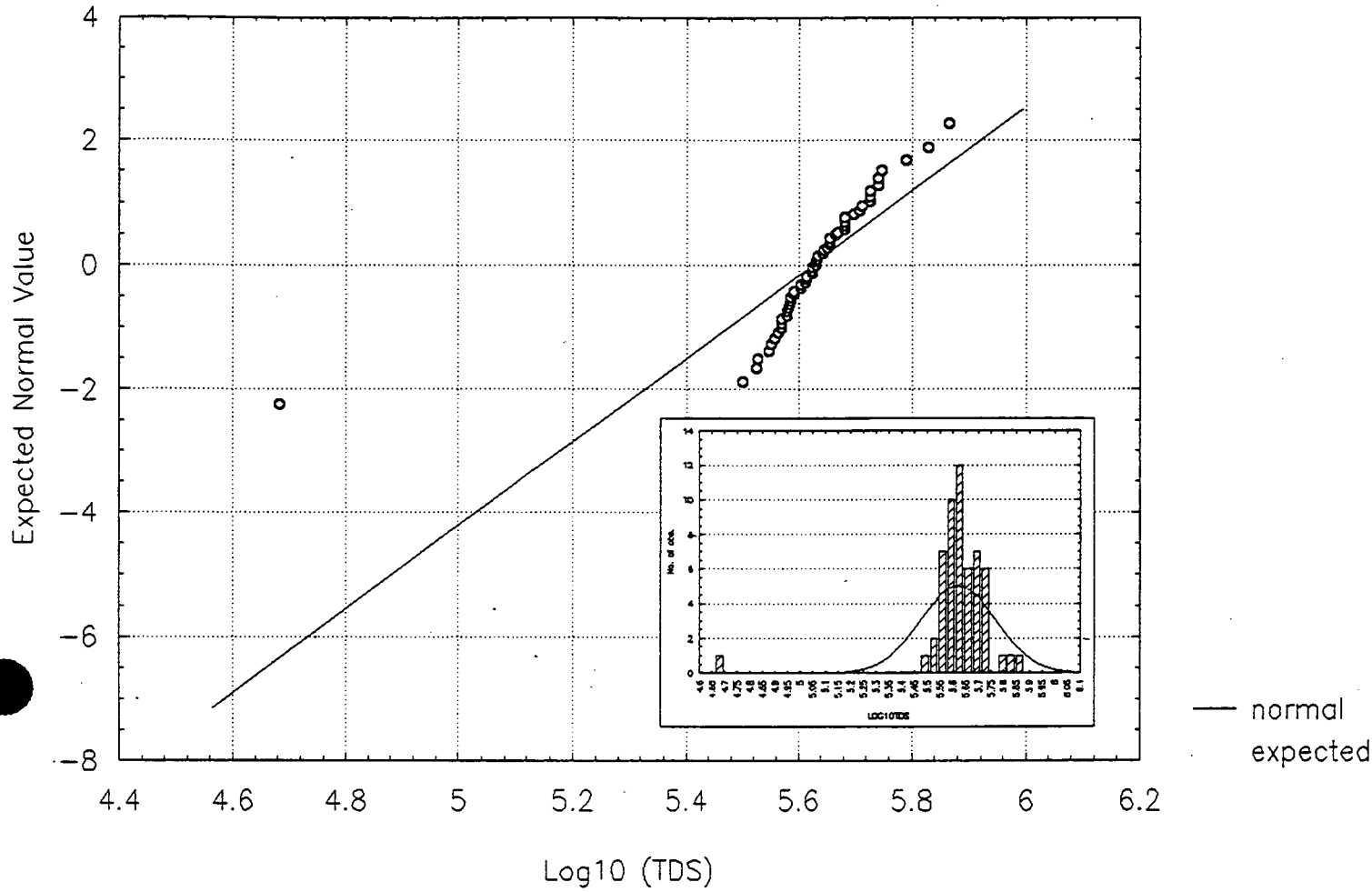


Normal Probablility Plot for Total Dissolved Solids
in Background Groundwater (Reduced Data Set)

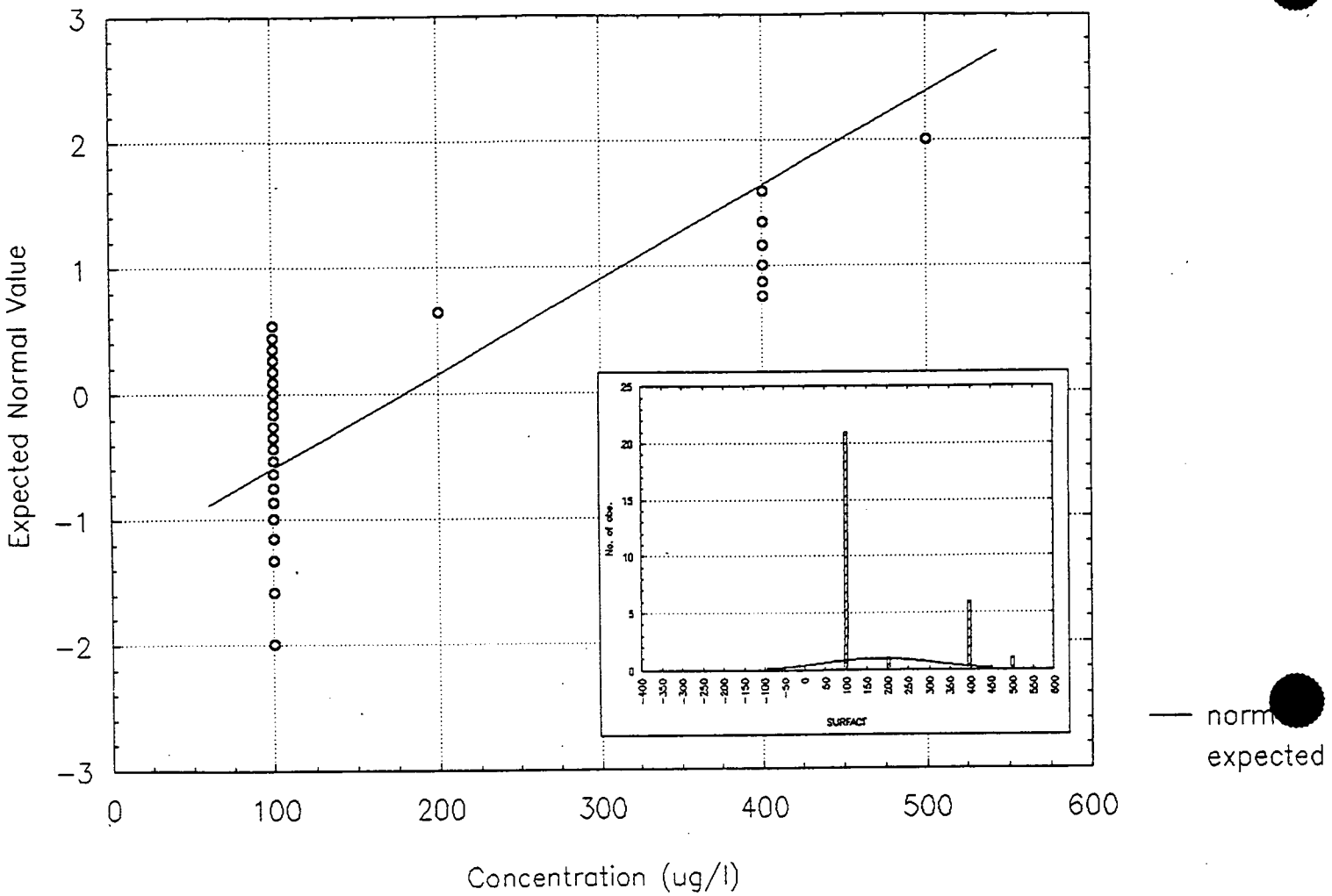


000677

Normal Probablility Plot for the Log Base 10
Transform of Total Dissolved Solids
in the Background Groundwater



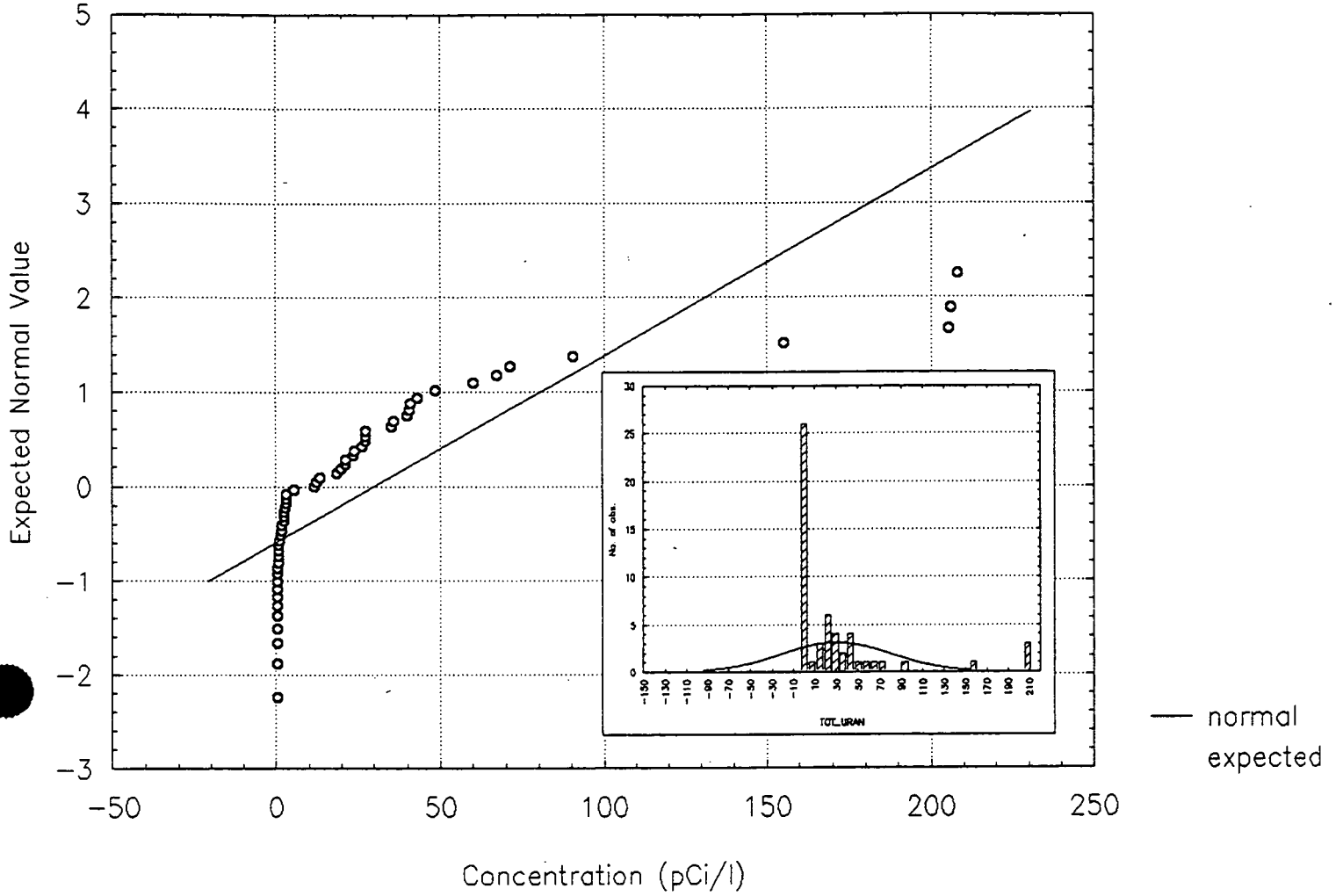
Normal Probablility Plot for Surfactants in the Background Groundwater (Reduced Data Set)



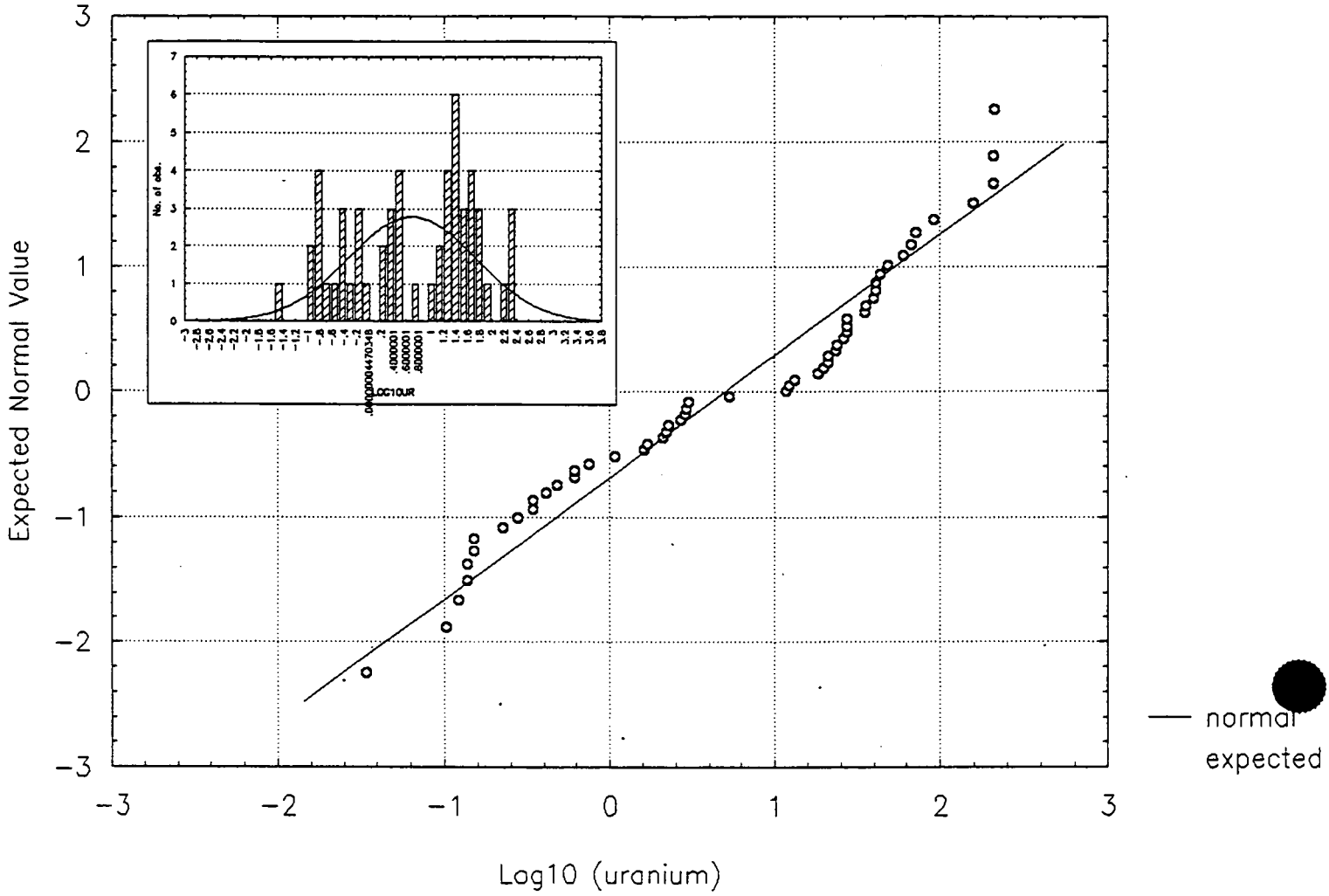
000679

RADIOLOGICAL PARAMETERS

Normal Probablility Plot for Total Uranium
in Background Groundwater

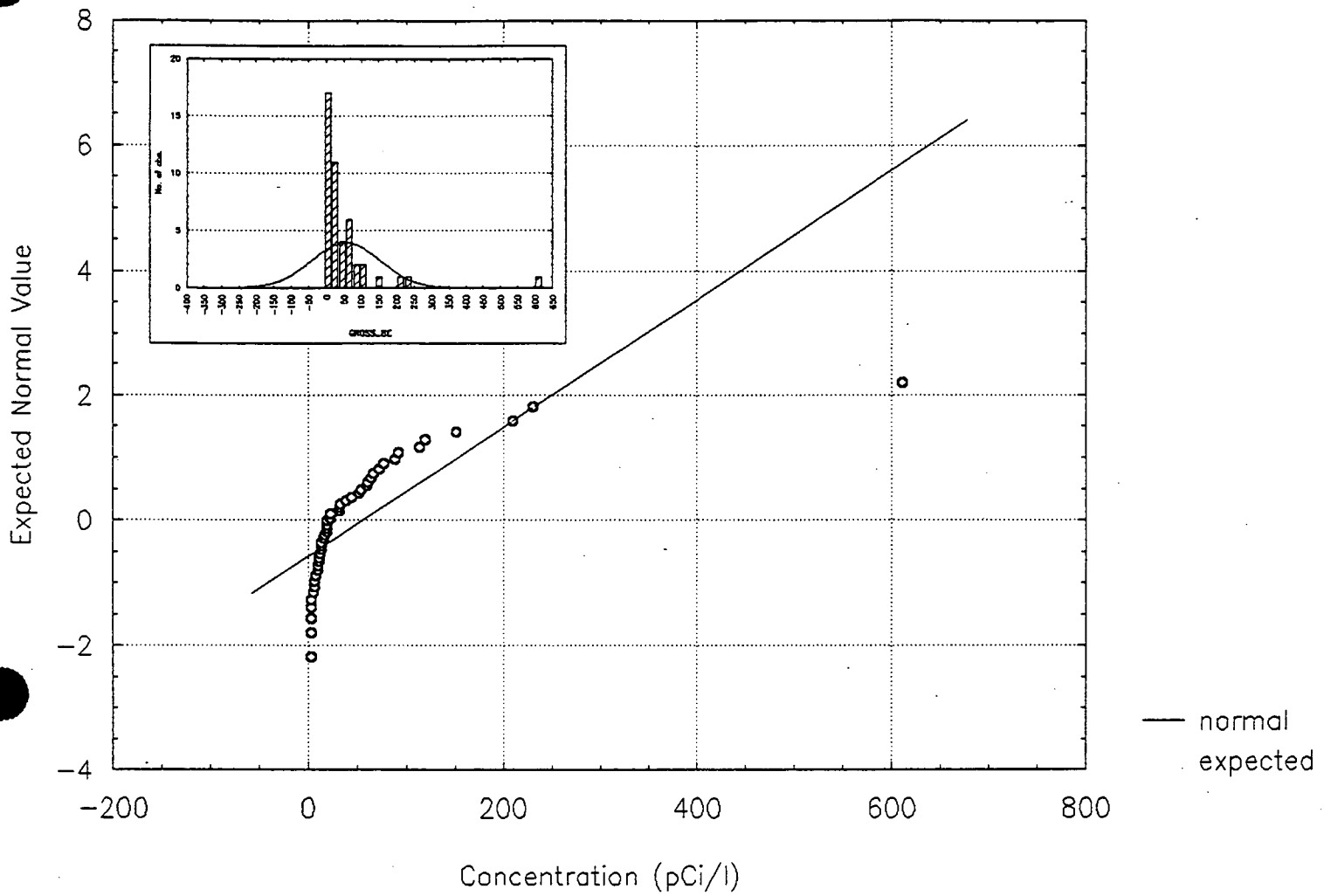


Normal Probablility Plot for the Log Base 10
Transform of Uranium in Background Groundwater

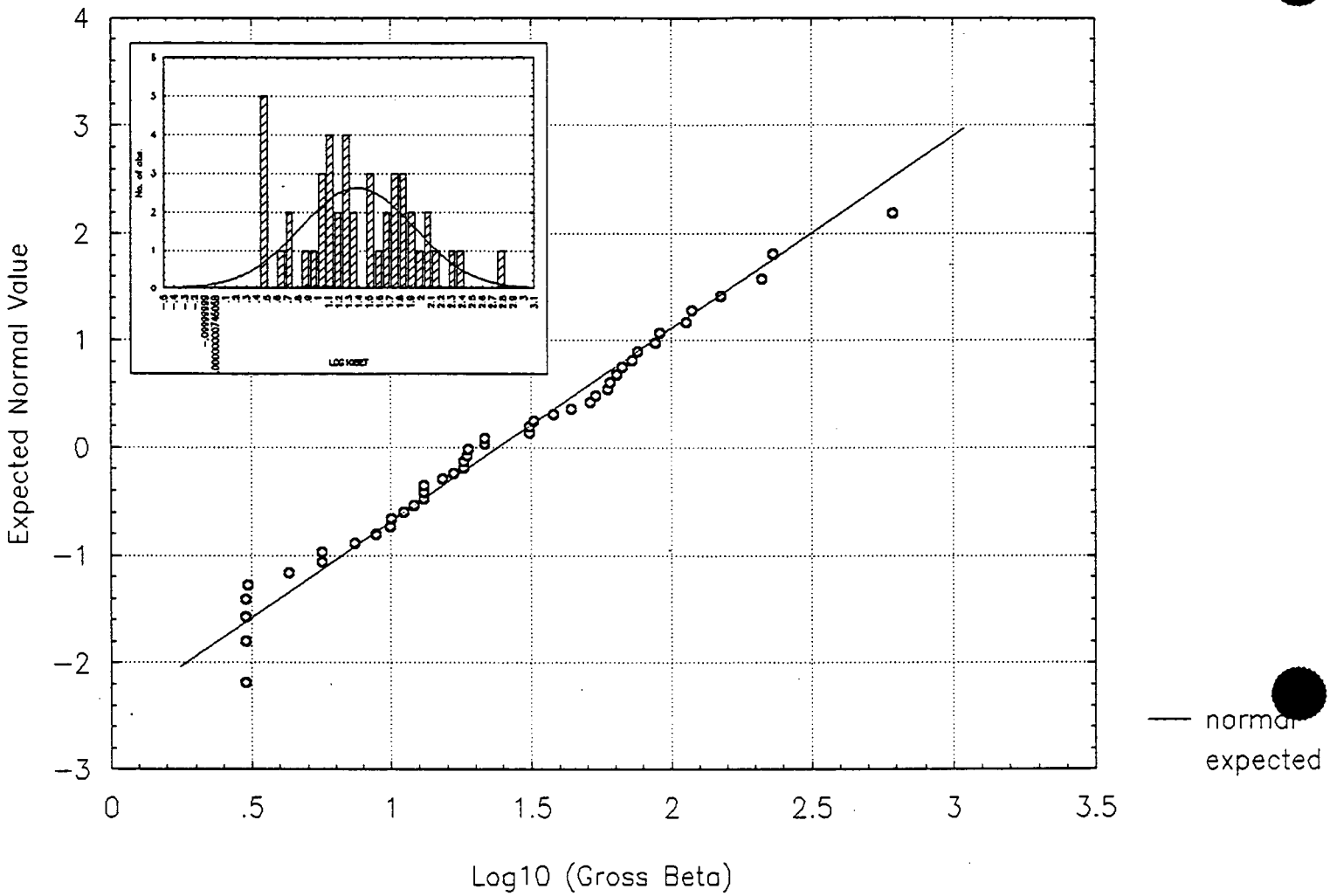


000682

Normal Probablility Plot for Gross Beta
in Background Groundwater

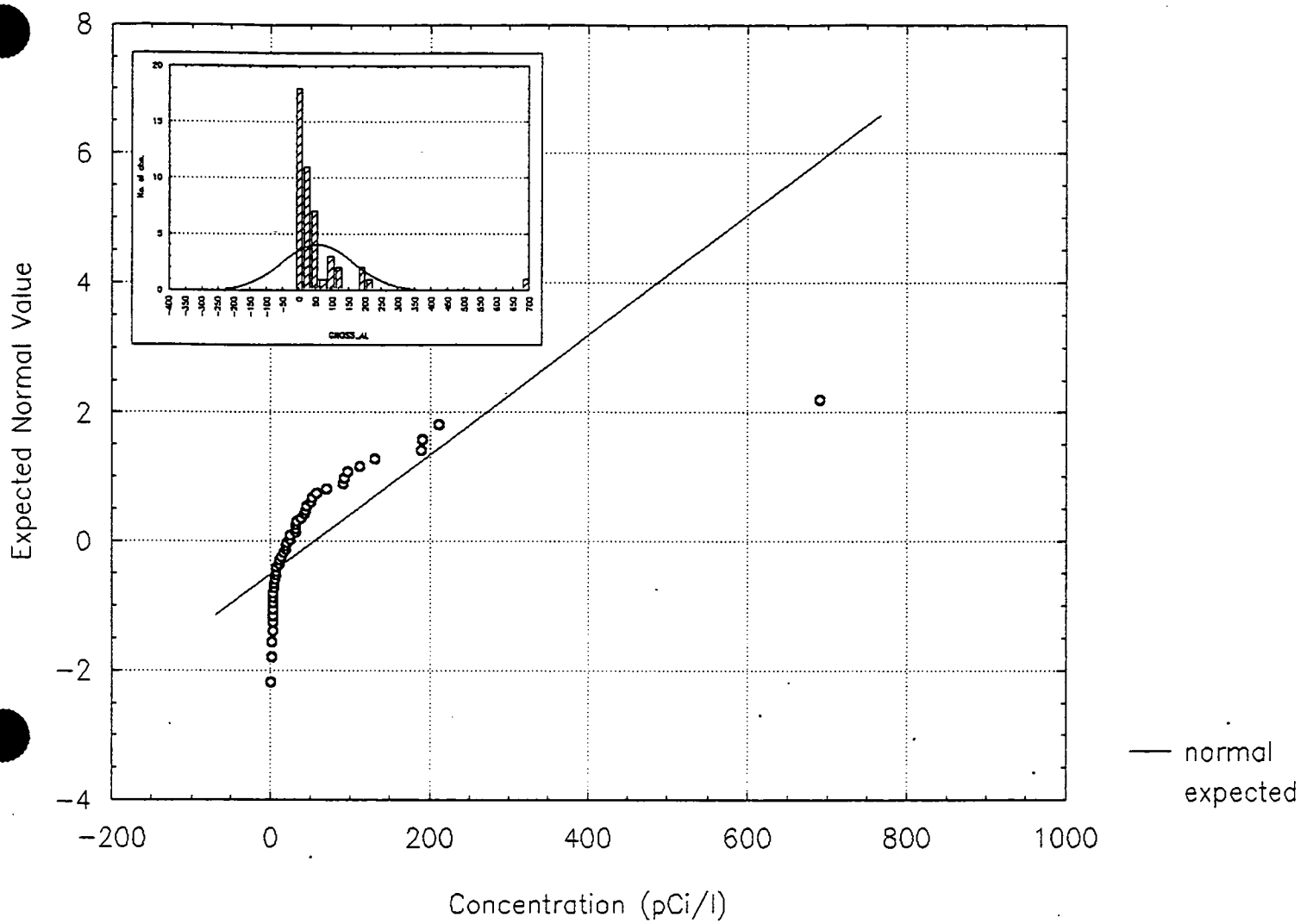


Normal Probablility Plot for the Log Base 10
Transform of Gross Beta in Background Groundwater

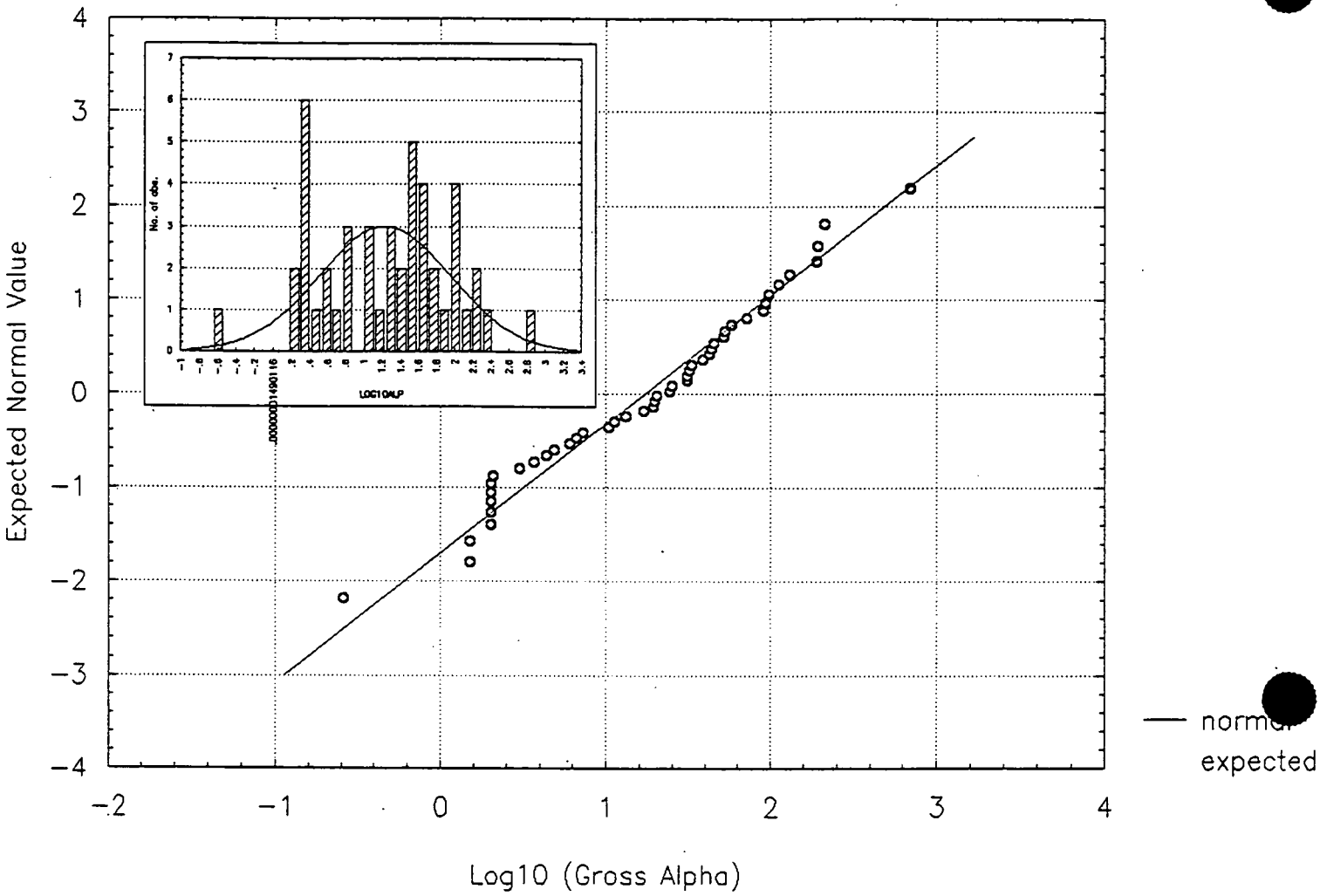


000684

Normal Probablility Plot for Gross Alpha in Background Groundwater

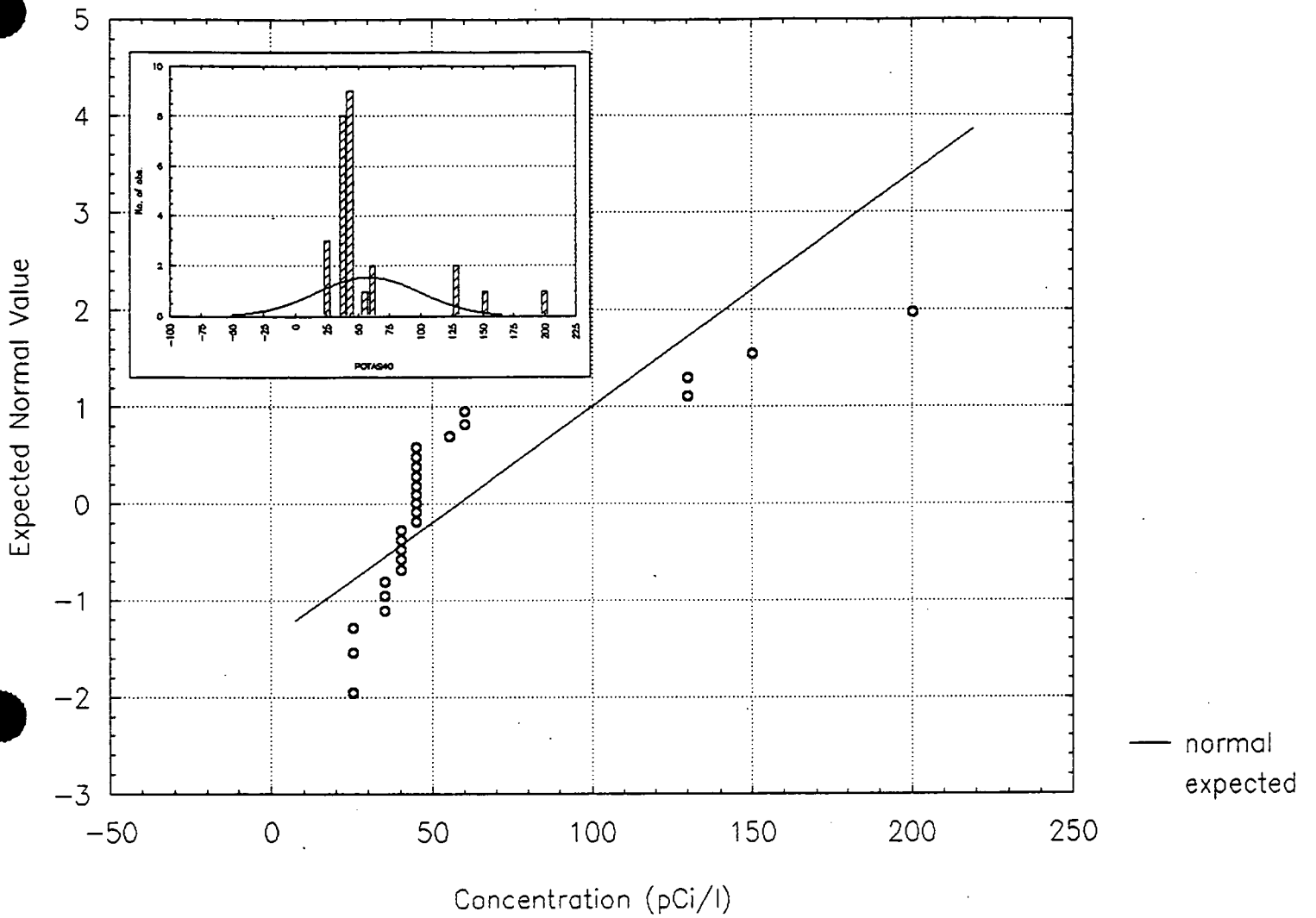


Normal Probablility Plot for the Log Base 10
Transform of Gross Alpha in Background Groundwater

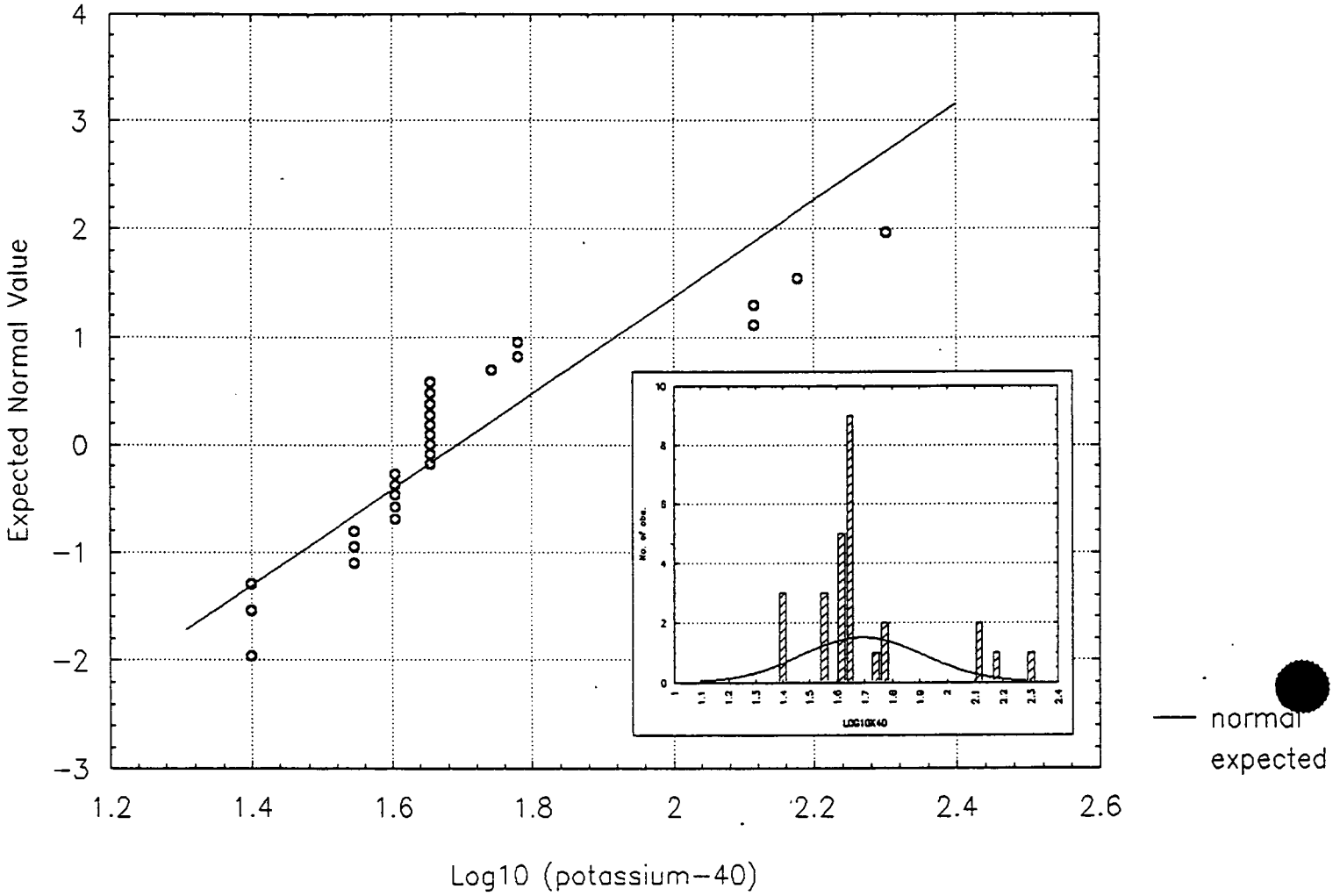


000686

Normal Probablility Plot for Potassium-40 in Background Groundwater



Normal Probablility Plot for the Log Base 10
Transform of Potassium−40 in Background Groundwater



000688

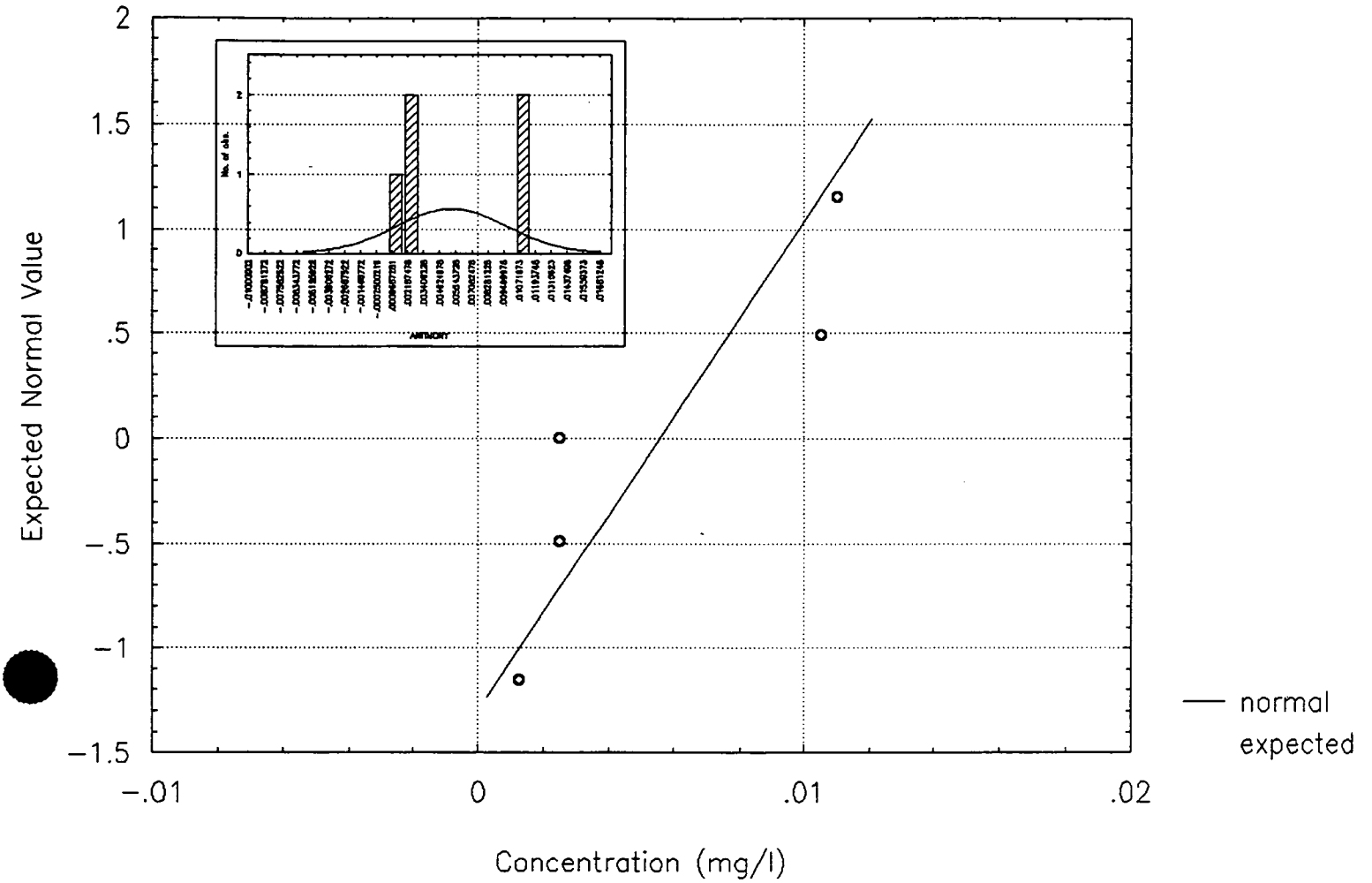
REV. 1: MAY 1994

APPENDIX G

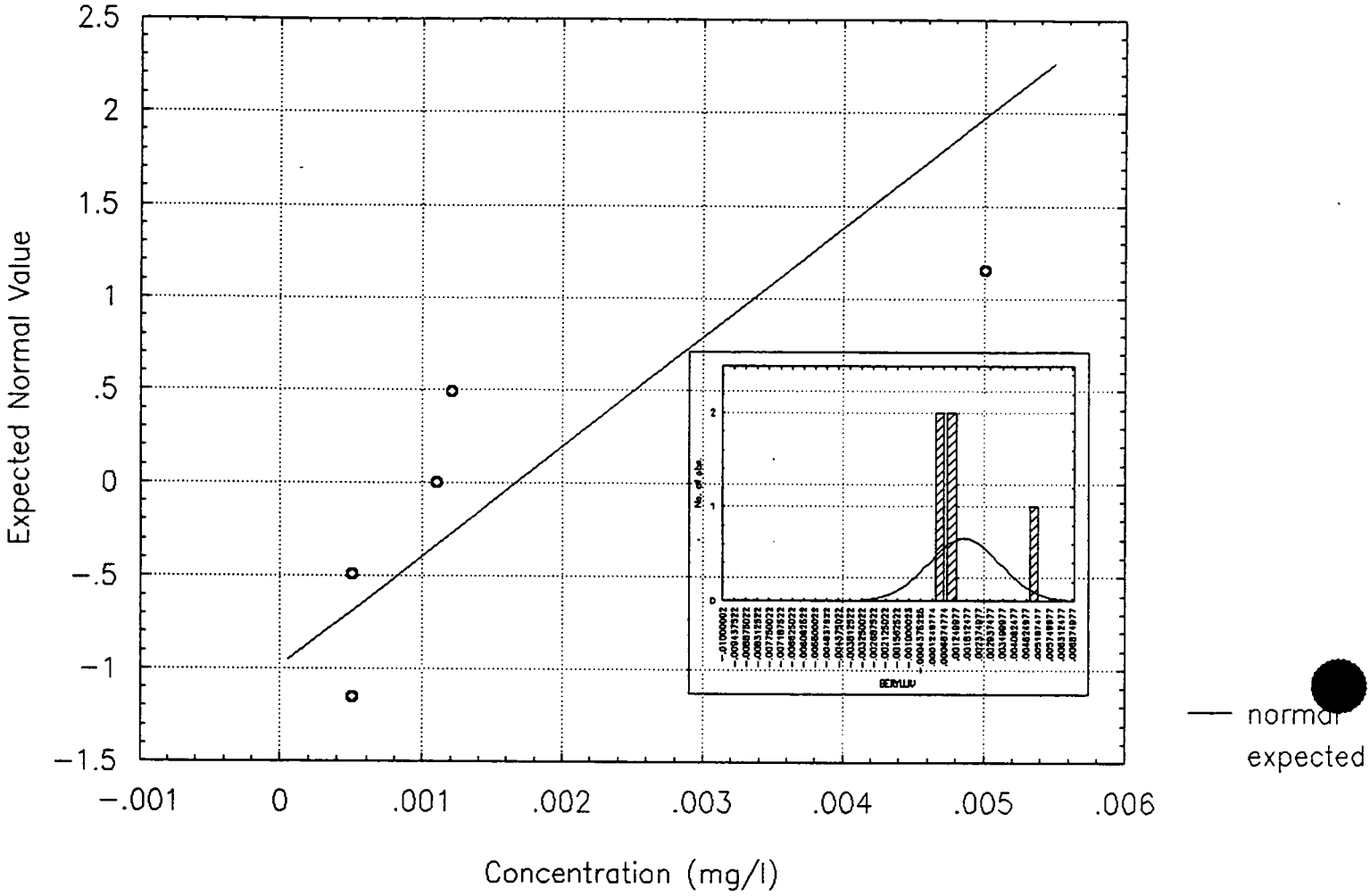
STATISTICAL EVALUATION SUMMARY - SURFACE WATER

DISSOLVED METALS

Normal Probablility Plot for
Dissolved Antimony
in Background Surface Water

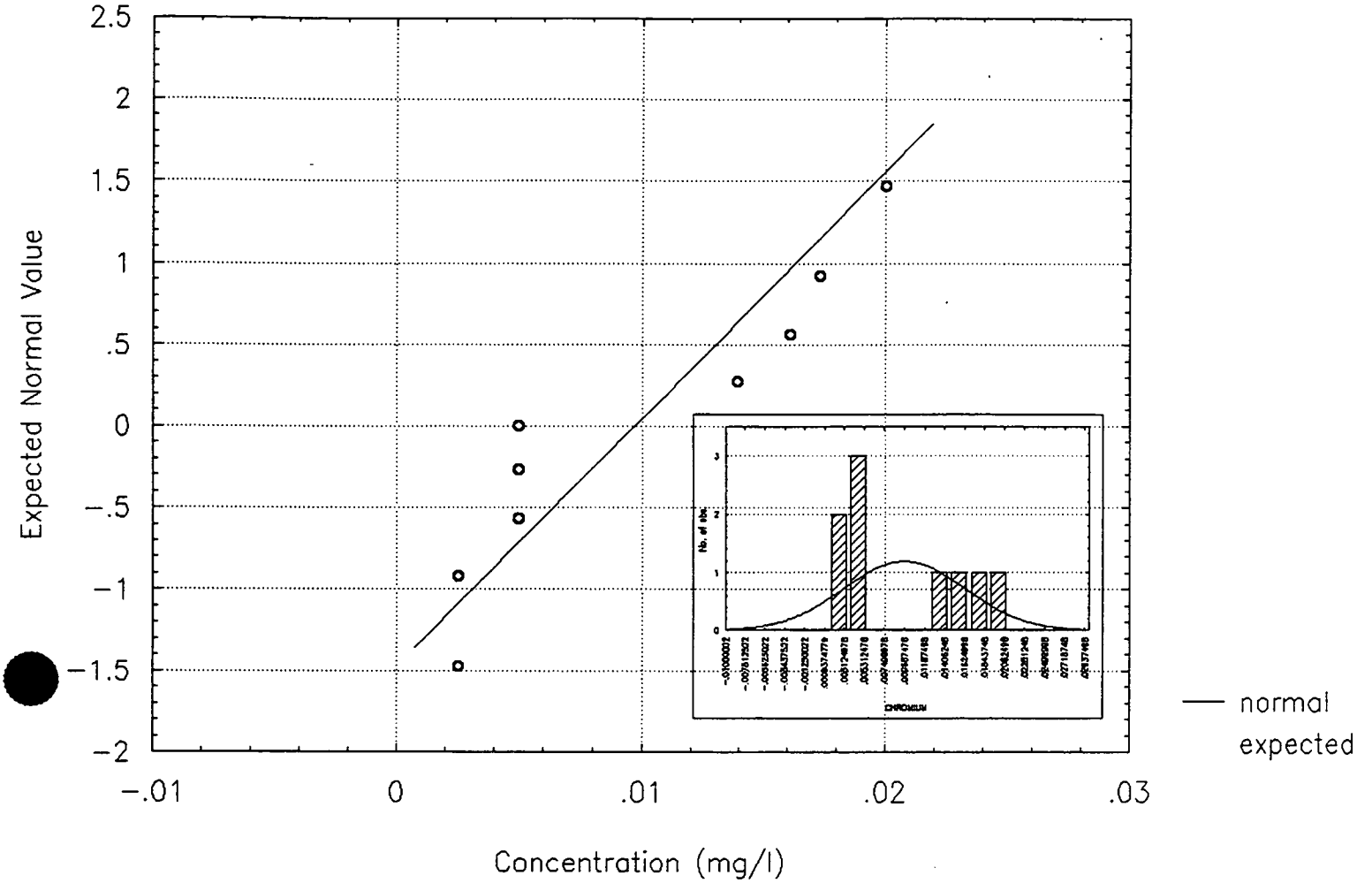


Normal Probablility Plot for
Dissolved Berylium
in Background Surface Water

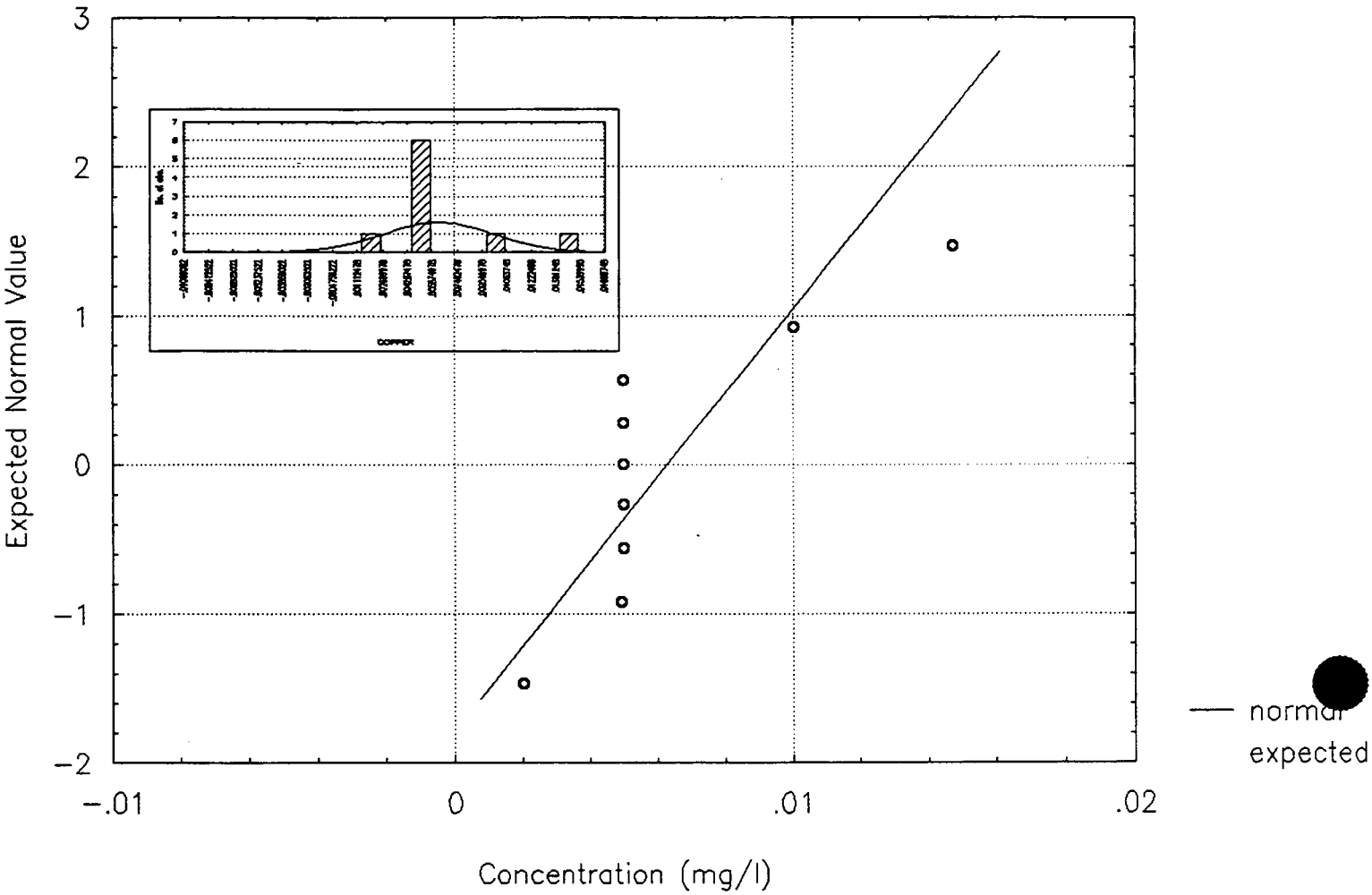


000692

Normal Probablility Plot for
Dissolved Chromium
in Background Surface Water

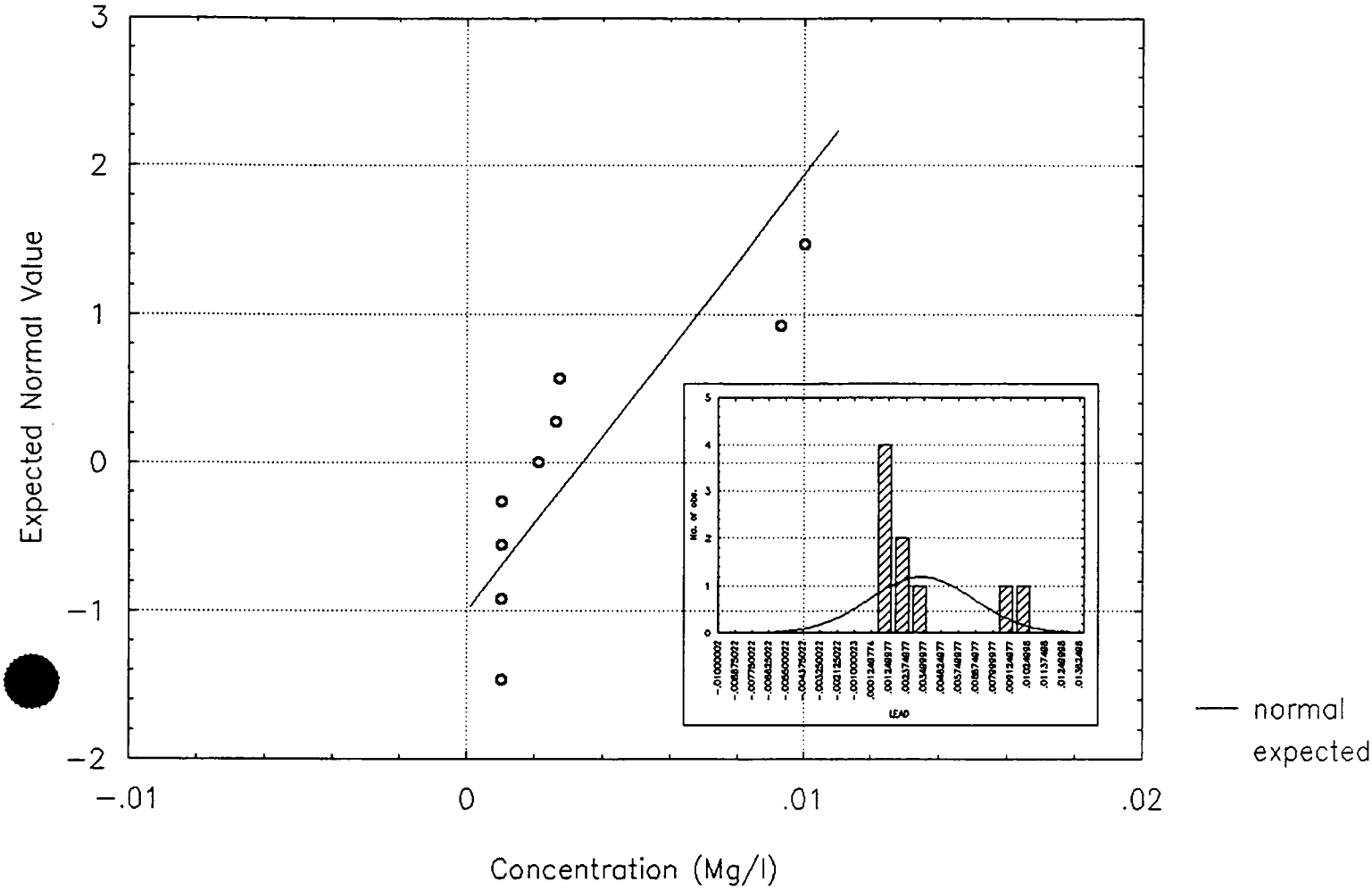


Normal Probablility Plot for
Dissolved Copper
in Background Surface Water

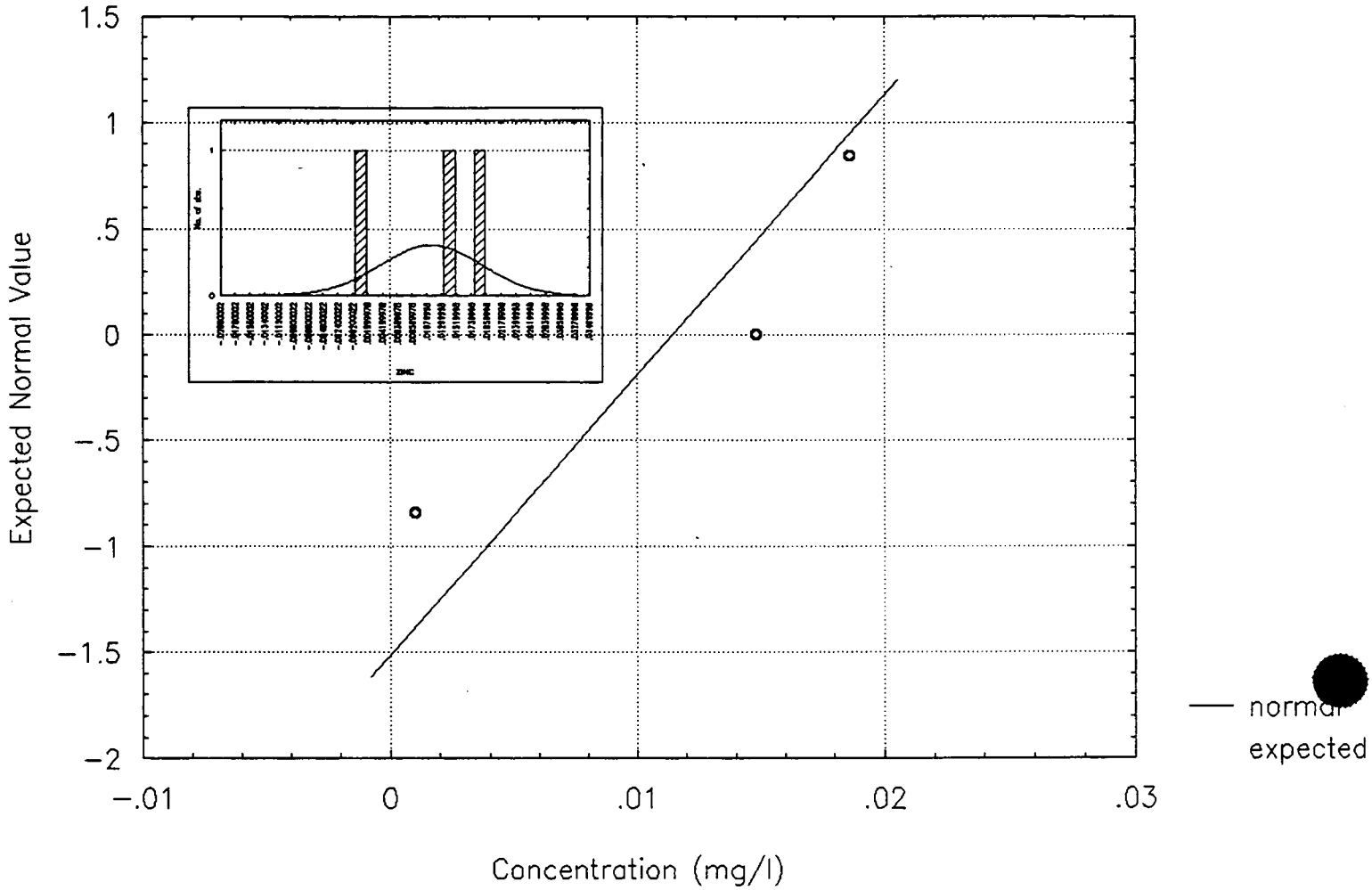


000694

Normal Probablility Plot for
Dissolved Lead
in Background Surface Water

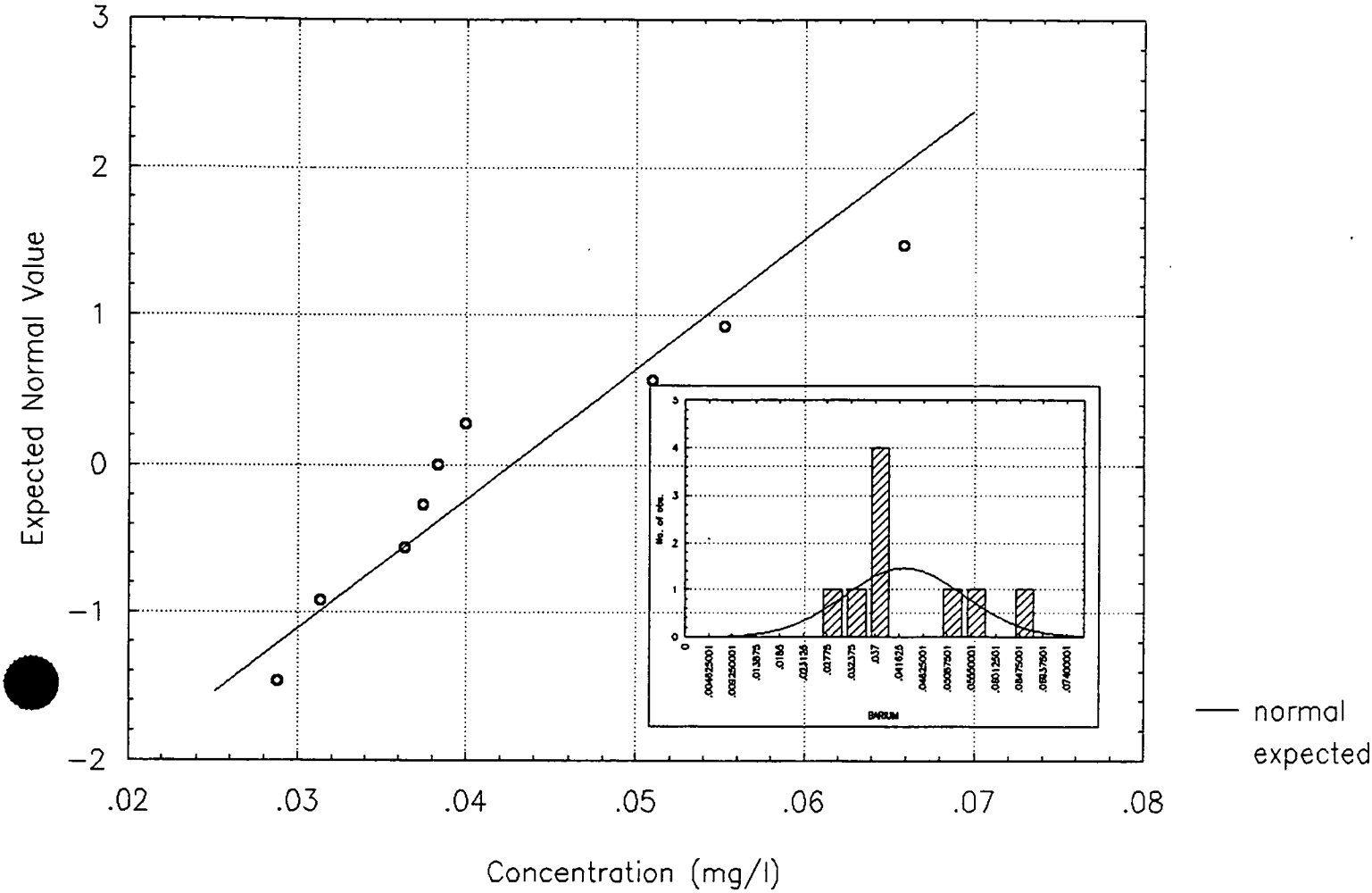


Normal Probablility Plot for
Dissolved Zinc
in Background Surface Water

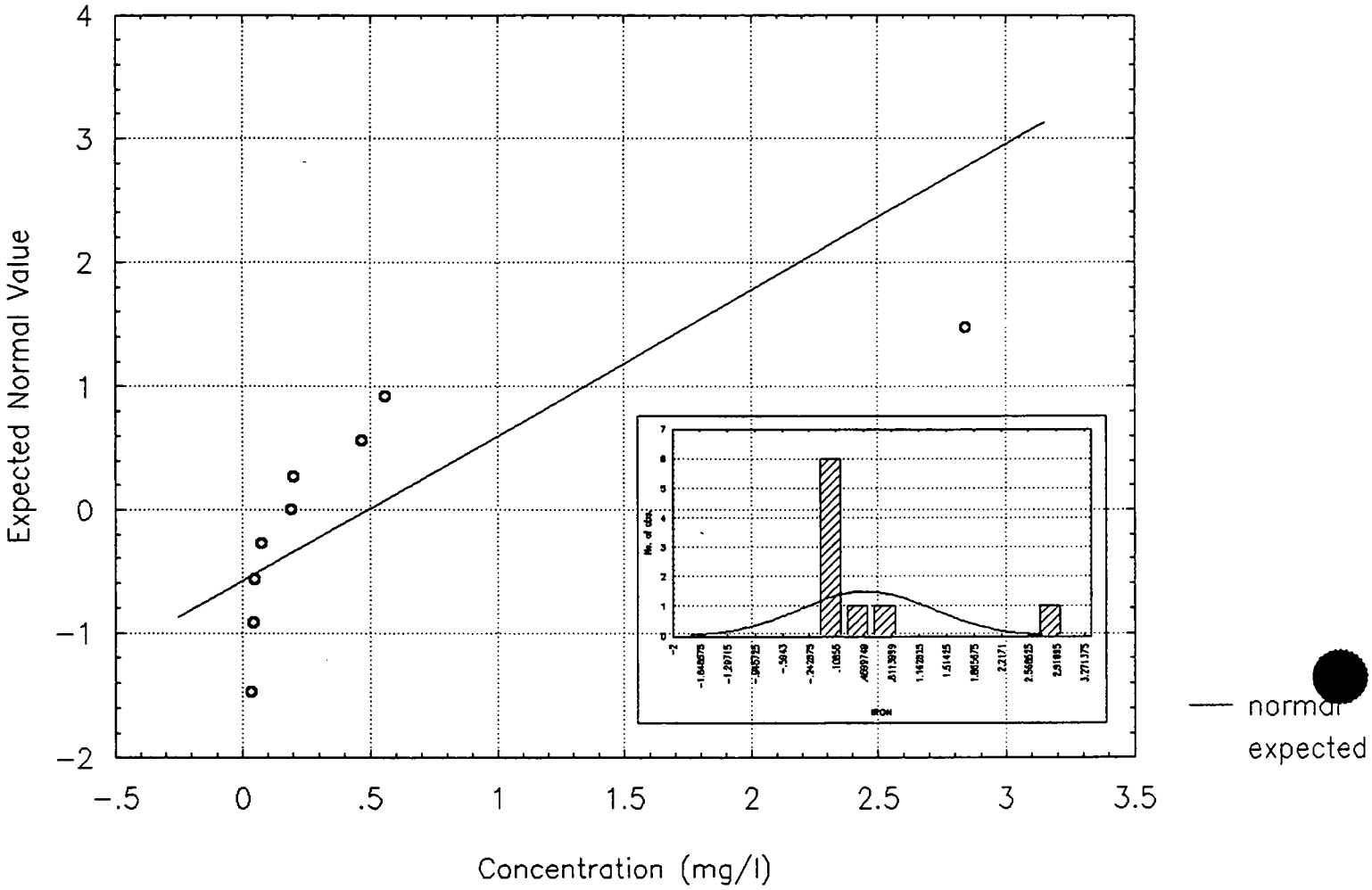


000696

Normal Probablility Plot for
Dissolved Barium
in Background Surface Water

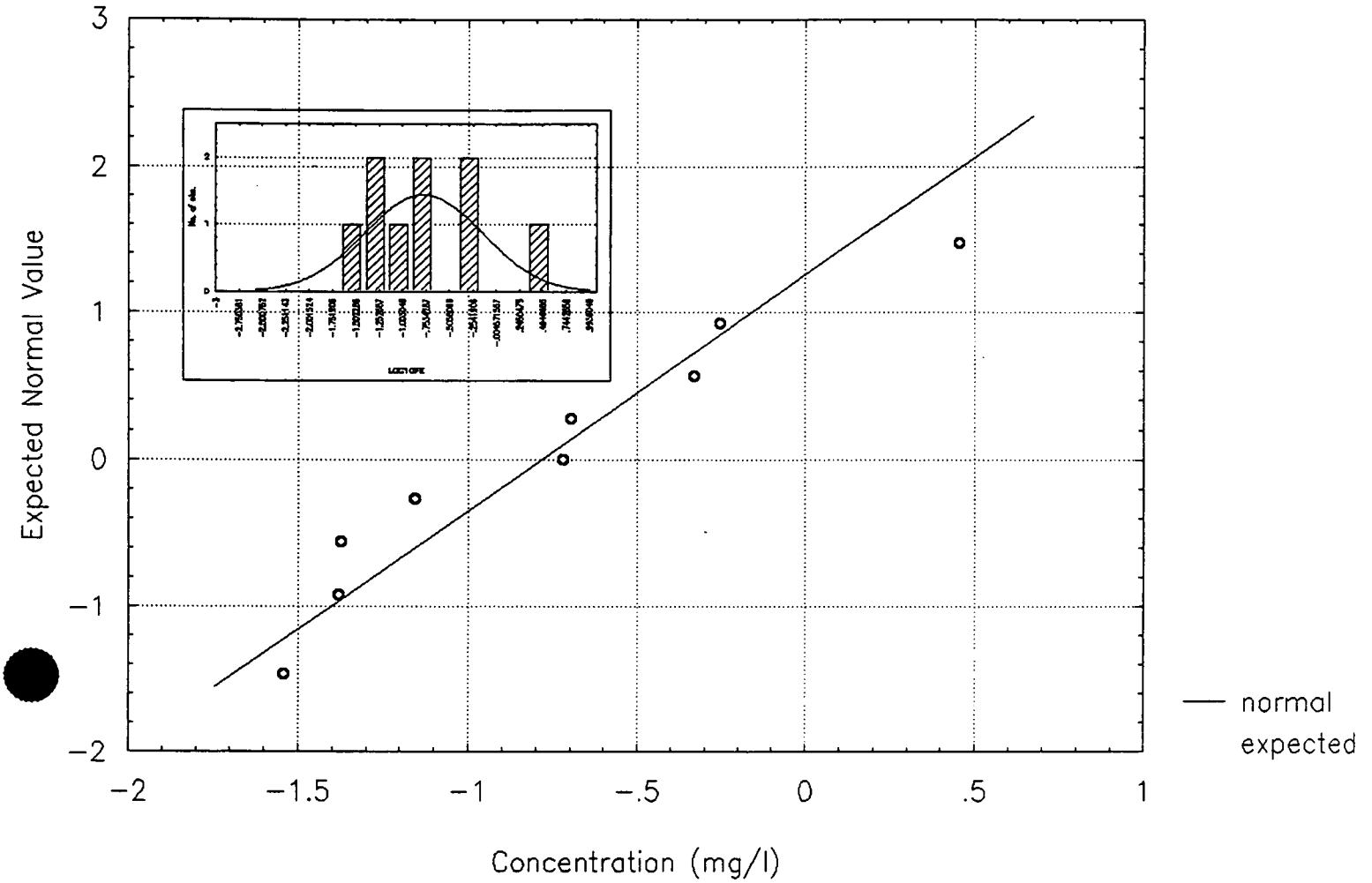


Normal Probablility Plot for
Dissolved Iron
in Background Surface Water

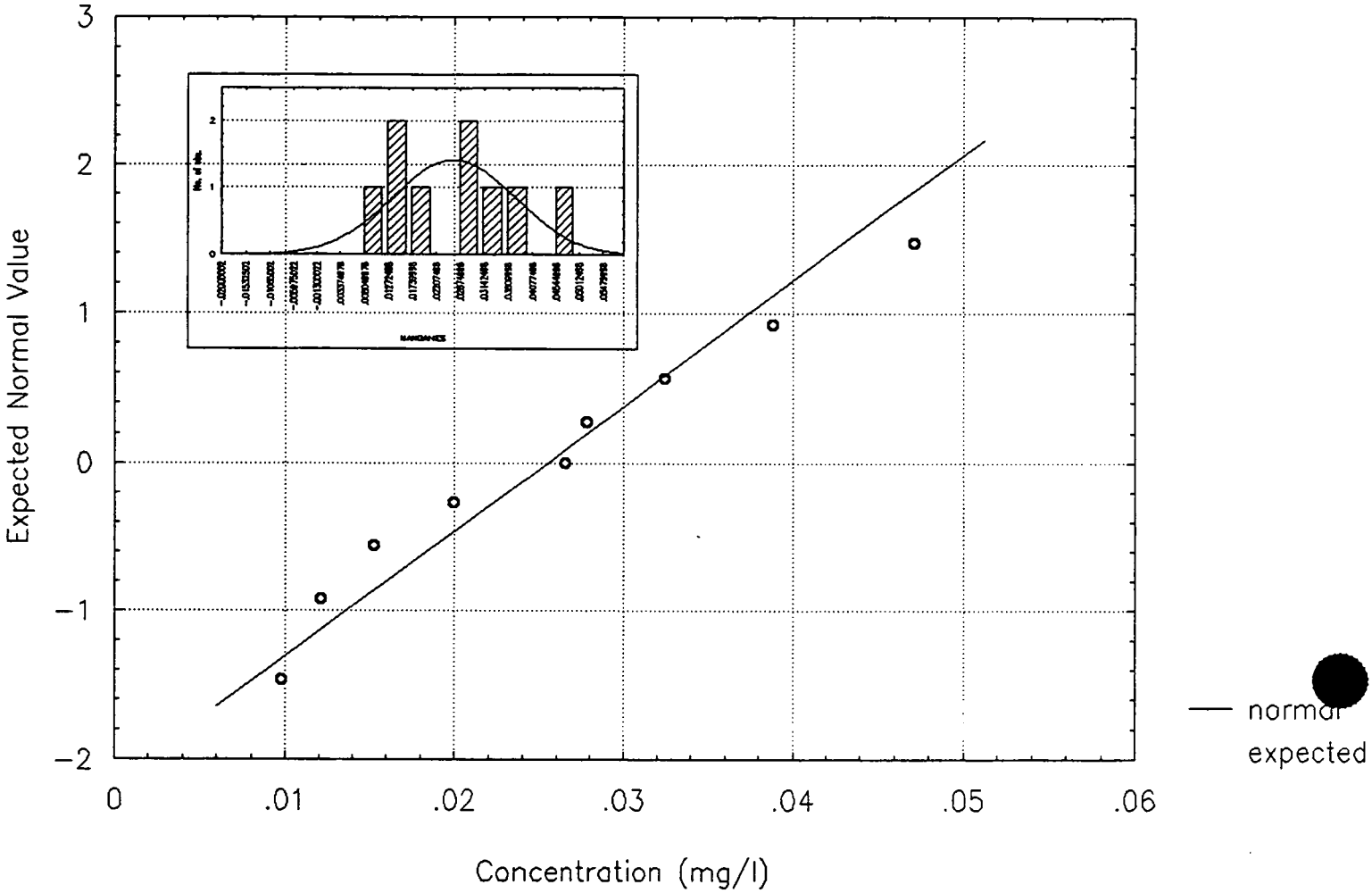


000698

Normal Probablility Plot for
Log Base 10 Dissolved Iron
in Background Surface Water

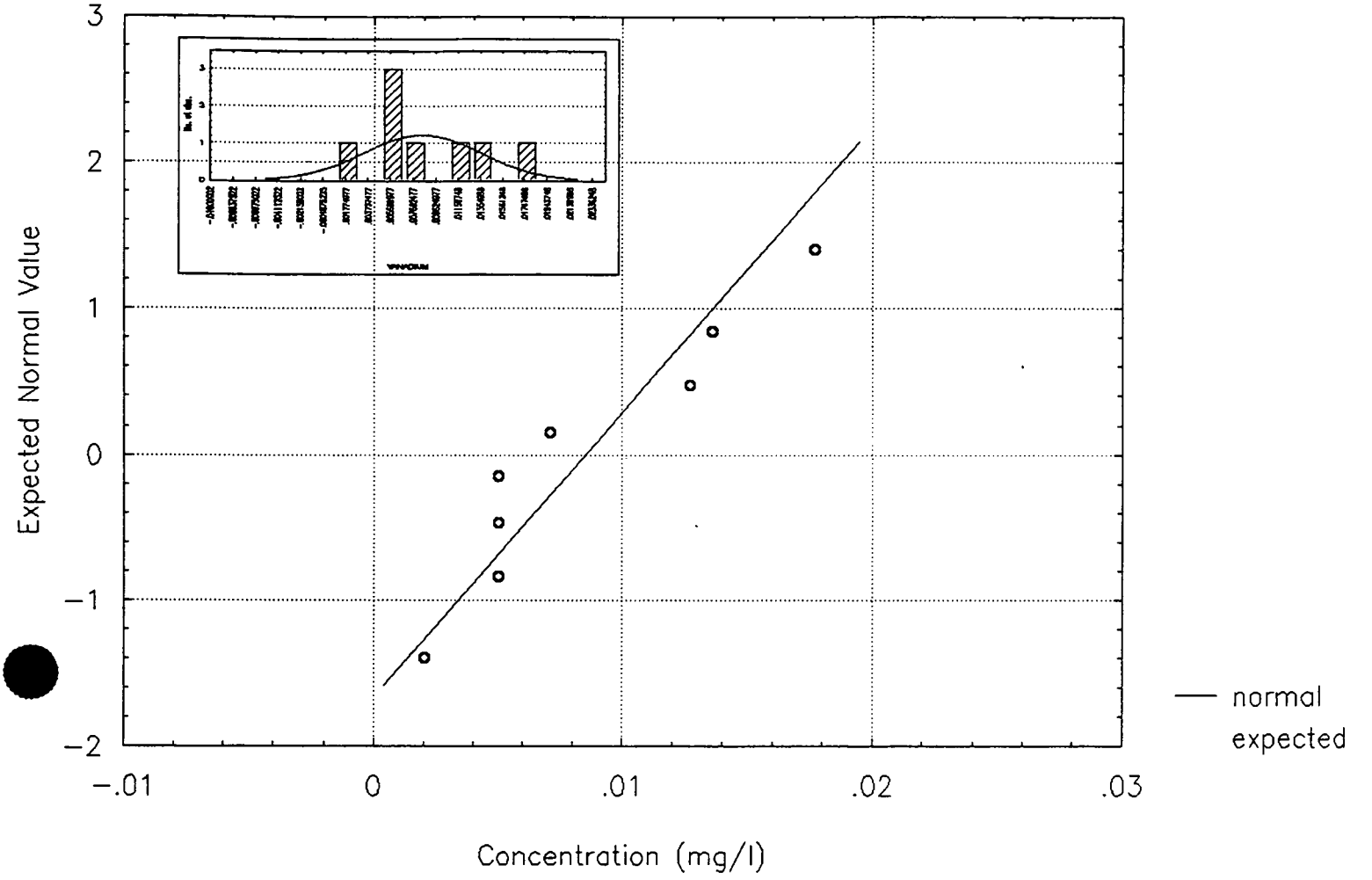


Normal Probablility Plot for
Dissolved Manganese
in Background Surface Water

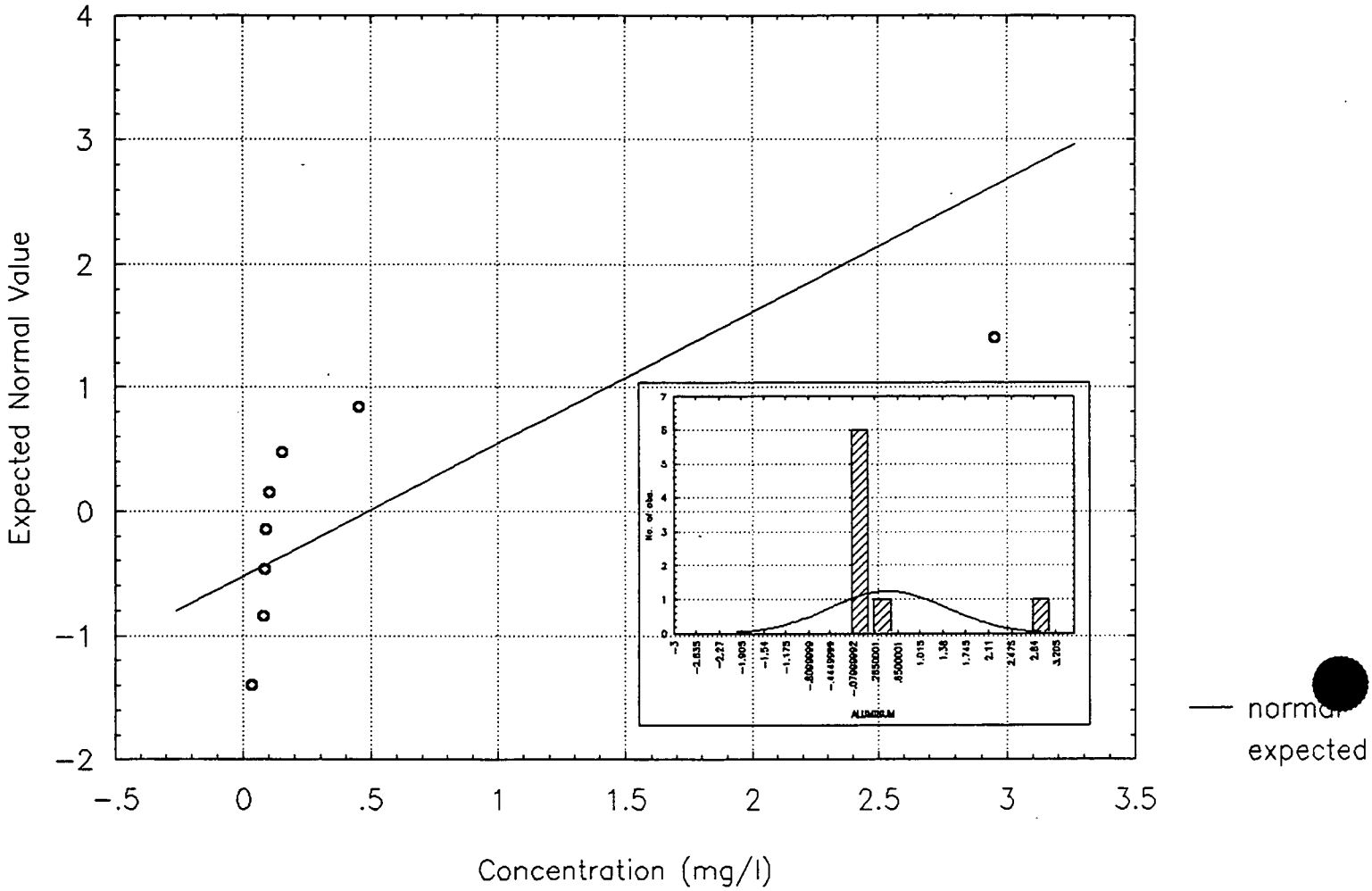


000700

Normal Probablility Plot for
Dissolved Vanadium
in Background Surface Water

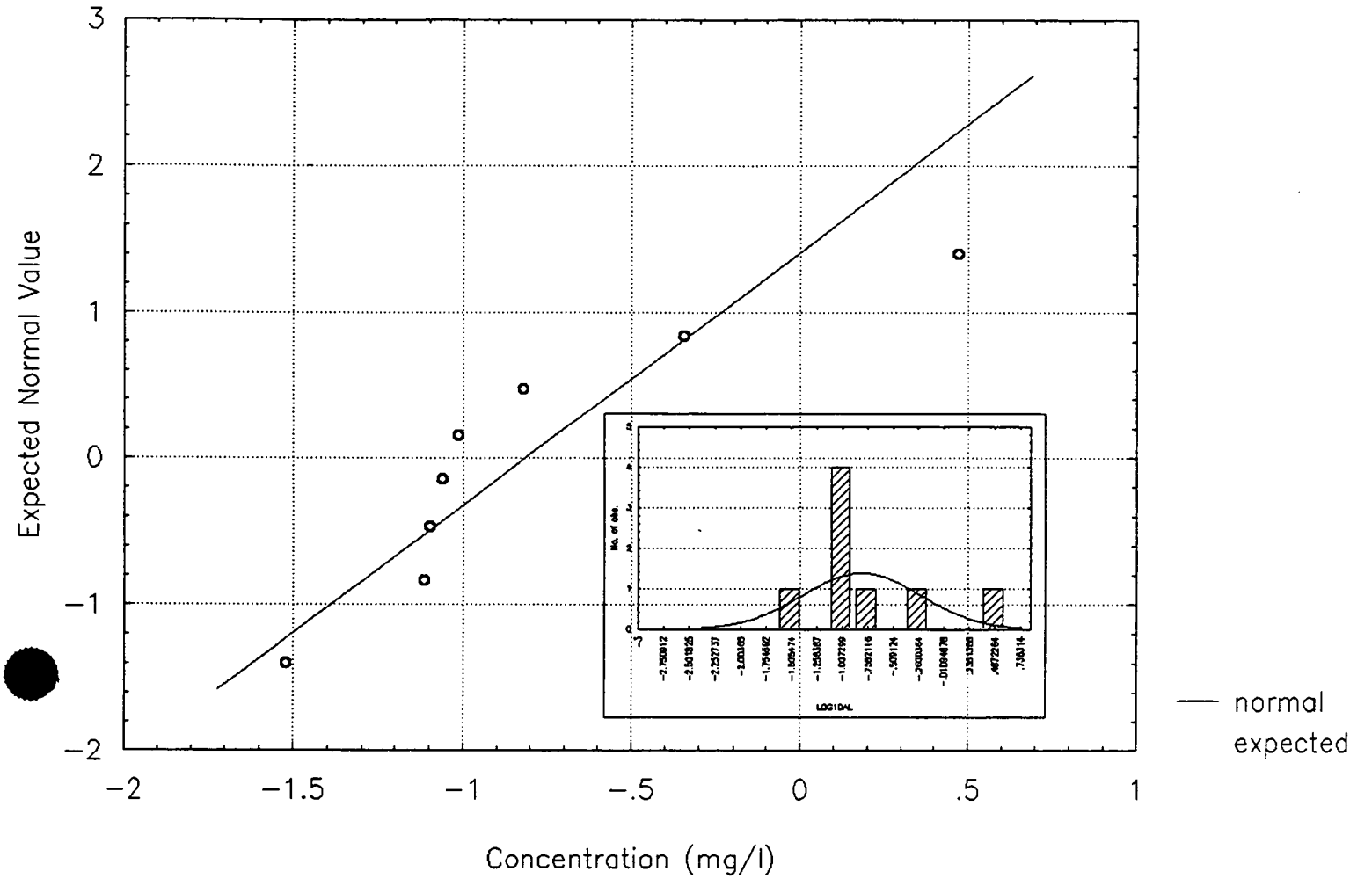


Normal Probablility Plot for
Dissolved Aluminum
in Background Surface Water

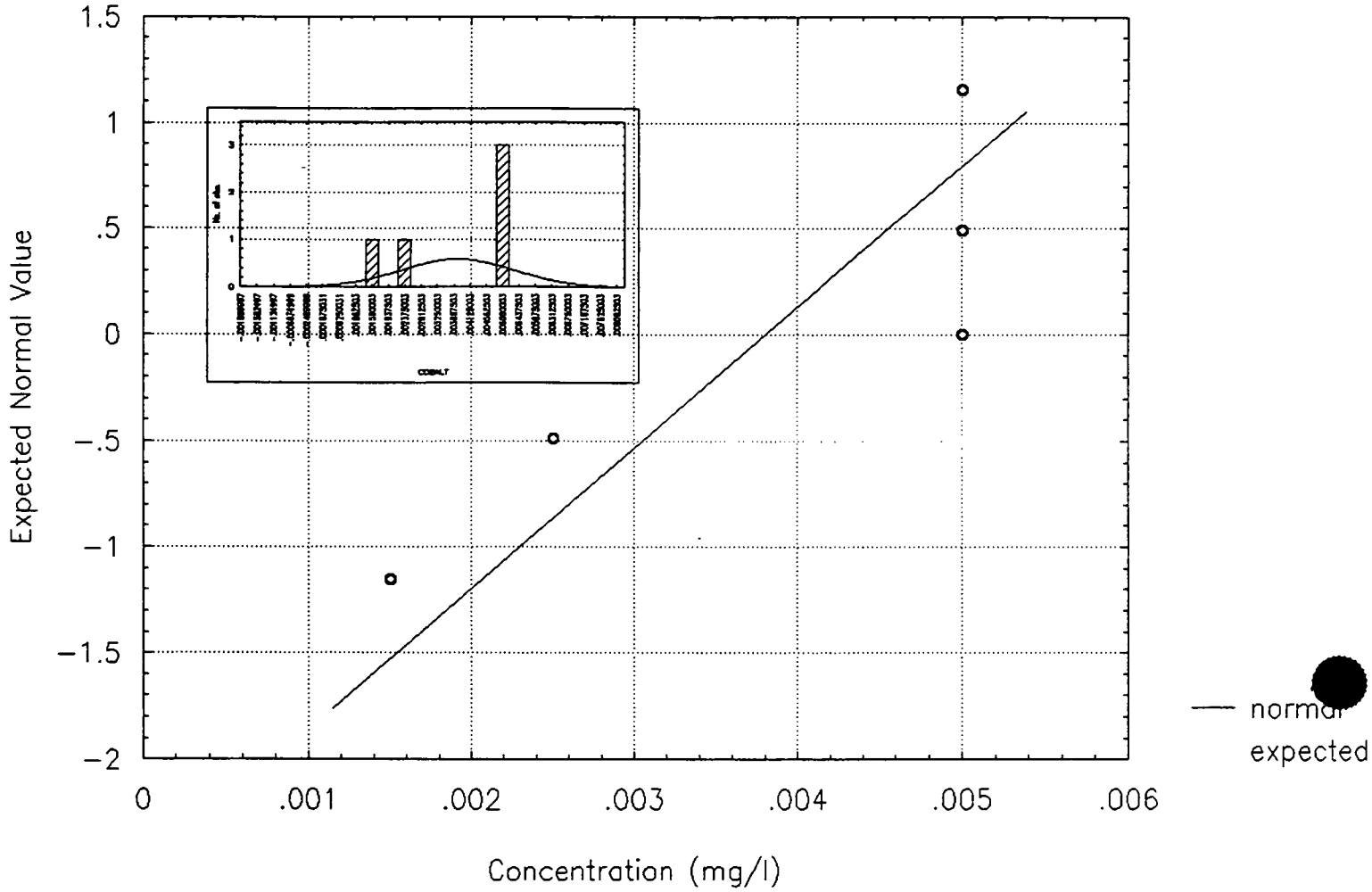


000702

Normal Probablility Plot for
Log 10 Dissolved Aluminum
in background Surface Water

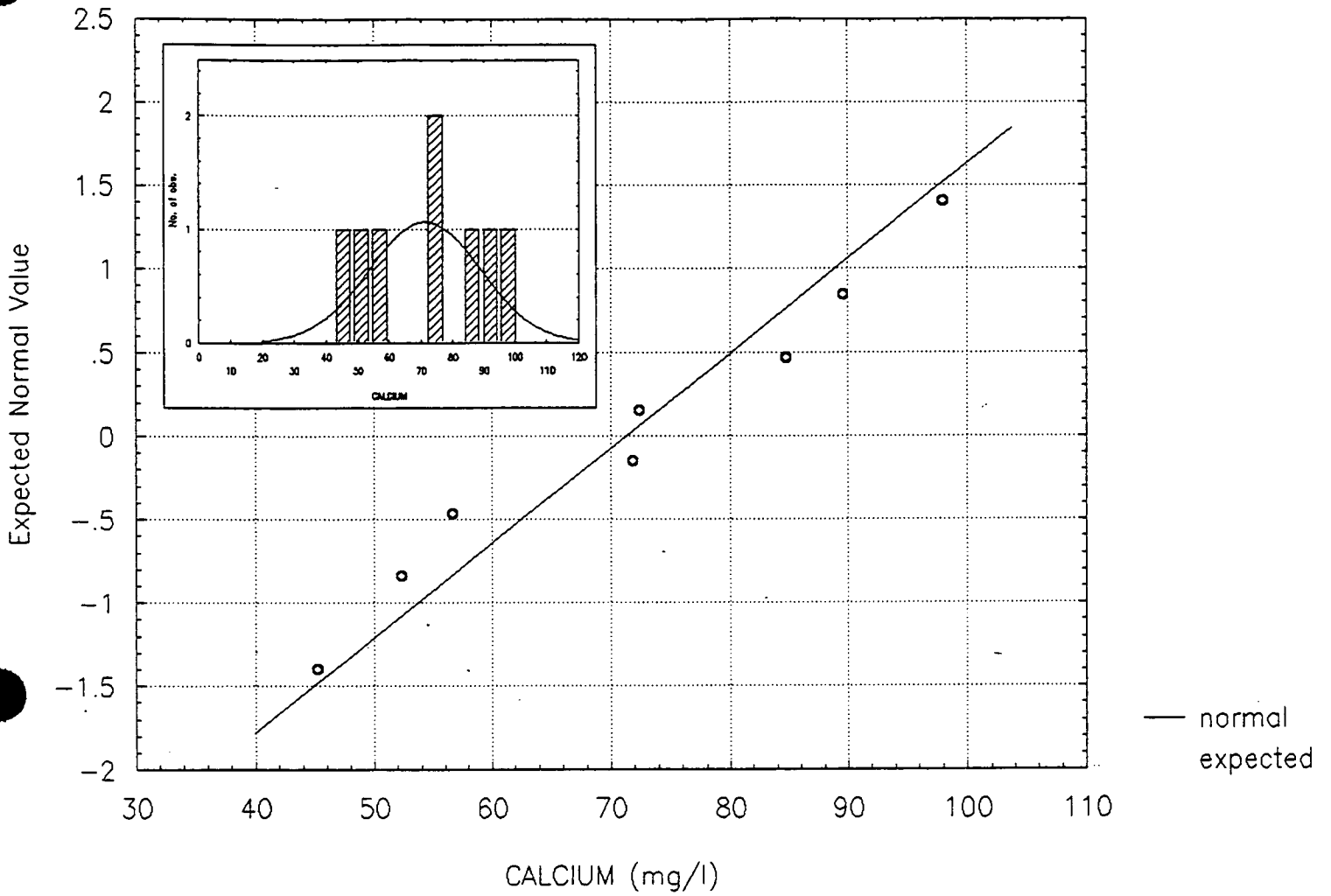


Normal Probablility Plot for
Dissolved Cobalt
in Background Surface Water

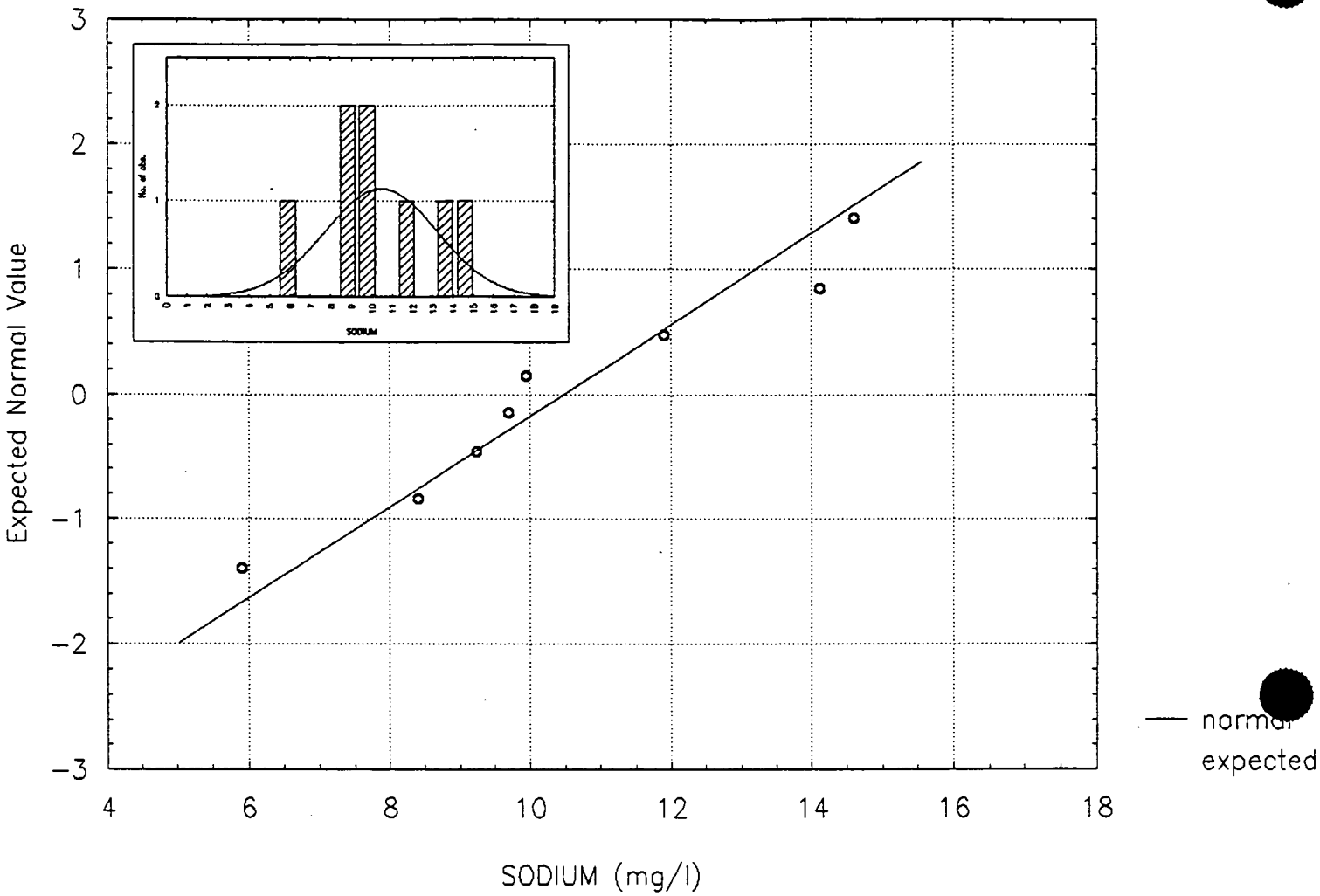


000704

Normal Probablility Plot for Dissolved
Calcium in Background Surface Water

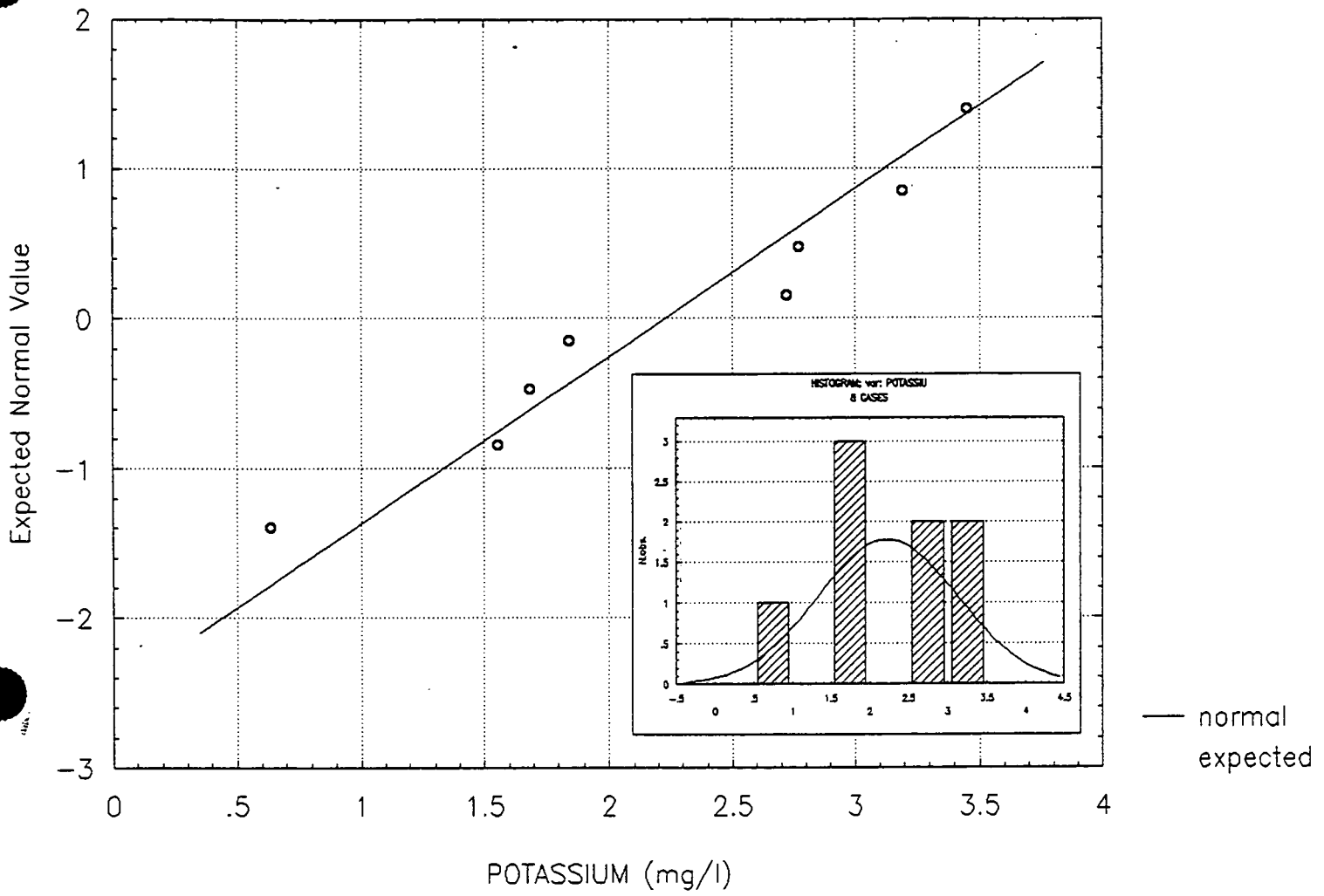


Normal Probablility Plot for Dissolved Sodium in Background Surface Water



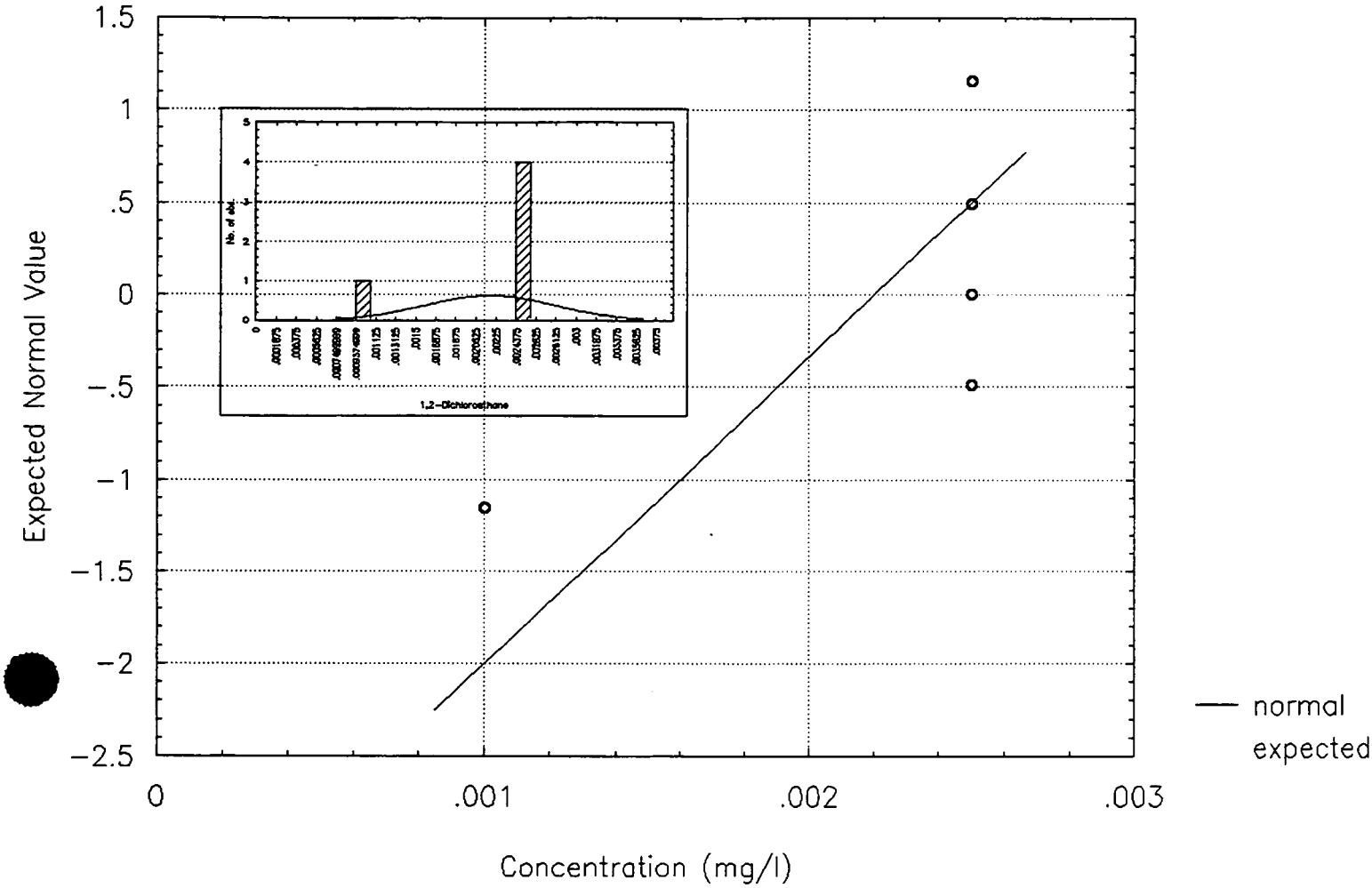
000706

Normal Probablility Plot for Dissolved Potassium in Background Surface Water

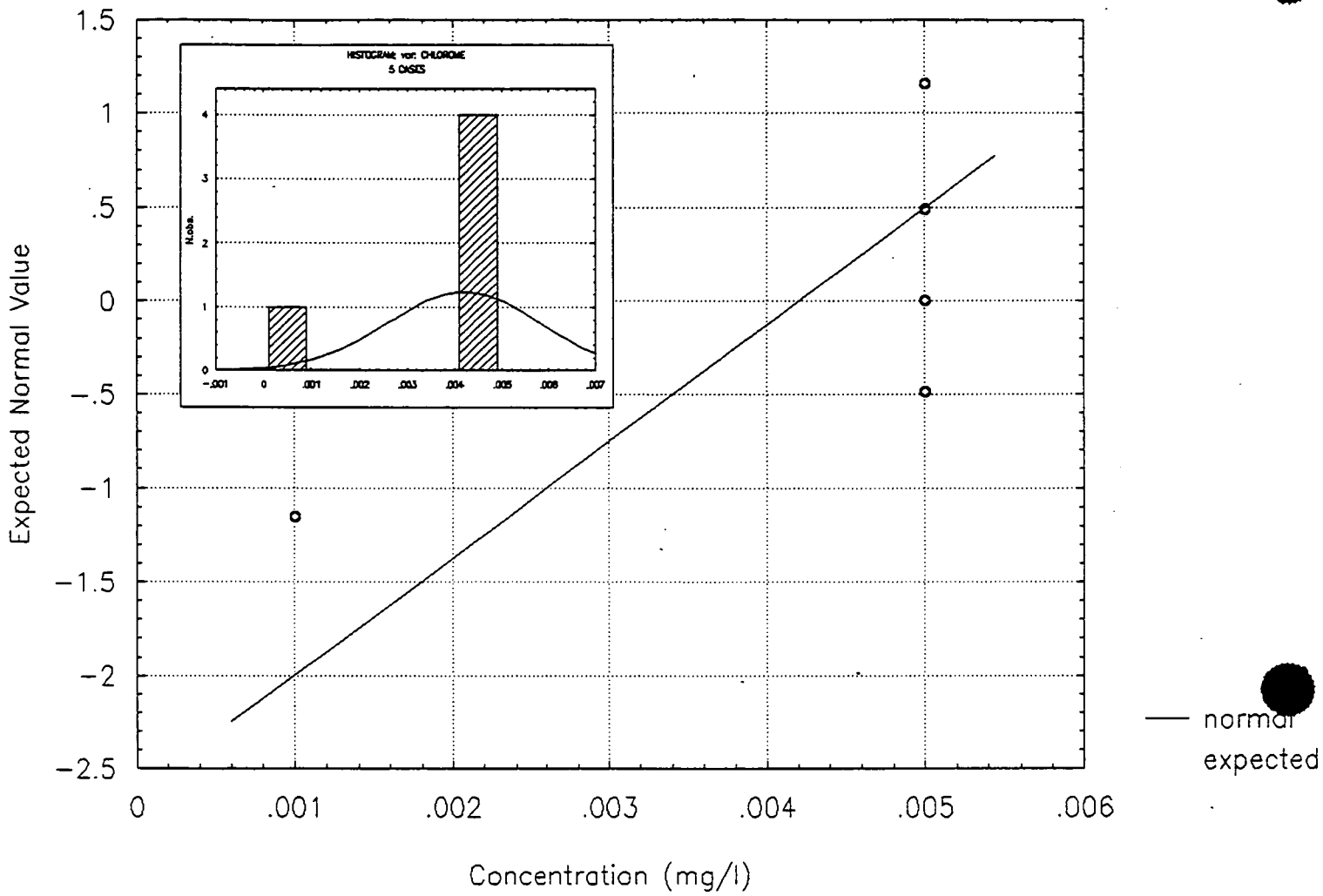


VOLATILE ORGANIC COMPOUNDS

Normal Probablility Plot for
1,2–Dichloroethane
in Background Surface Waters

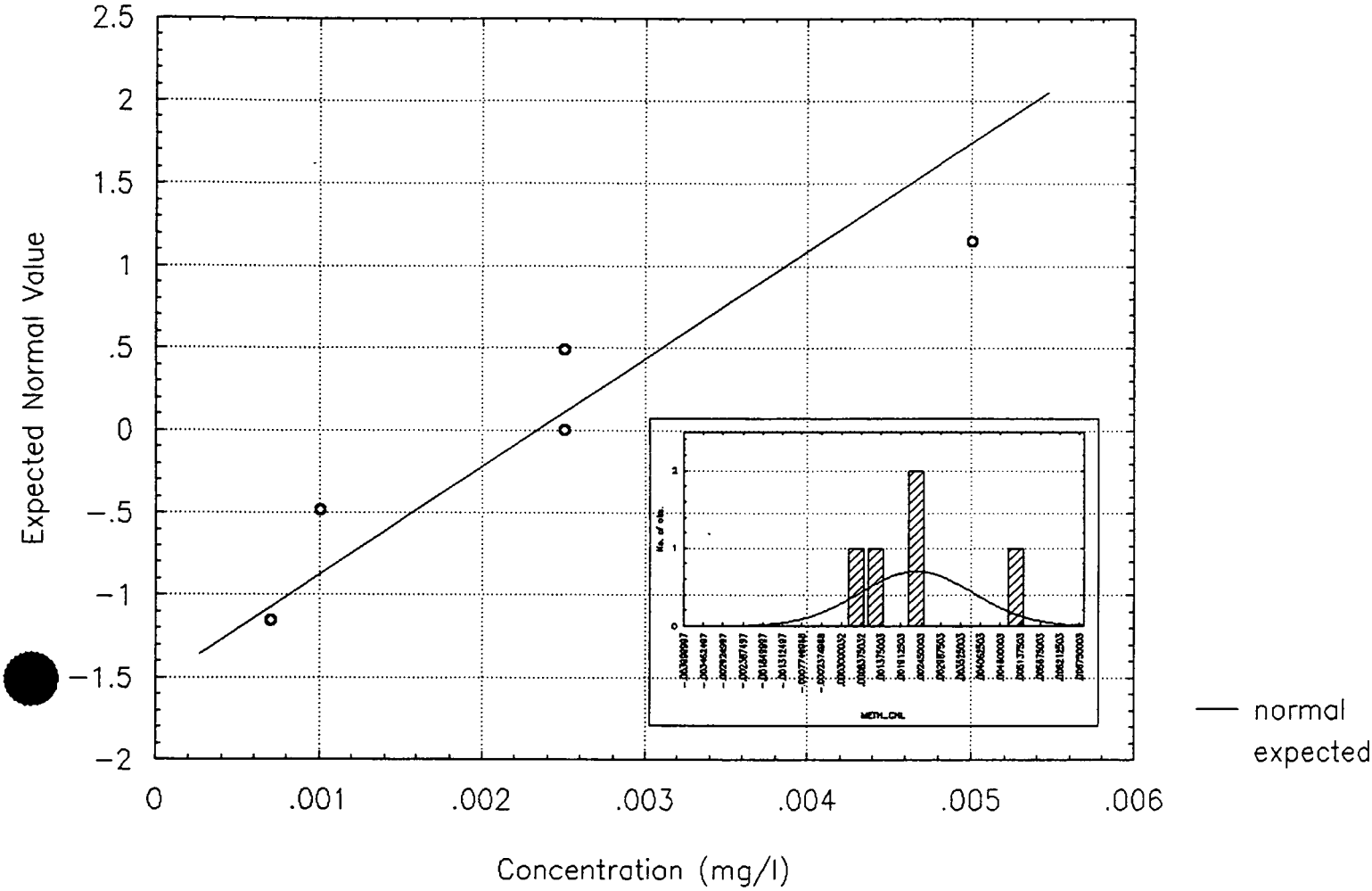


Normal Probablility Plot for Chloromethane
in Background Surface Water

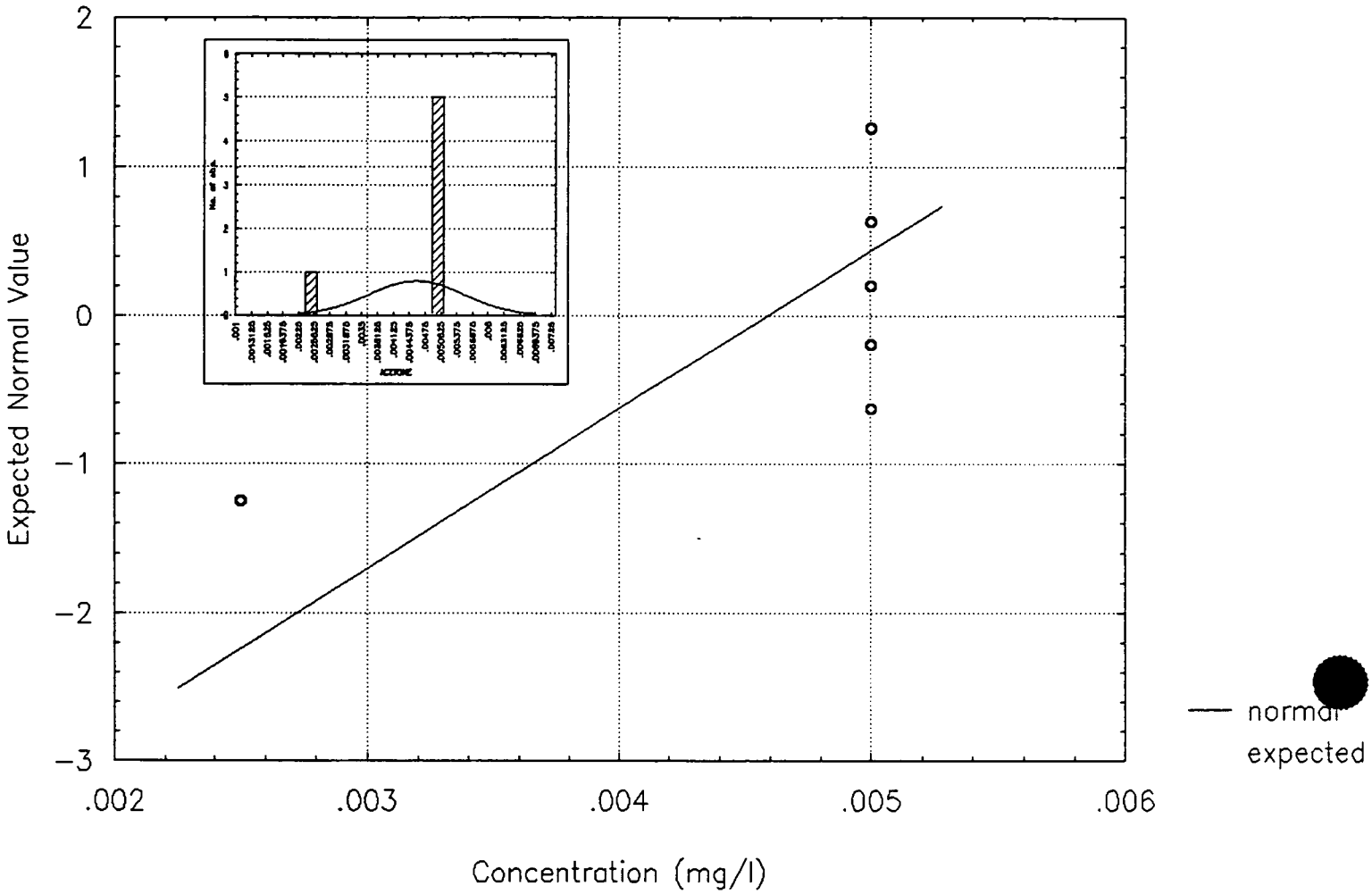


000710

Normal Probablility Plot for
Methylene Chloride
in Background Surface Water



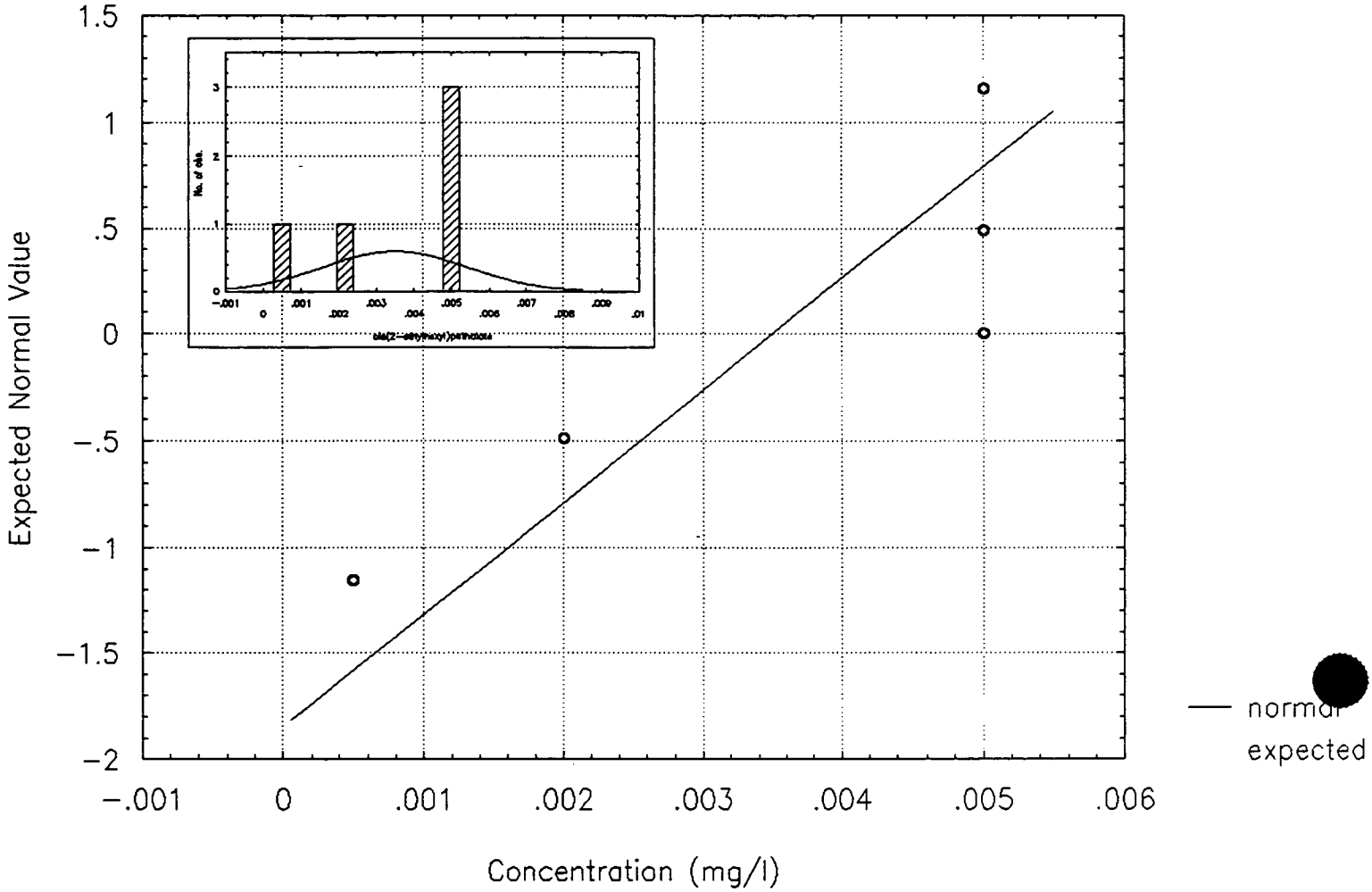
Normal Probablility Plot for
Acetone
in Background Surface Water



000712

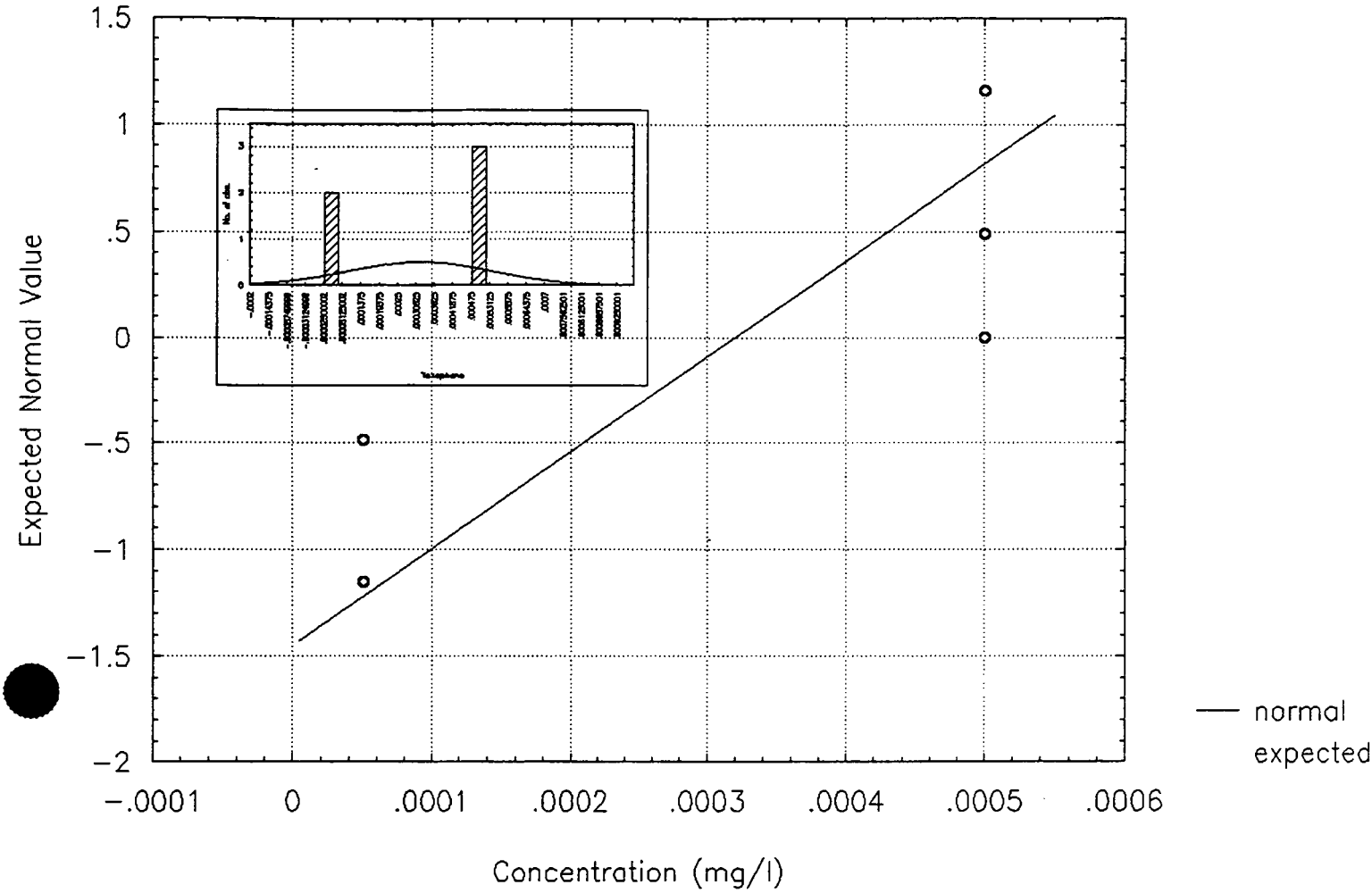
SEMIVOLATILES AND PESTICIDES

Normal Probablility Plot for
bis(2-ethylhexyl)phthalate
in Background Surface Waters



000714

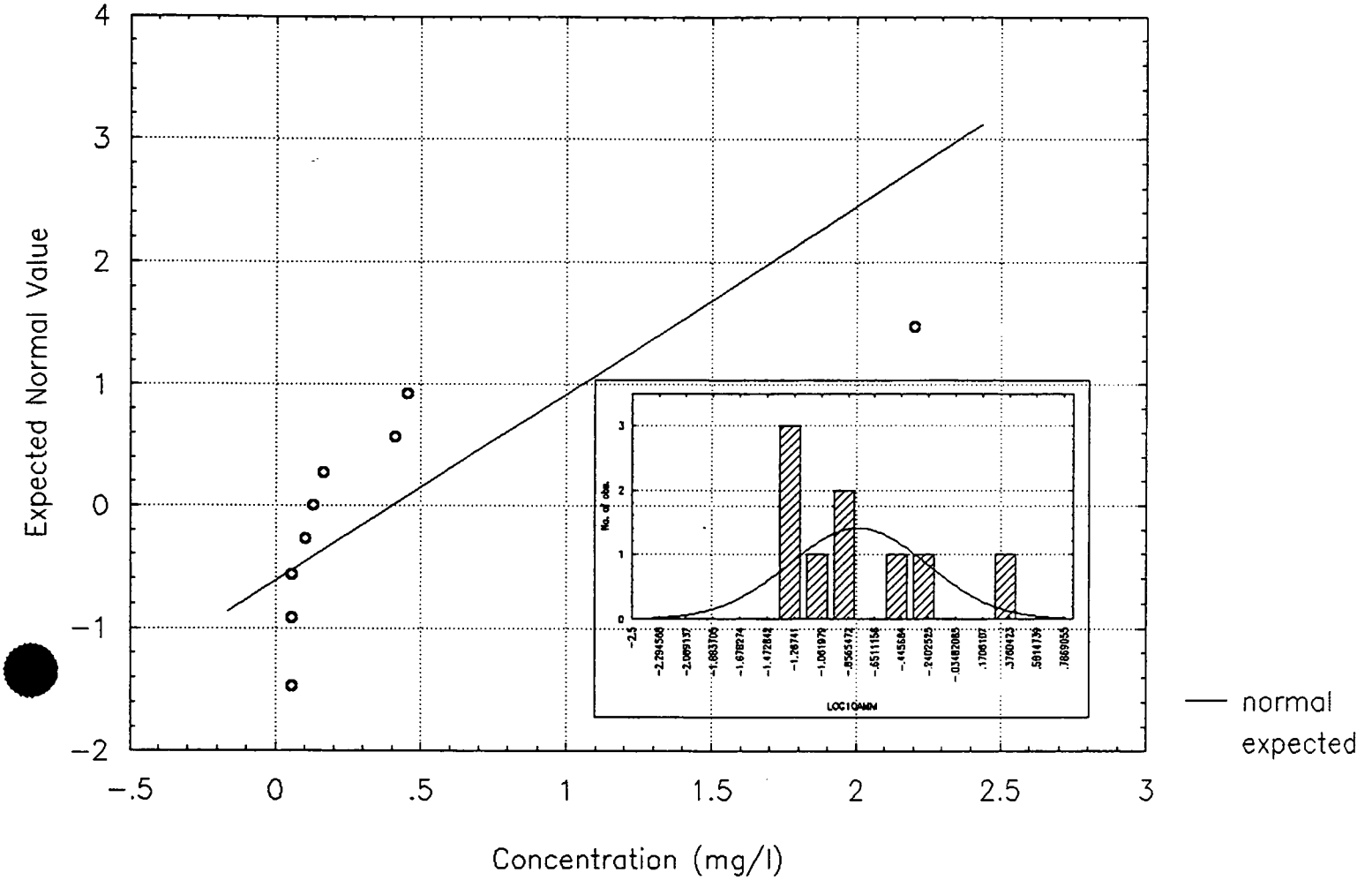
Normal Probablility Plot for
Toxaphene
in Background Surface Water



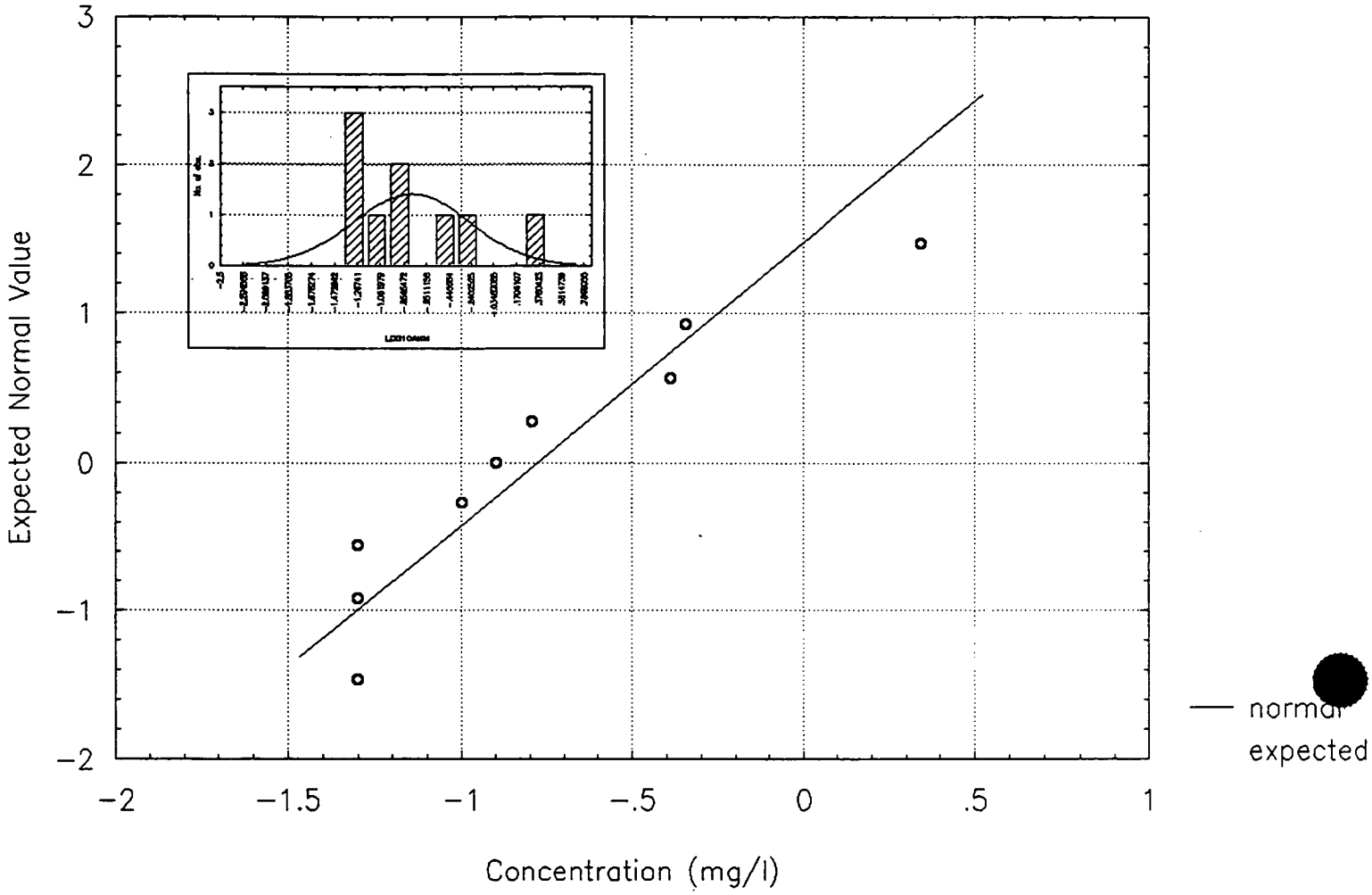
GENERAL PARAMETERS

000716

Normal Probablility Plot for
Ammonia
in Background Surface Water

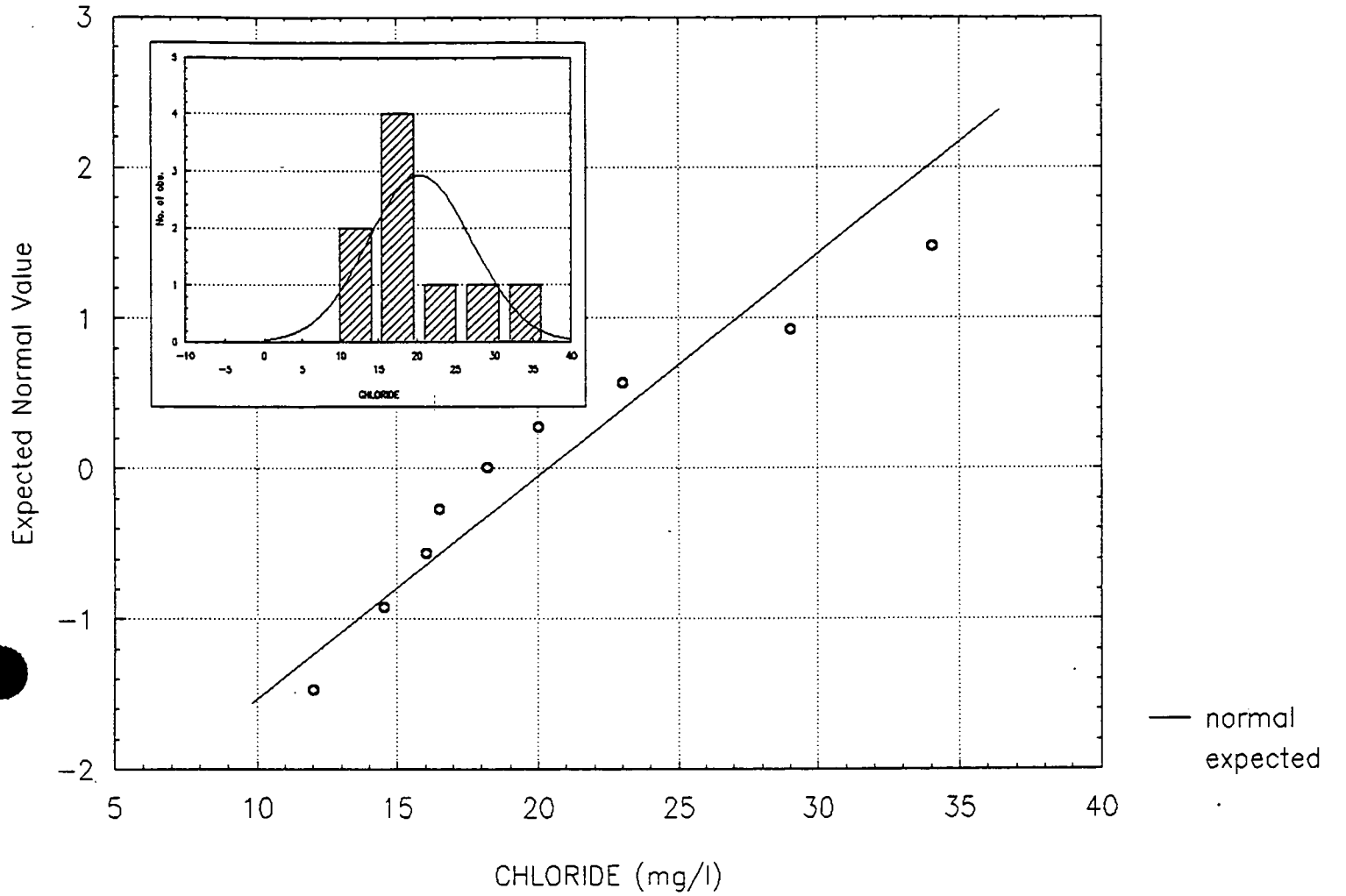


Normal Probablility Plot for
Log Base 10 Ammonia
in Background Surface Water

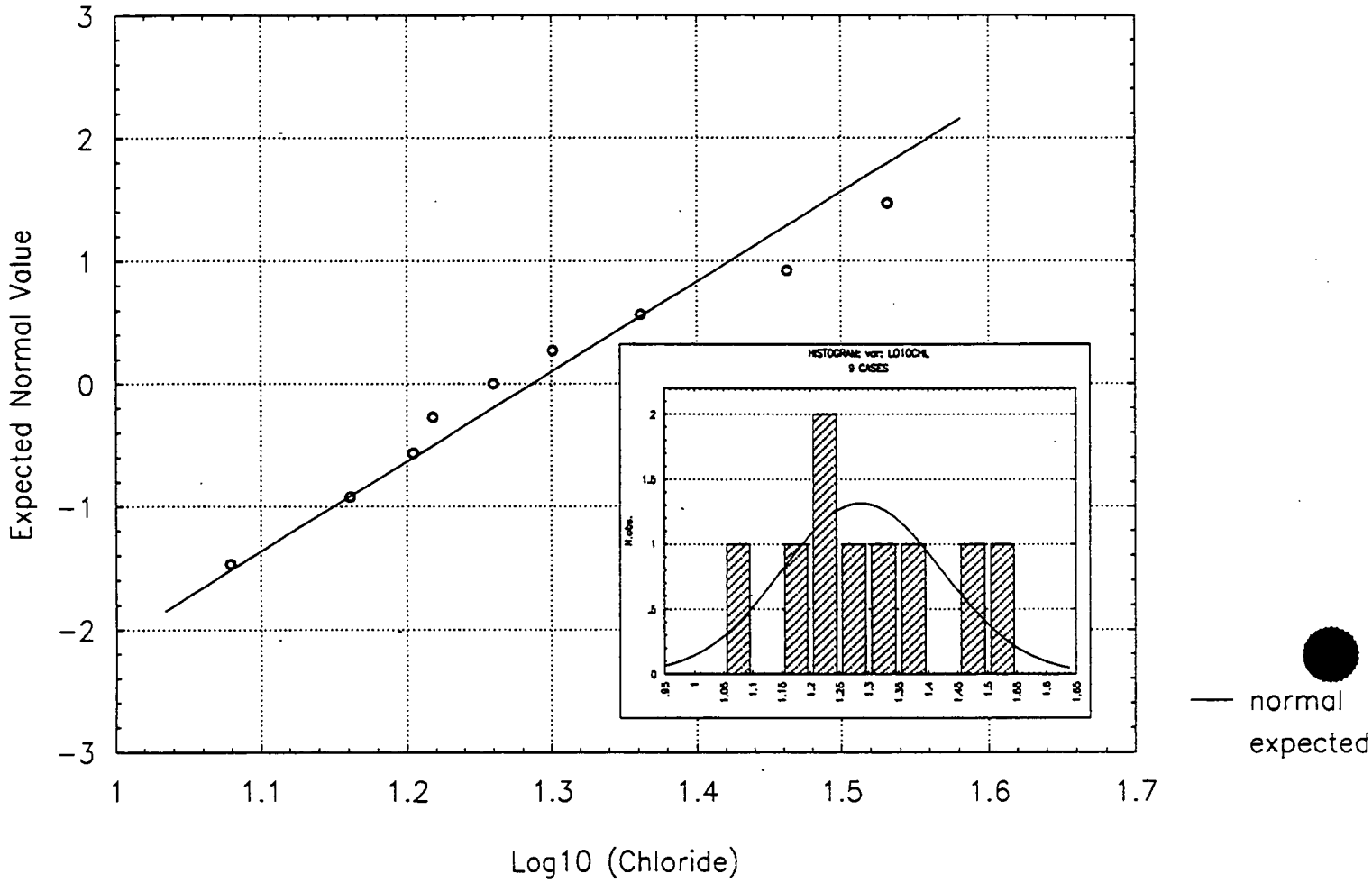


000718

Normal Probablility Plot for Chloride
in Background Surface Water

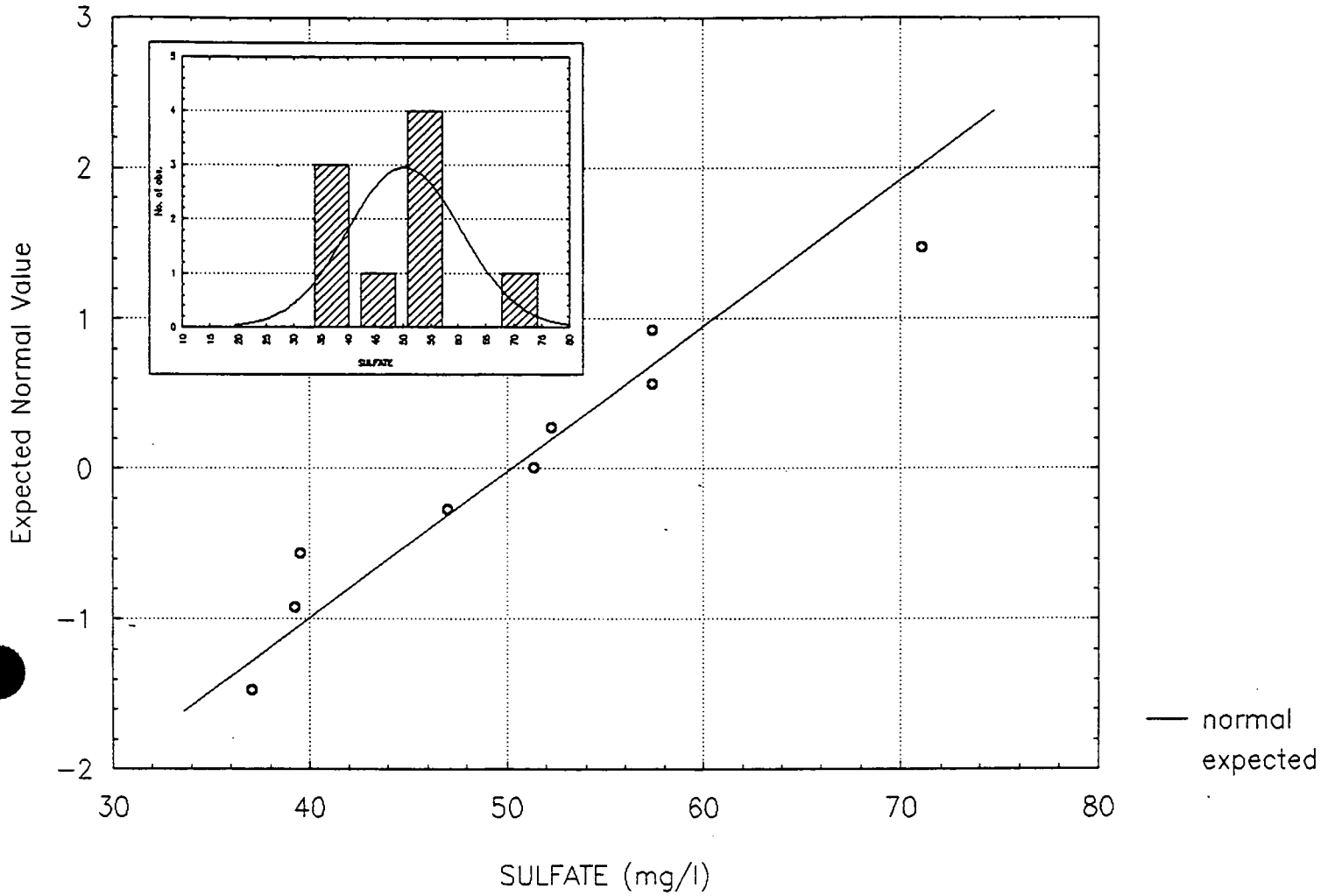


Normal Probablility Plot for the Log
Base 10 Transform of Chloride in
Background Surface Waters

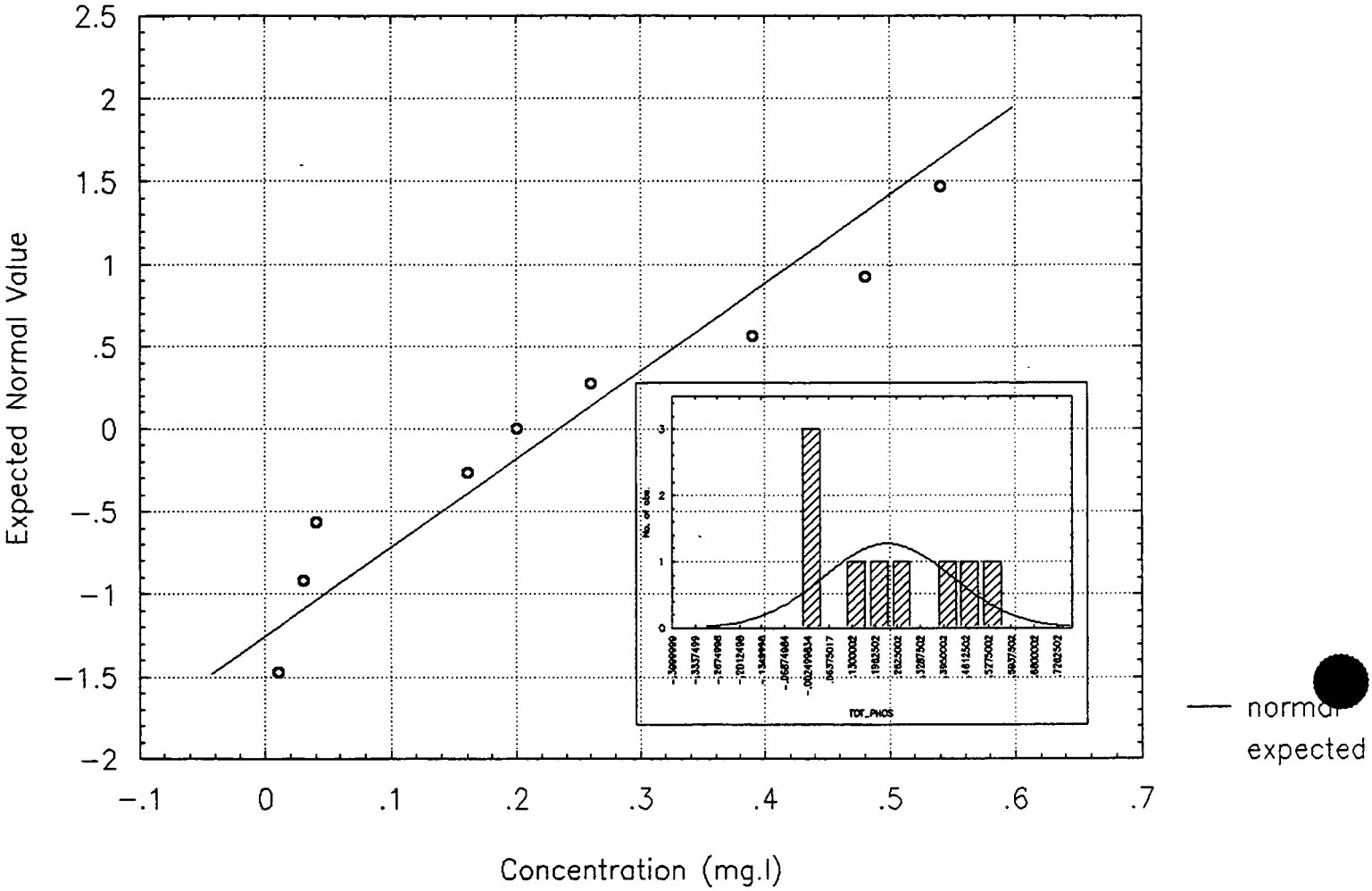


000720

Normal Probablility Plot for Sulfate
in Background Surface Waters

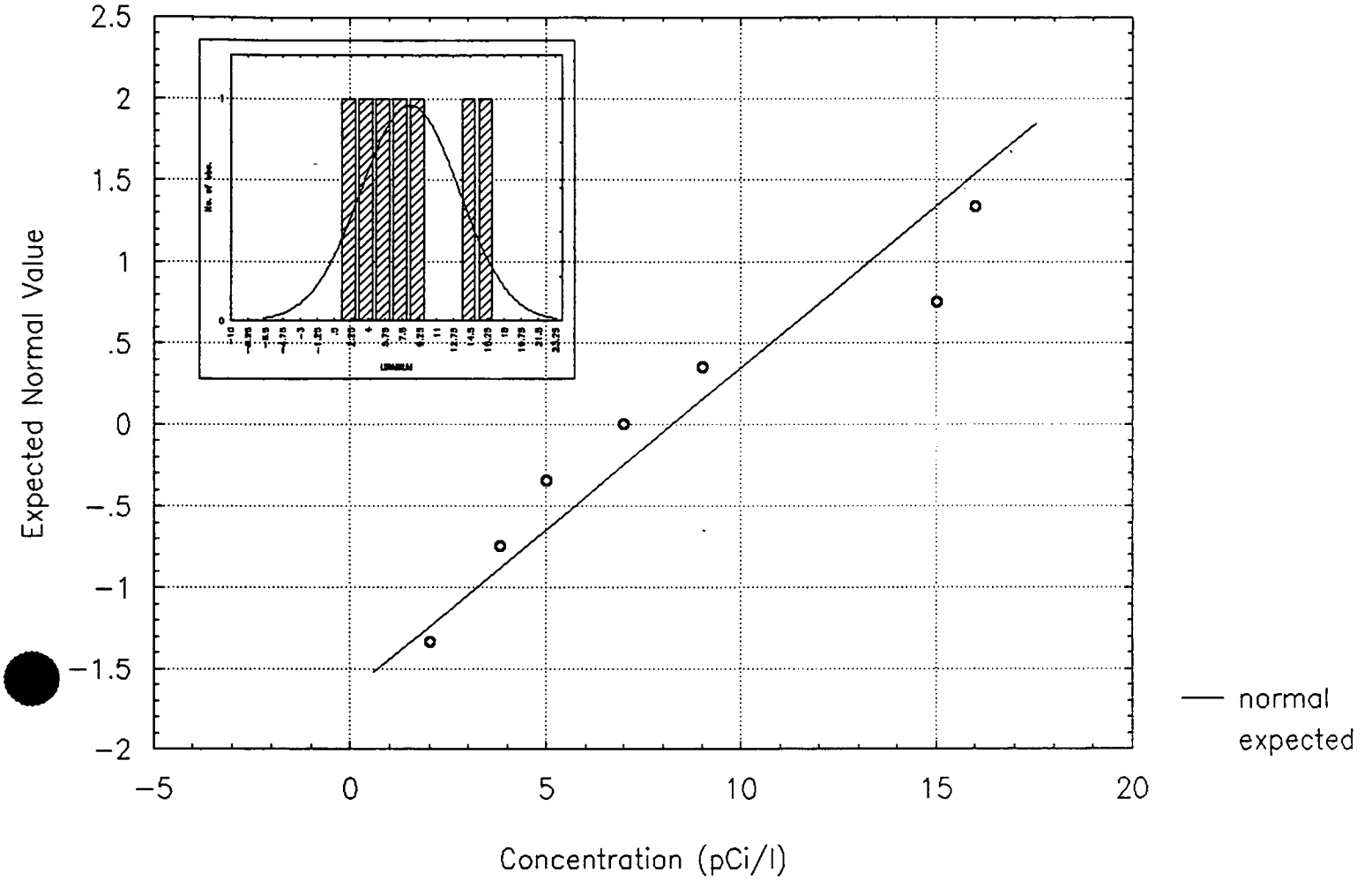


Normal Probablility Plot for
Total Phosphorus
in Background Surface Water



000722

Normal Probablility Plot for
Uranium
in Background Surface Water



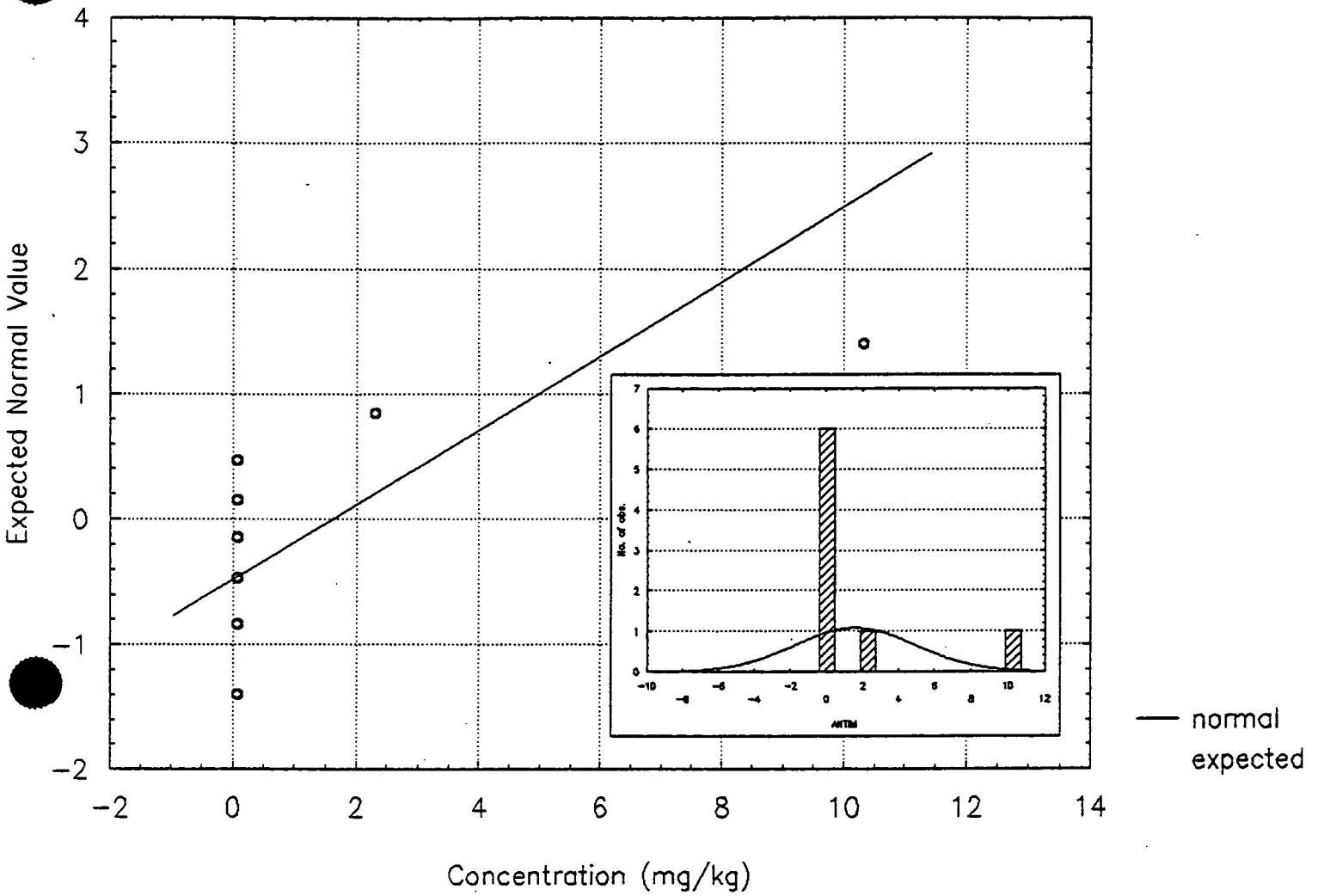
REV. 1: MAY 1994

APPENDIX H

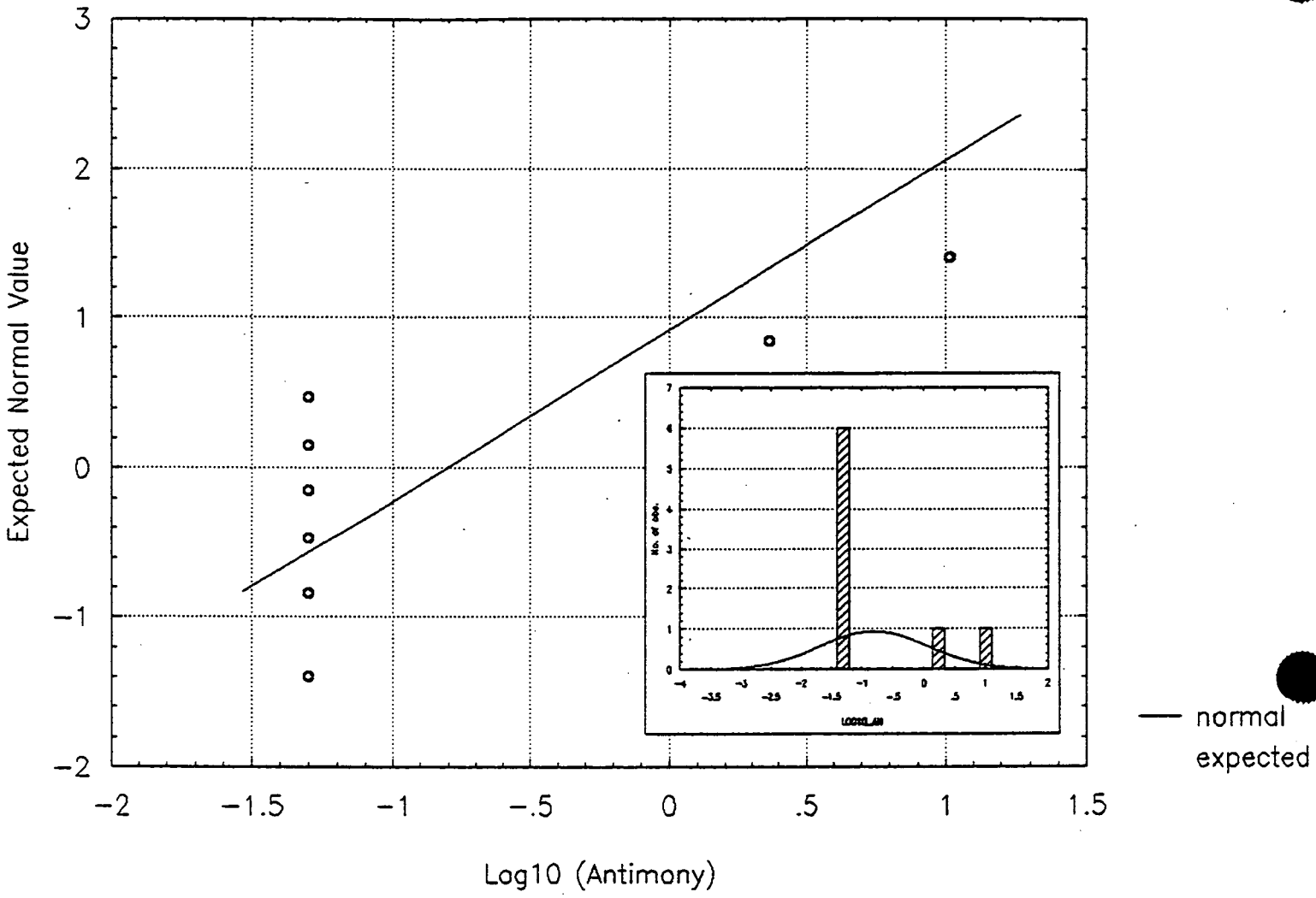
STATISTICAL EVALUATION SUMMARY - STREAM SEDIMENTS

TOTAL METALS

Normal Probablility Plot for Antimony
in Background Stream Sediments

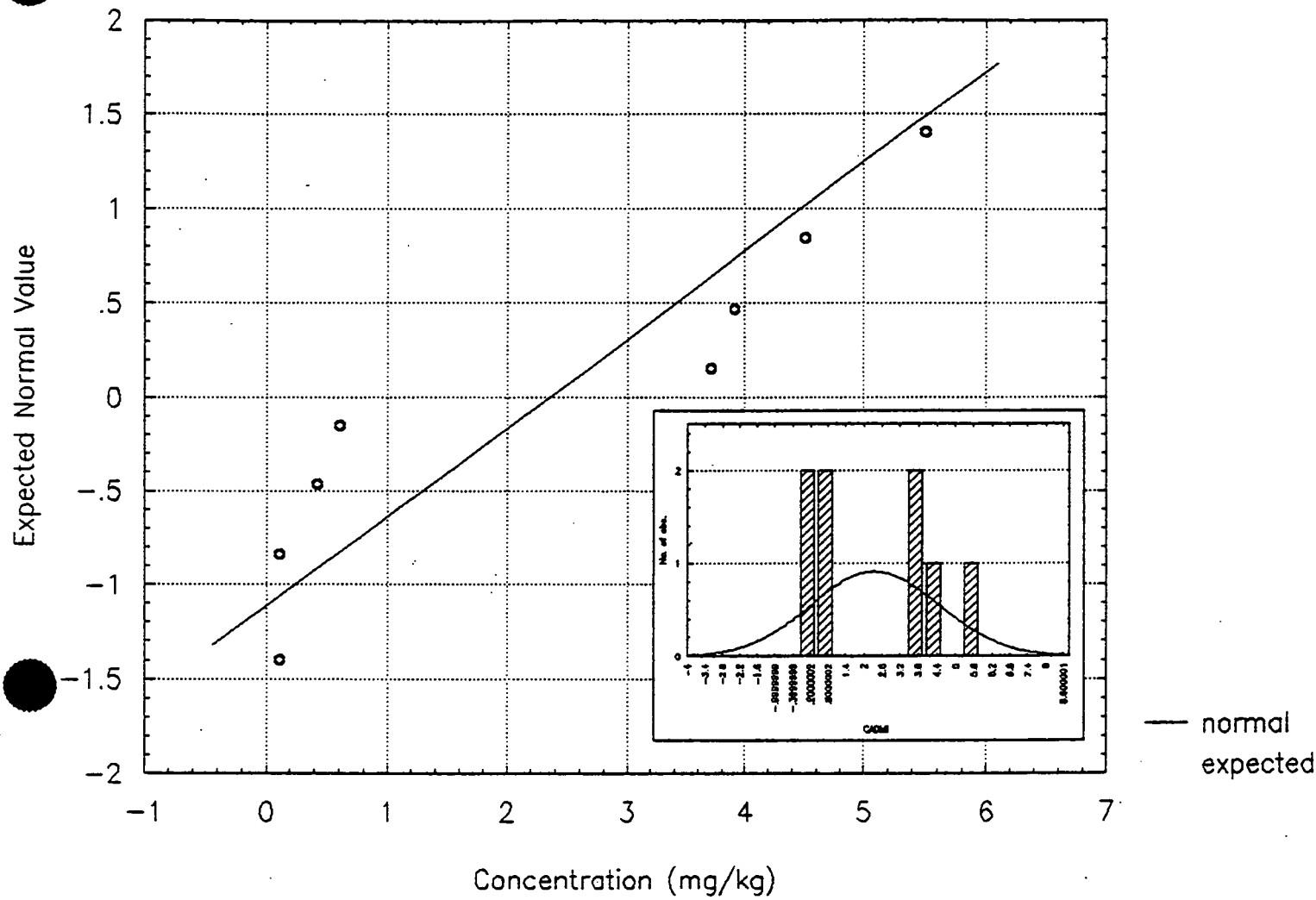


Normal Probablility Plot for the Log Base 10 Transform
of Antimony in the Background Sediments

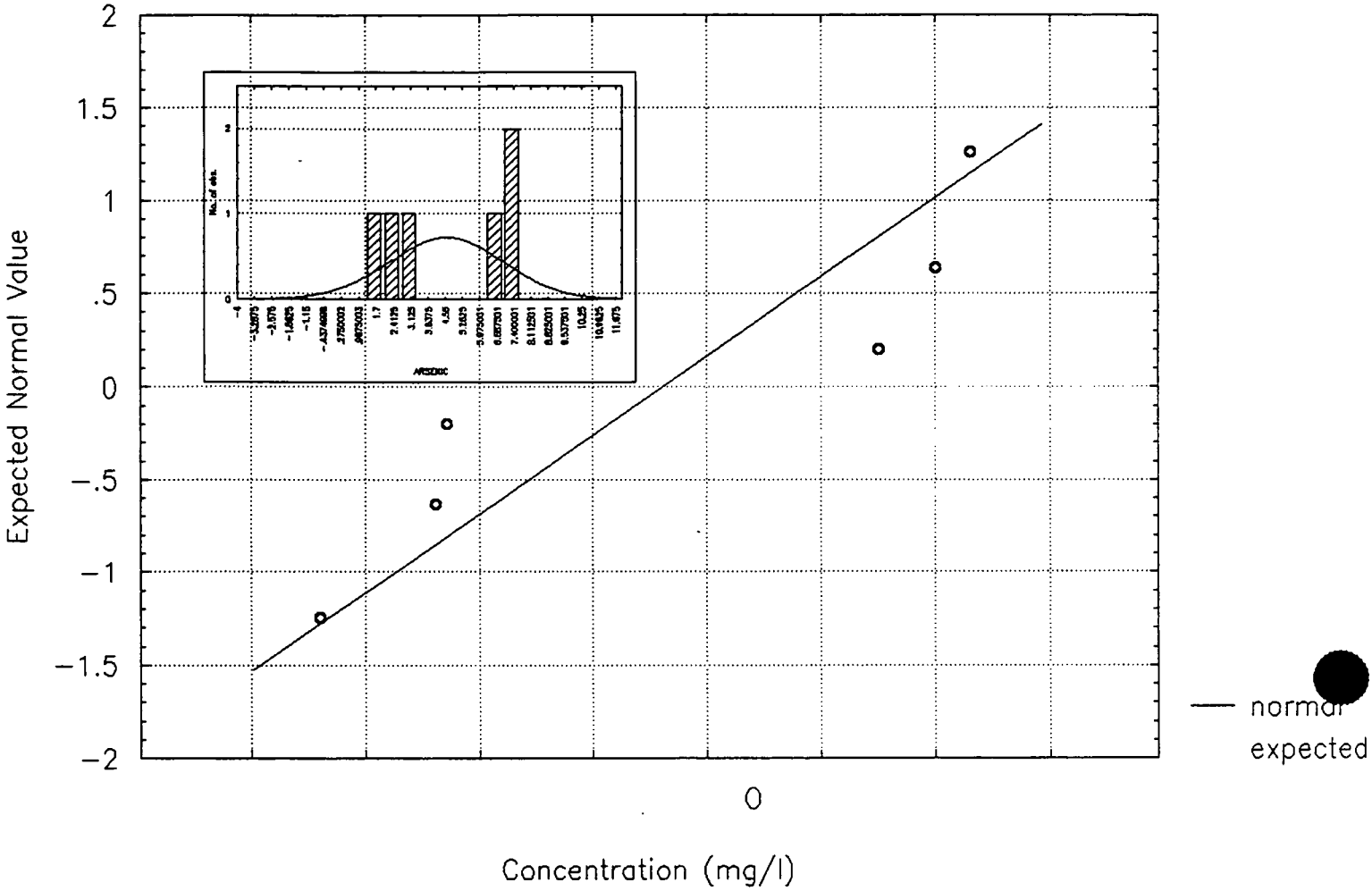


000727

Normal Probablility Plot for Cadmium
in Background Stream Sediments

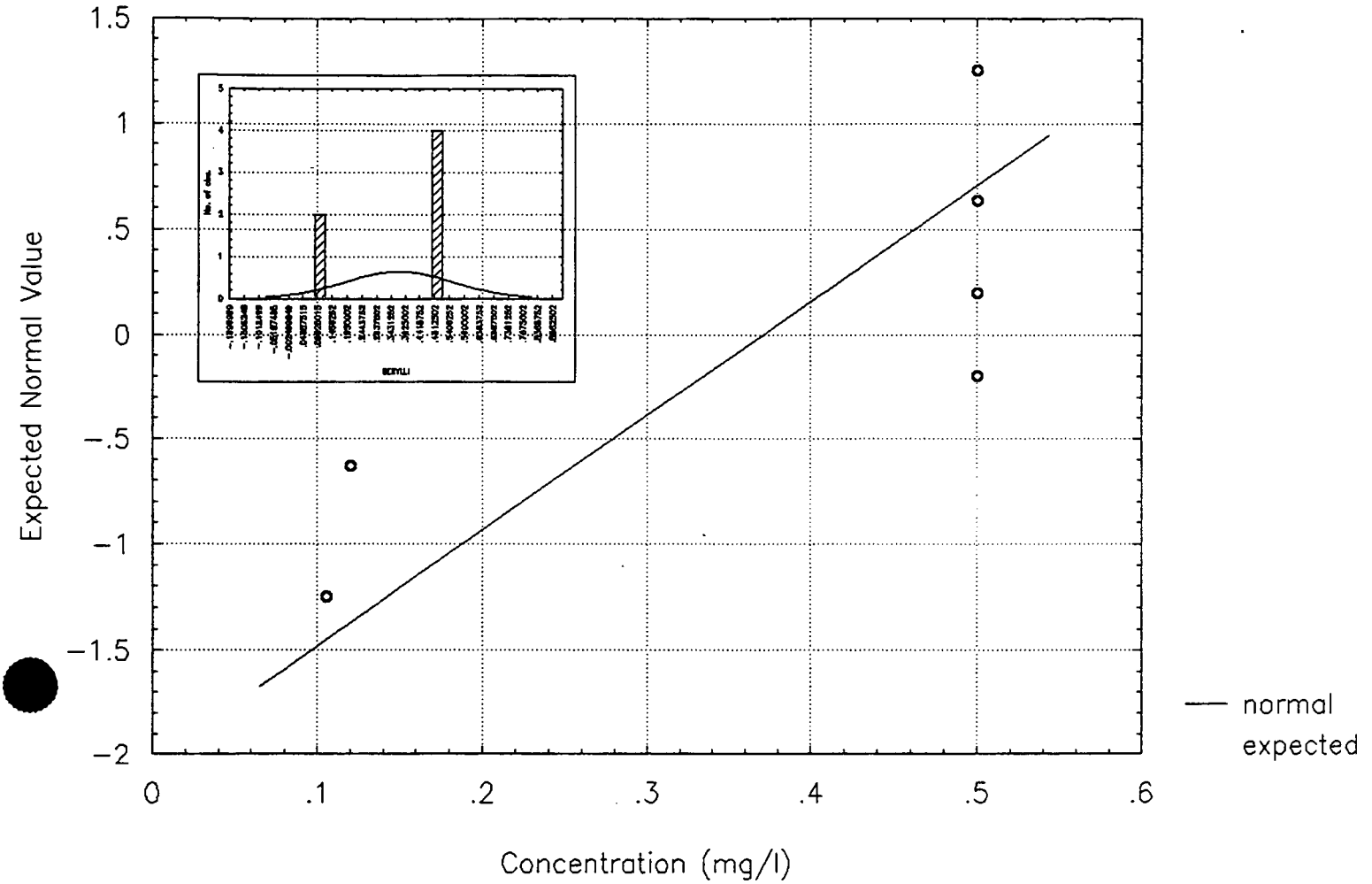


Normal Probablility Plot for
Total Arsenic
in Background Sediments

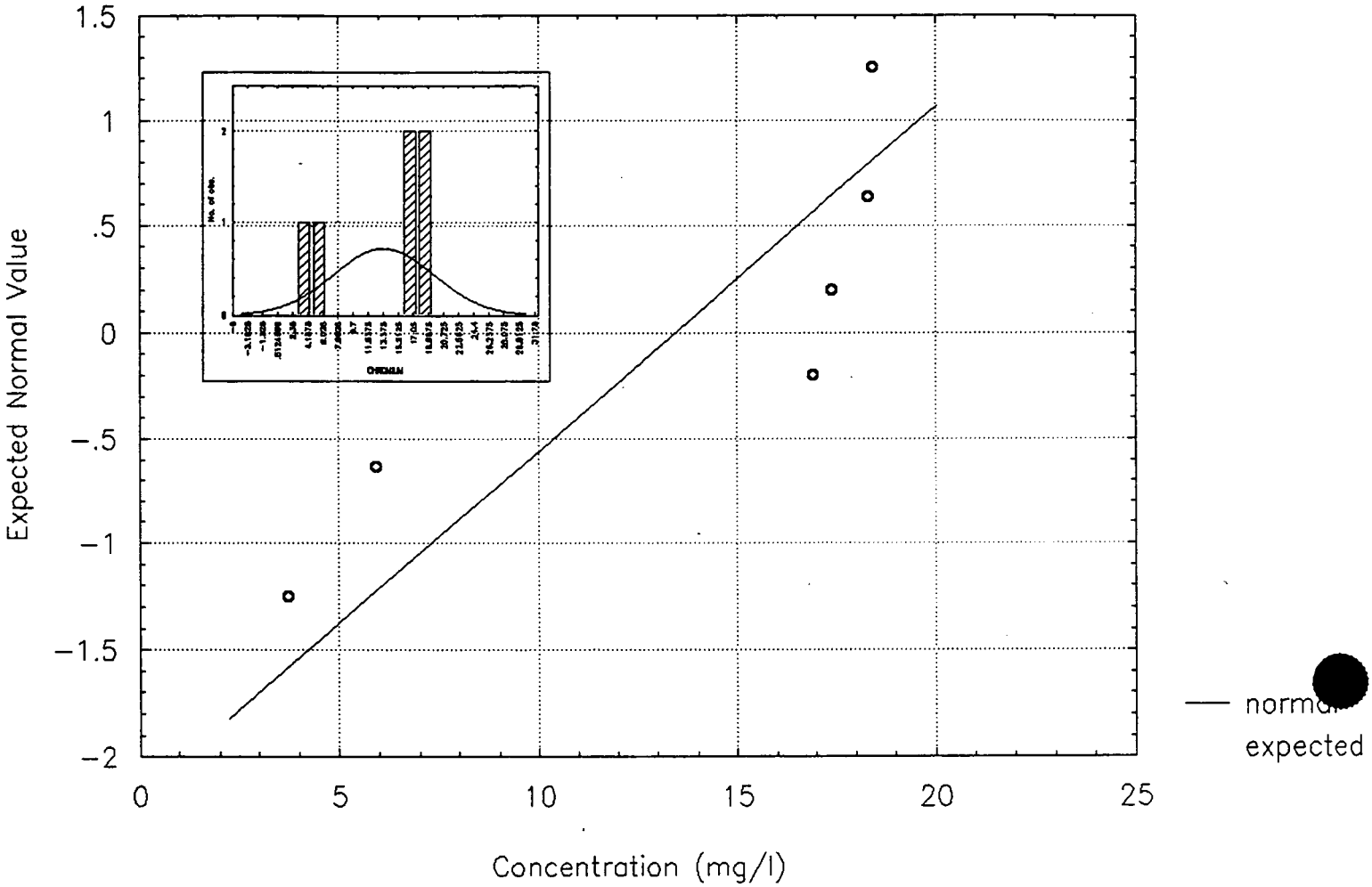


000729

Normal Probablility Plot for
Total Beryllium
in Background Sediments

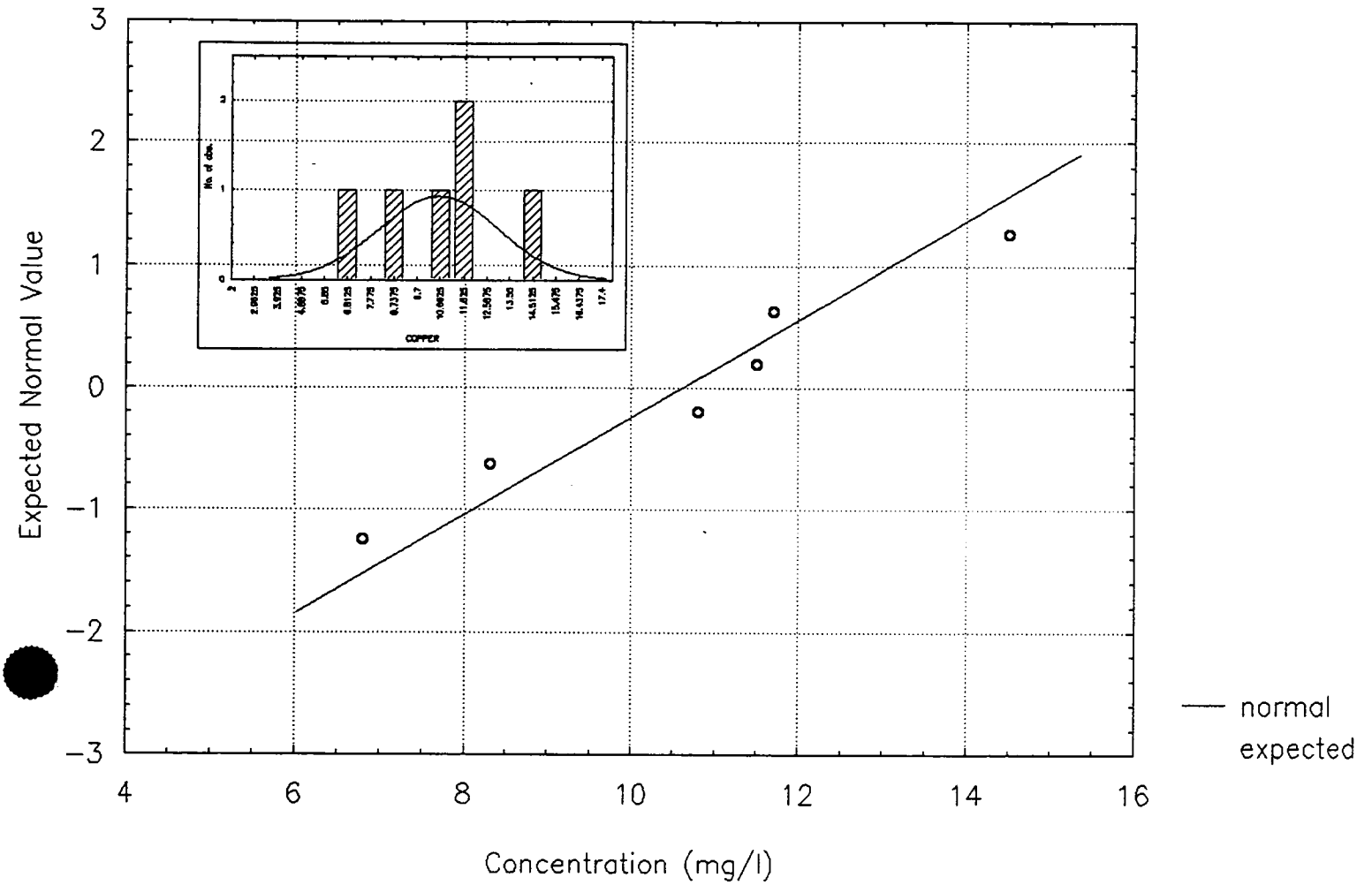


Normal Probablility Plot for
Total Chromium
in Background Sediments

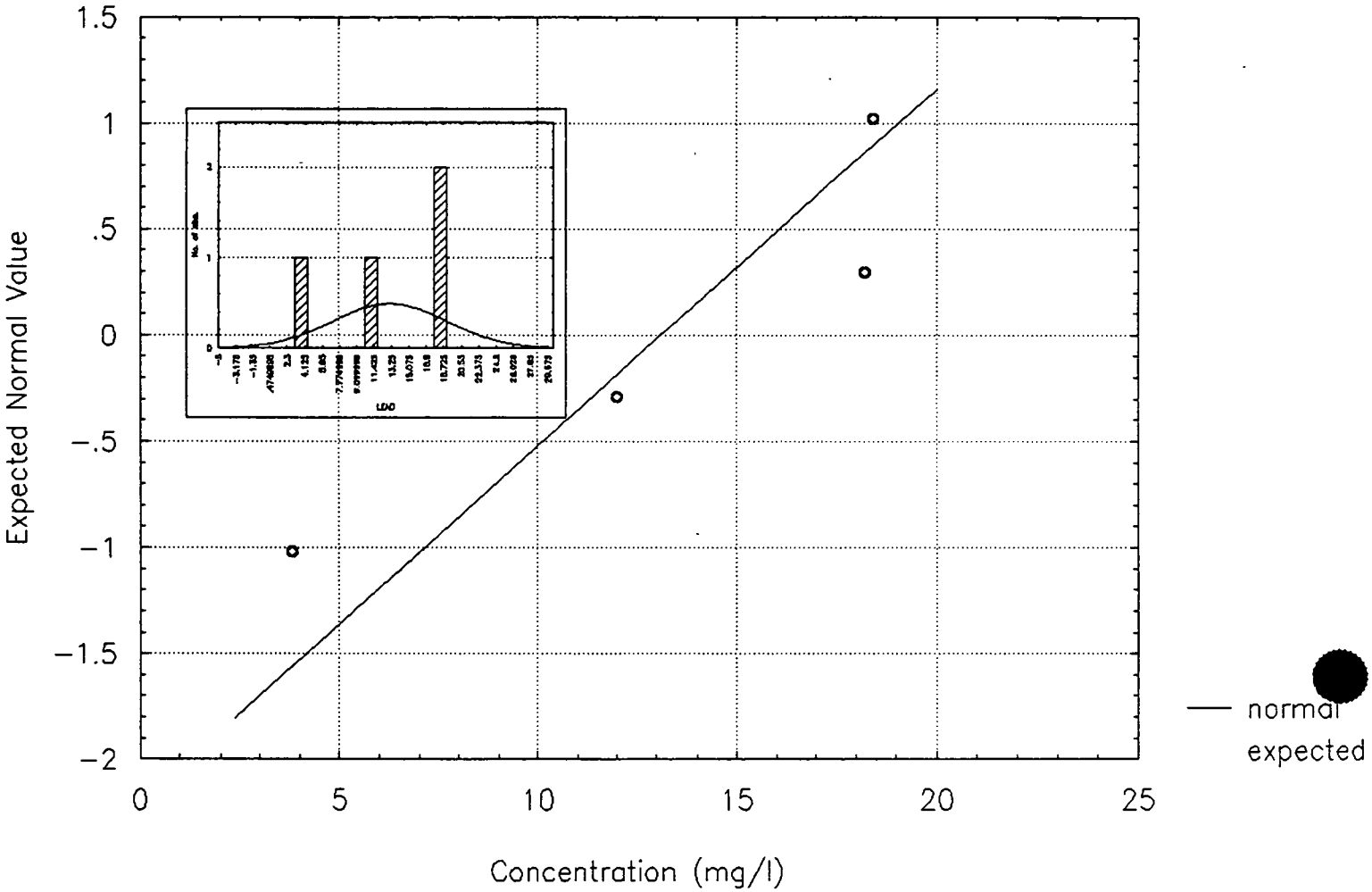


000731

Normal Probablility Plot for
Total Copper
in Background Sediments

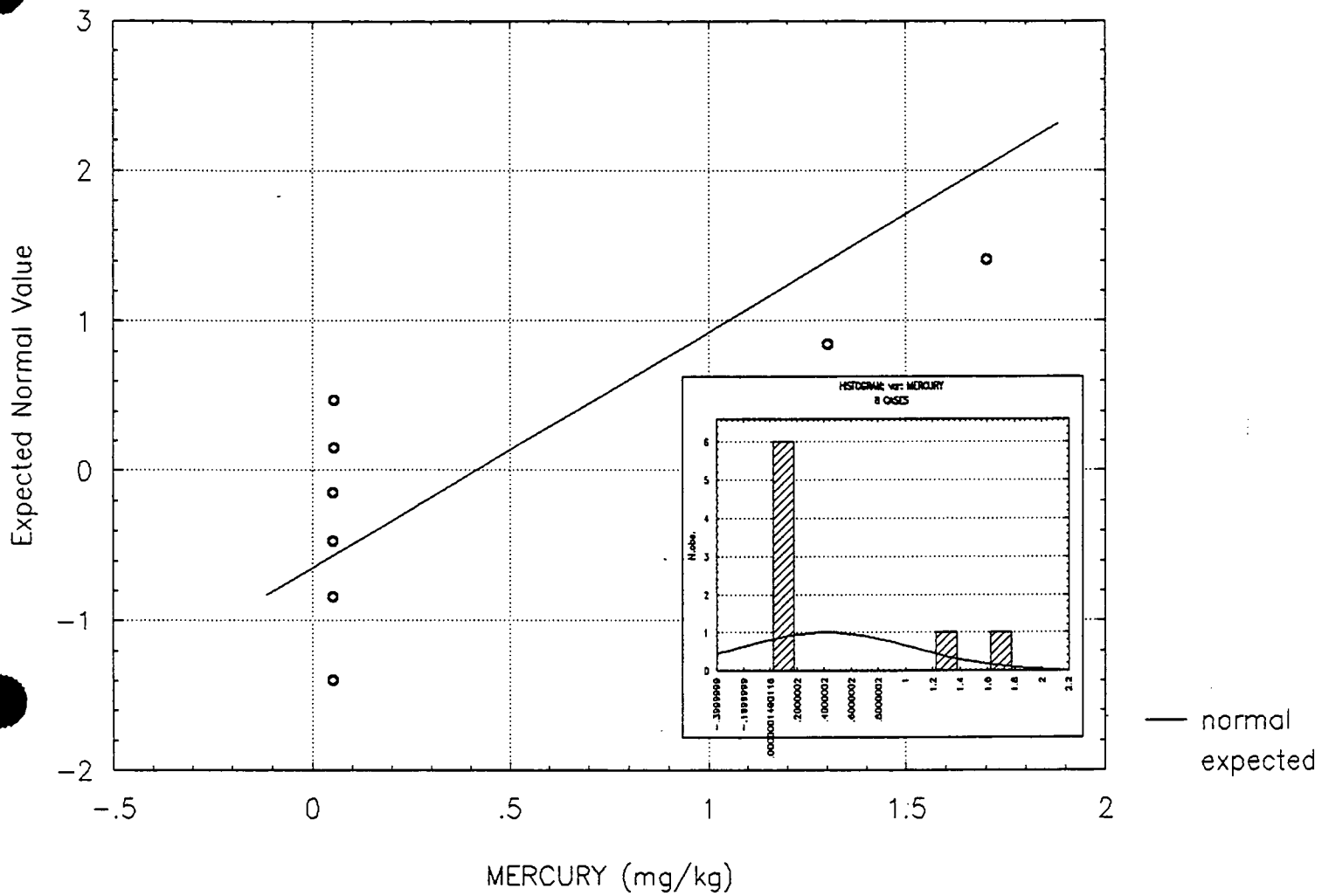


Normal Probablility Plot for
Total Lead
in Background Sediments

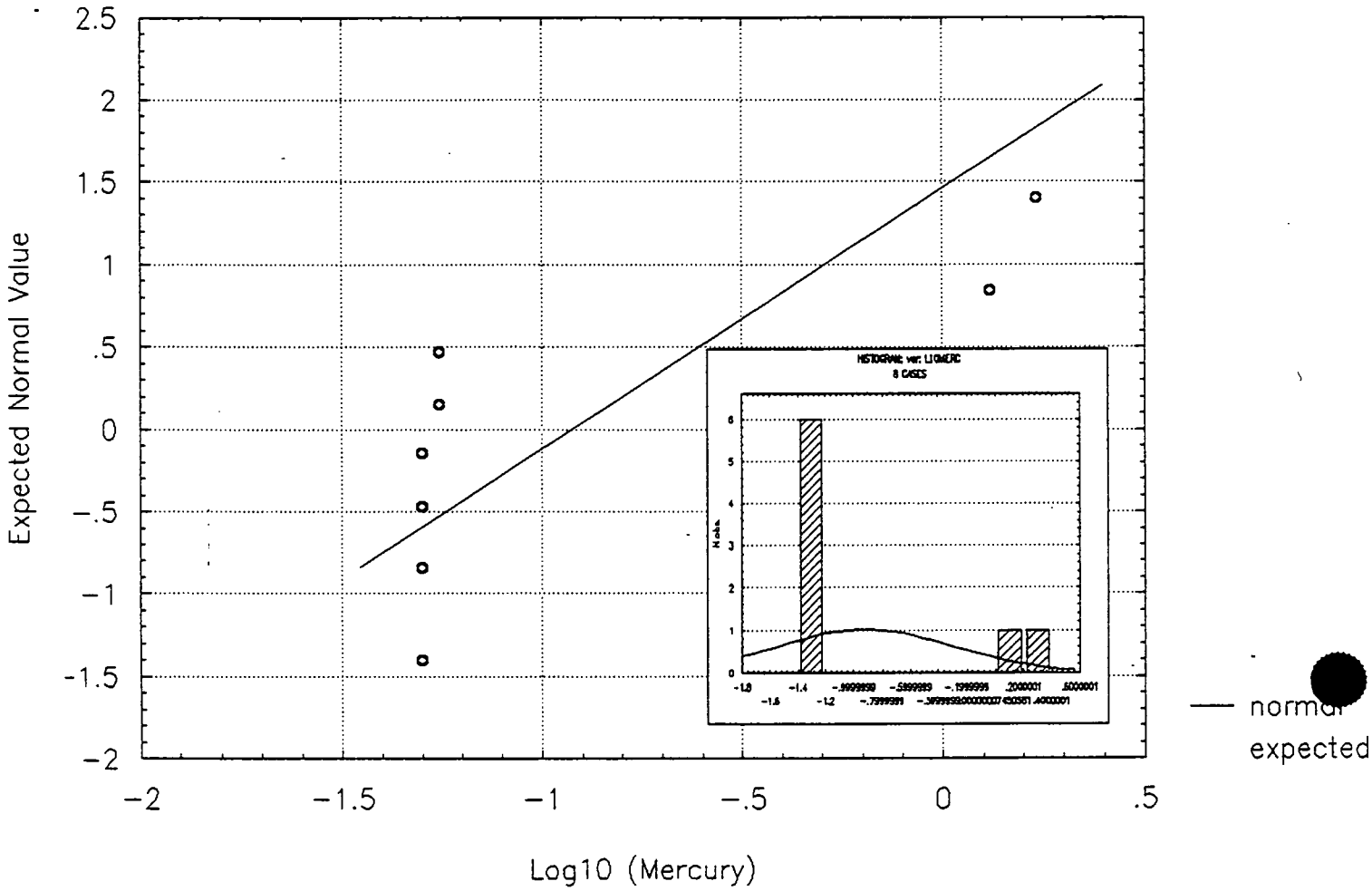


000733

Normal Probablility Plot for Mercury
in Background Sediment Samples

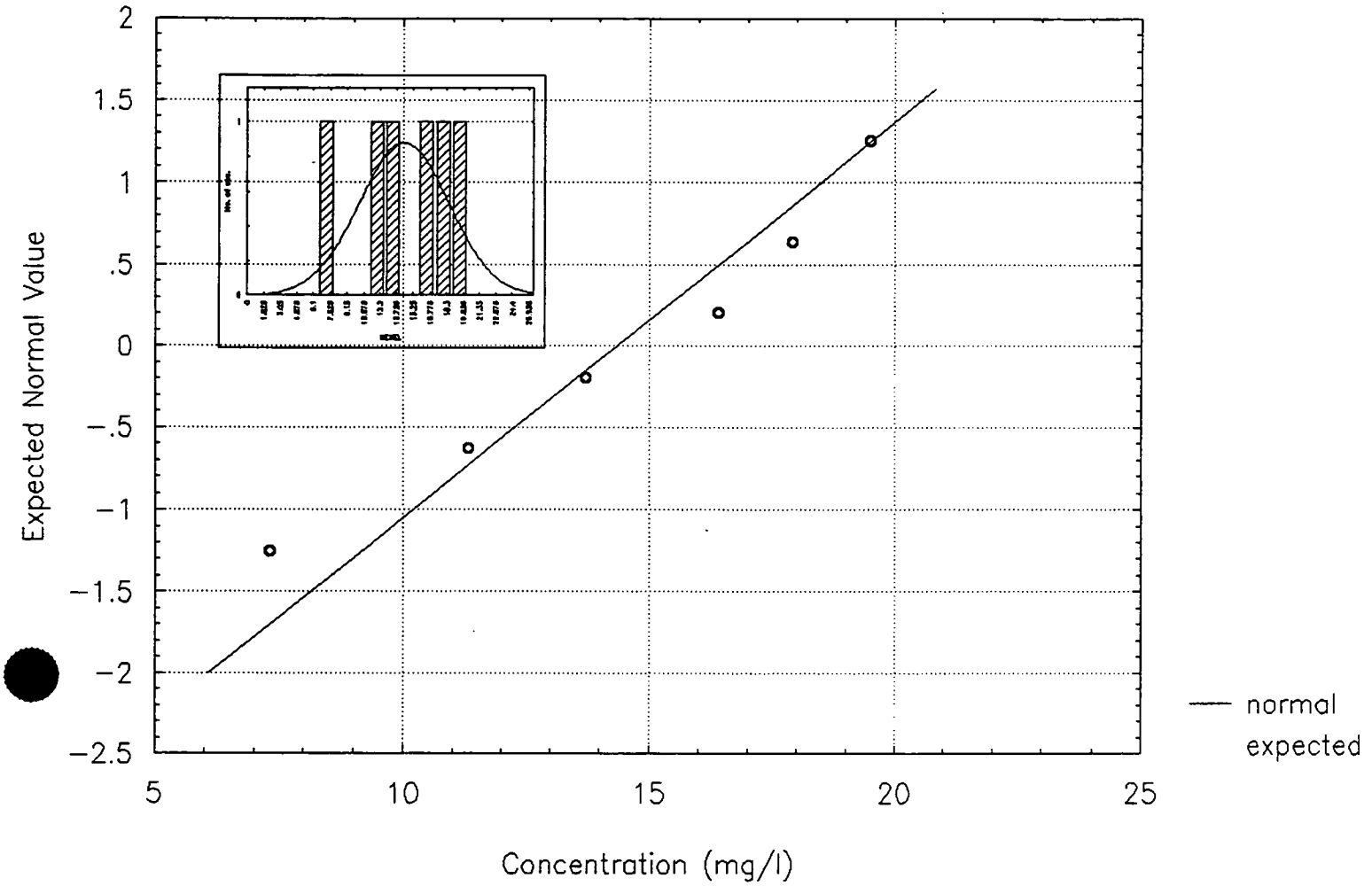


Normal Probablility Plot for the Log
Base 10 Transform of Mercury in Background
Sediment Samples

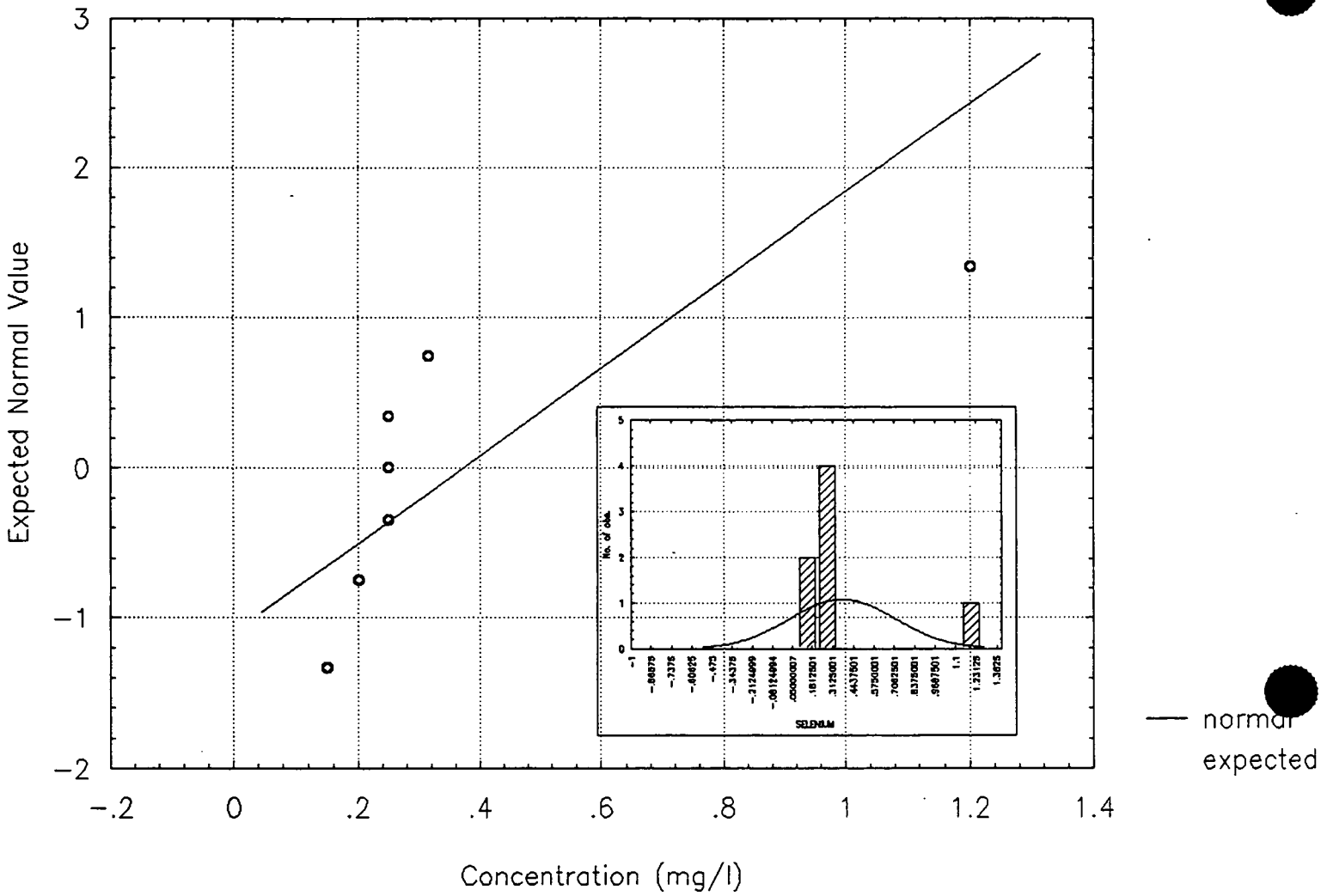


000735

Normal Probablility Plot for
Total Nickel
in Background Sediments

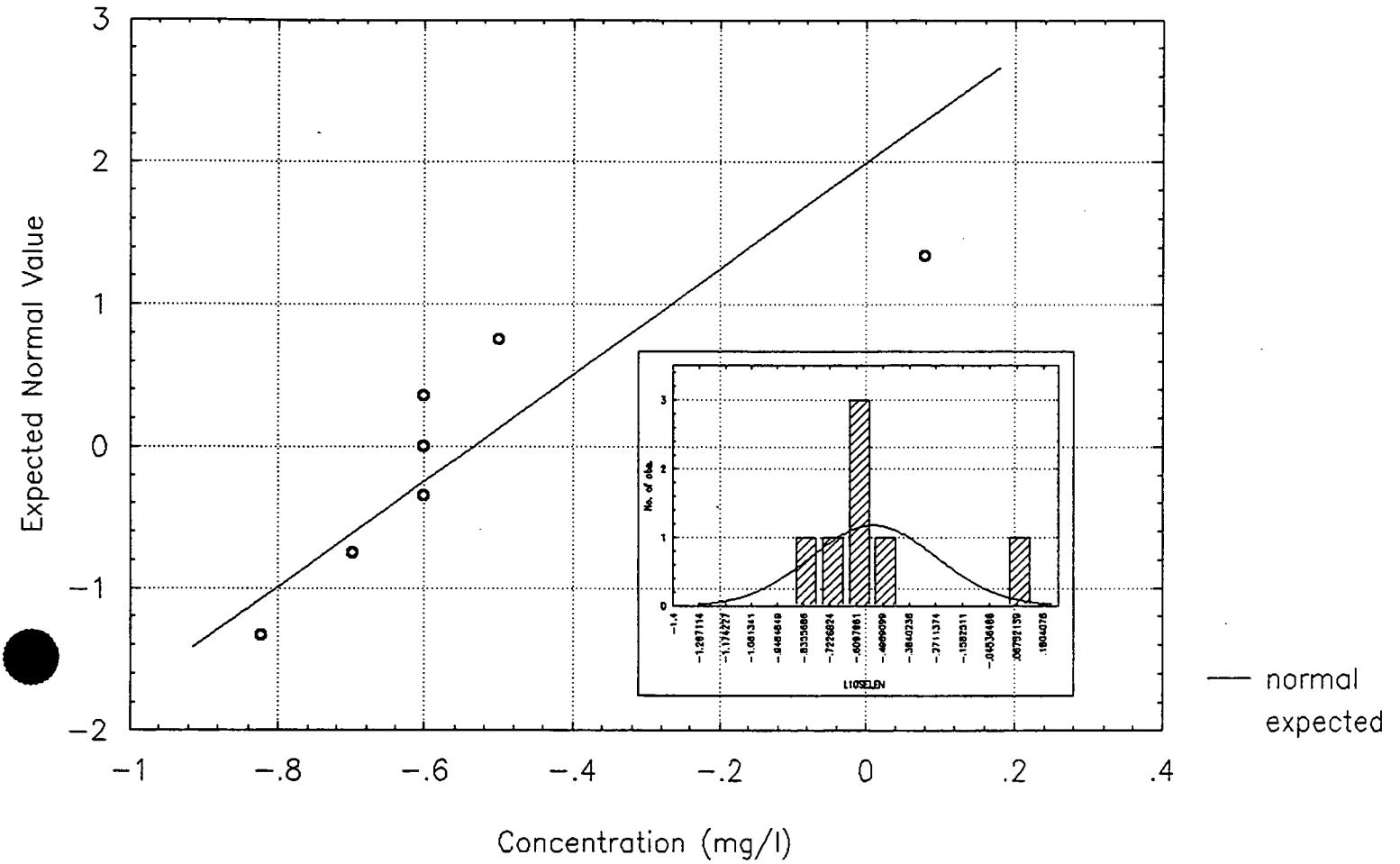


Normal Probablility Plot for
Total Selenium

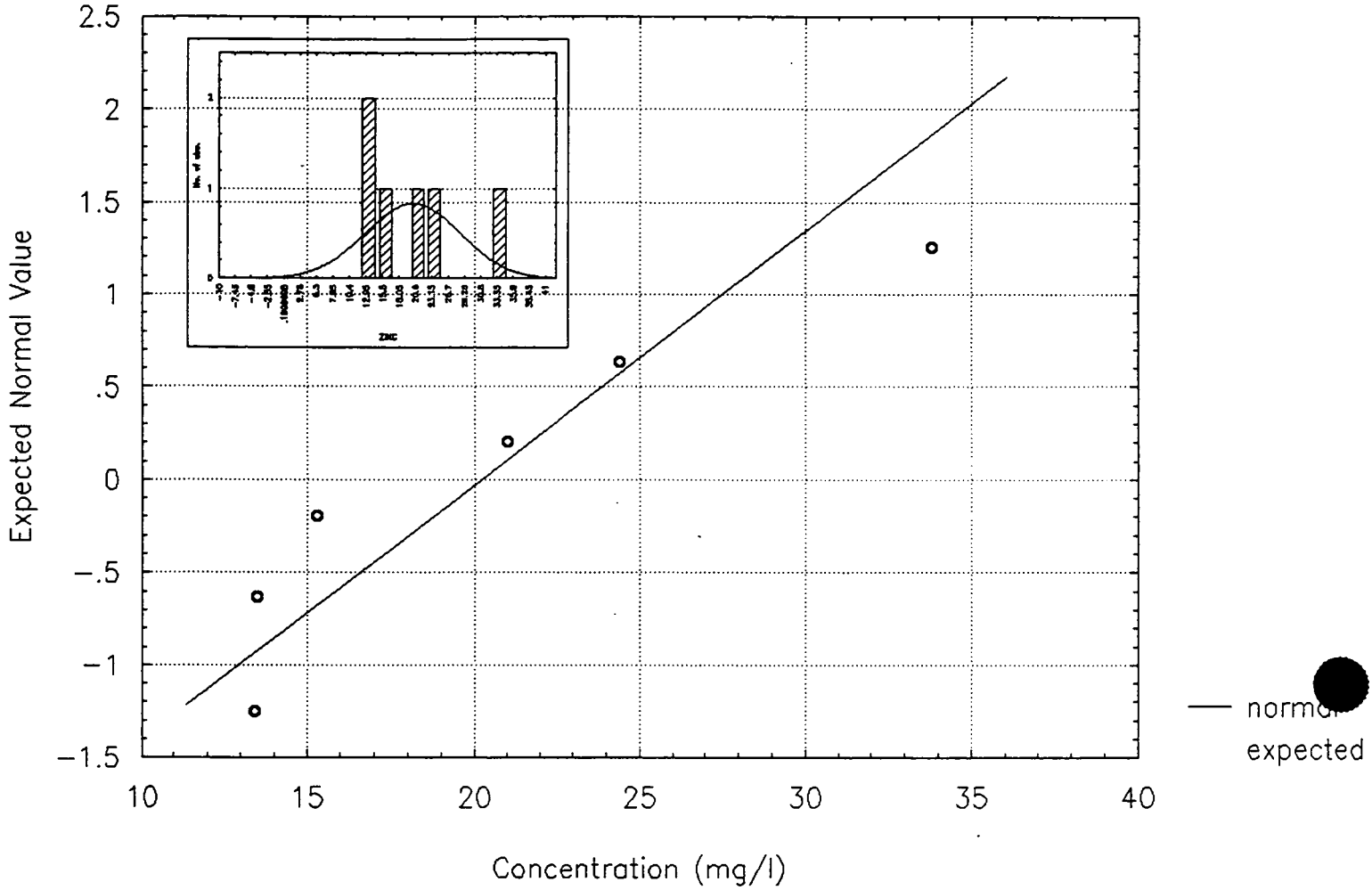


000737

Normal Probablility Plot for
Log Base 10 Of
Total Selenium
in Background Sediments

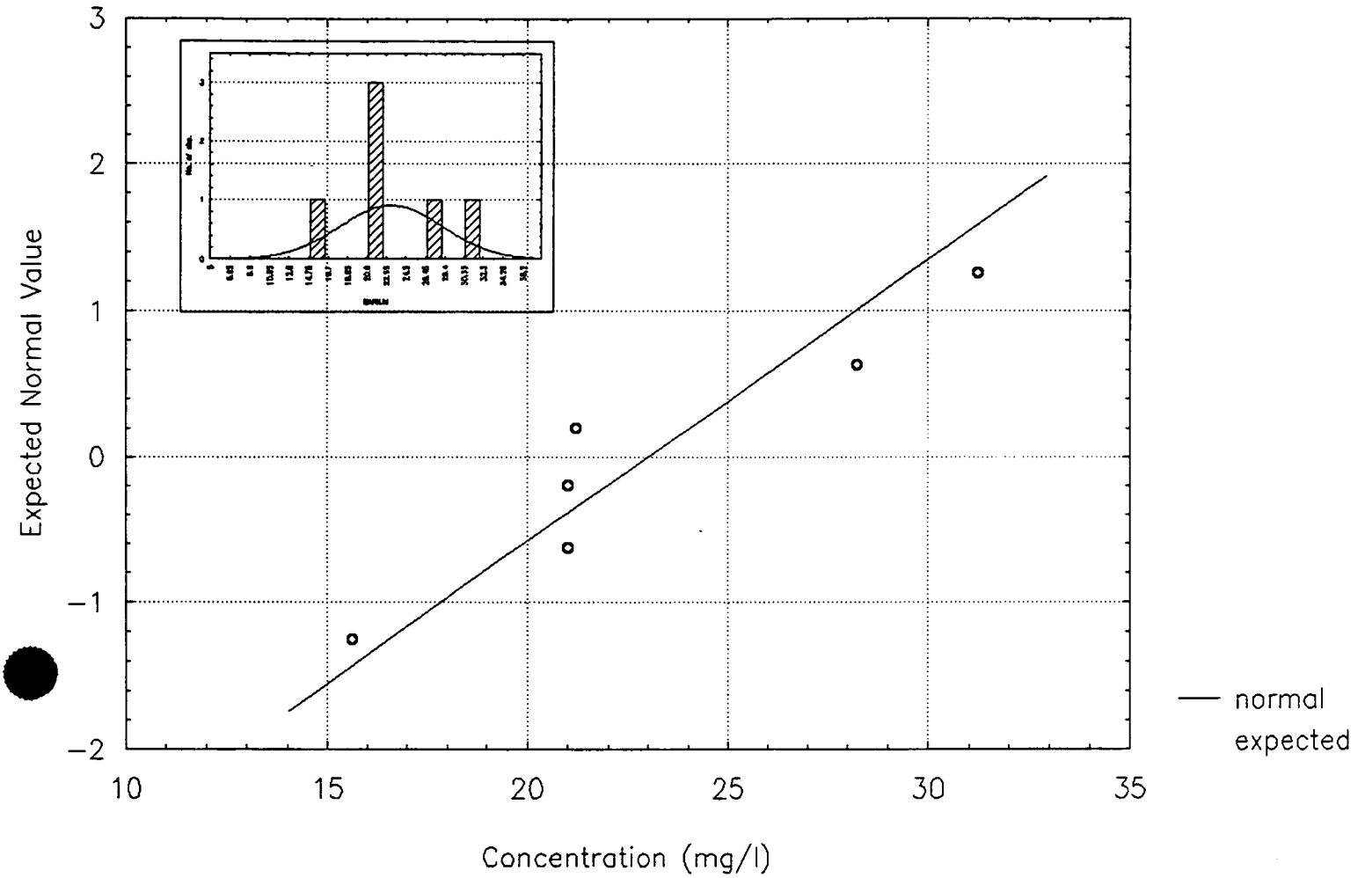


Normal Probablility Plot for
Total Zinc
in Background Sediments

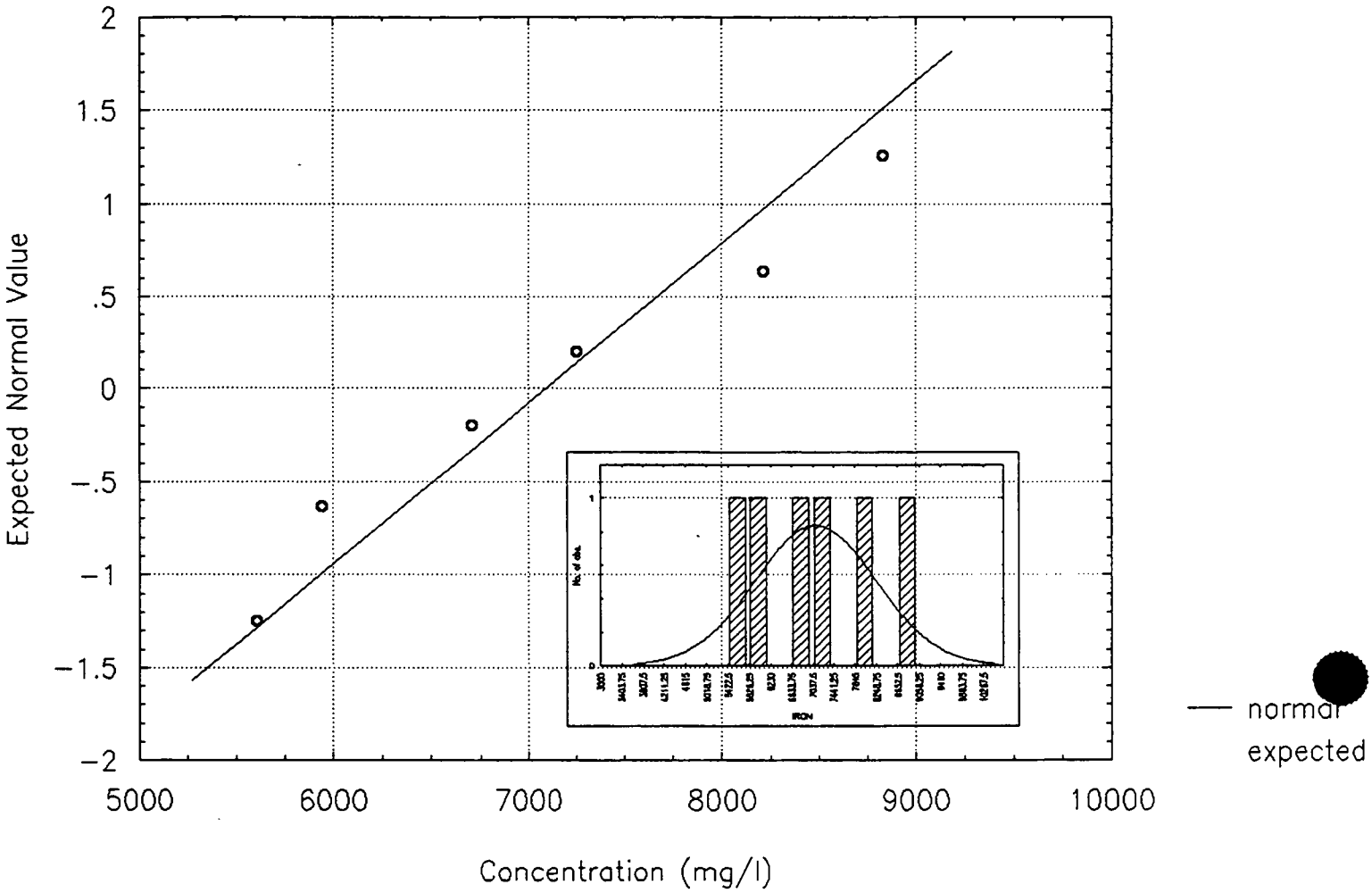


000739

Normal Probablility Plot for
Total Barium
in Background Sediments

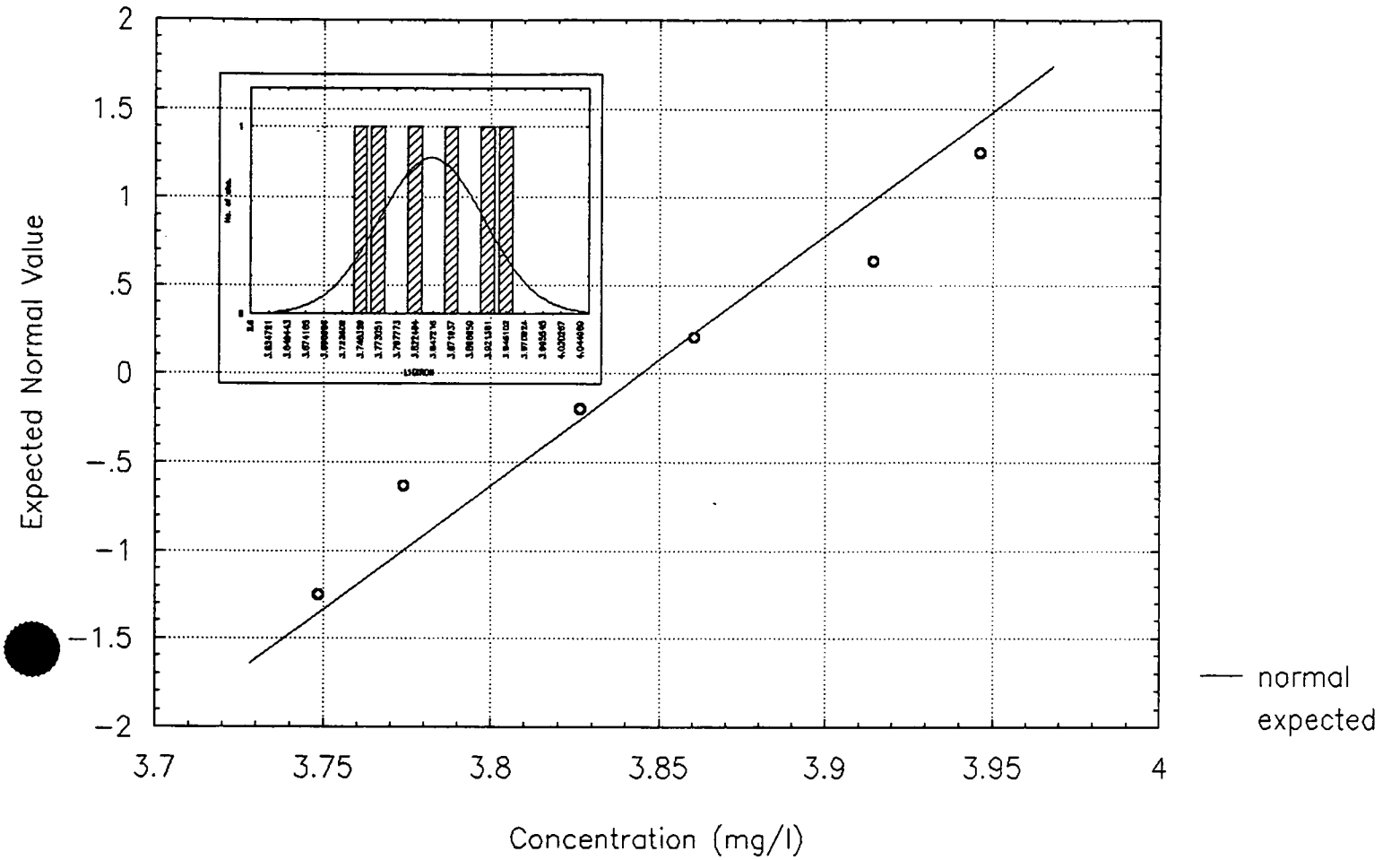


Normal Probablility Plot for
Total Iron
in Background Sediments

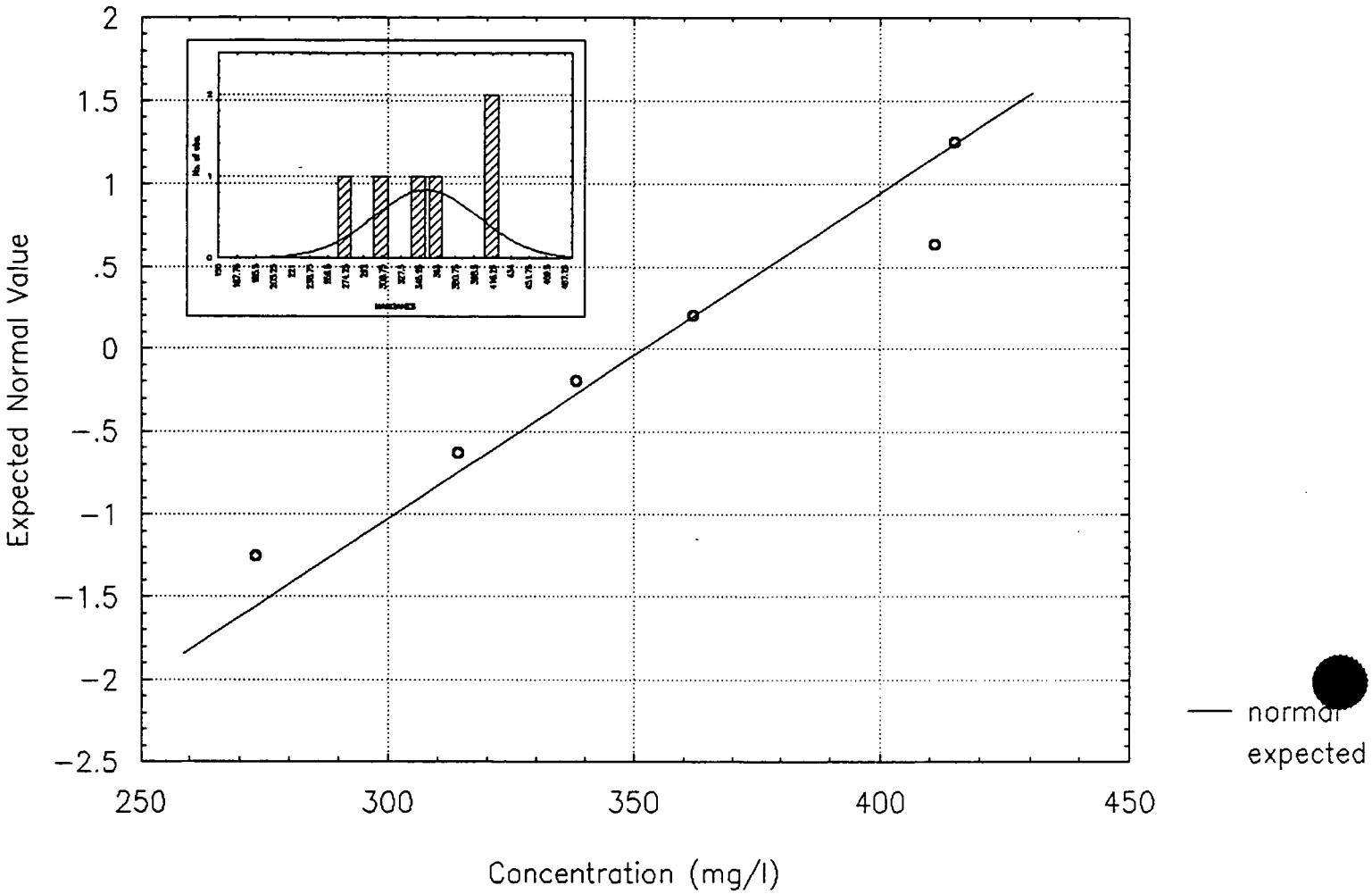


000741

Normal Probablility Plot for
Log Base 10 of
Total Iron
in Background Sediments

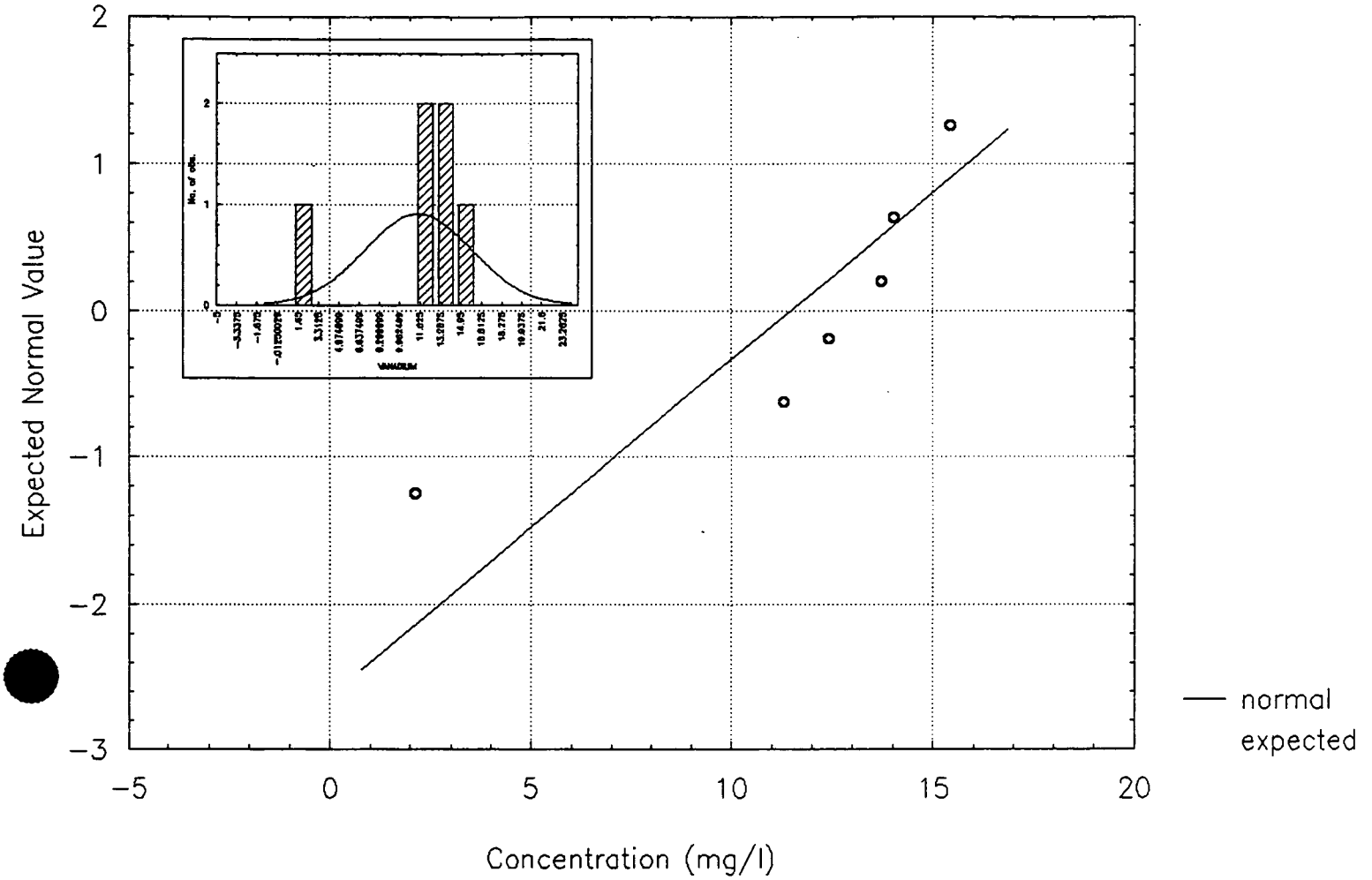


Normal Probablility Plot for
Total Manganese
in Background Sediment

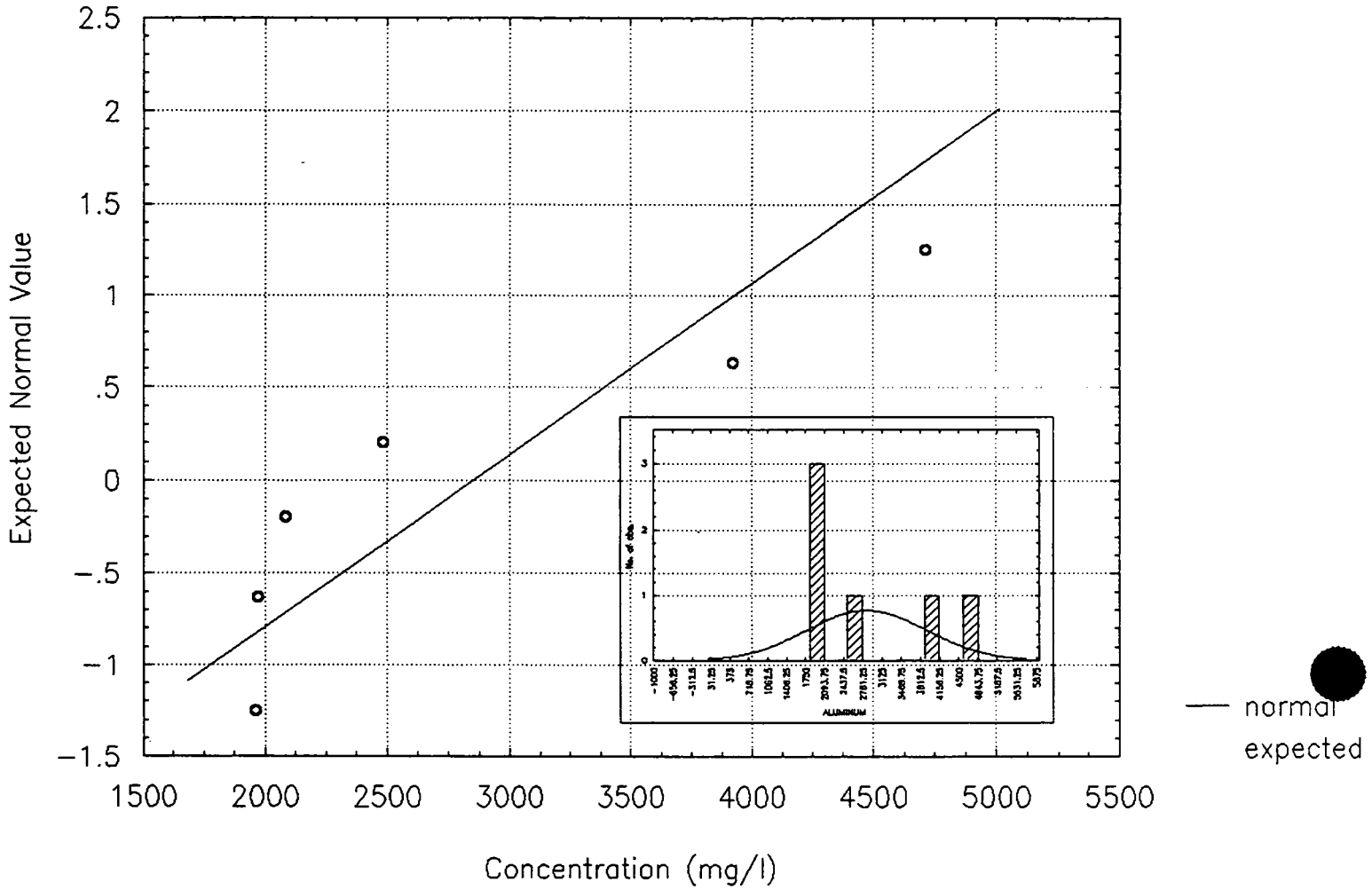


000743

Normal Probablility Plot for
Total Vanadium
in Background Sediments

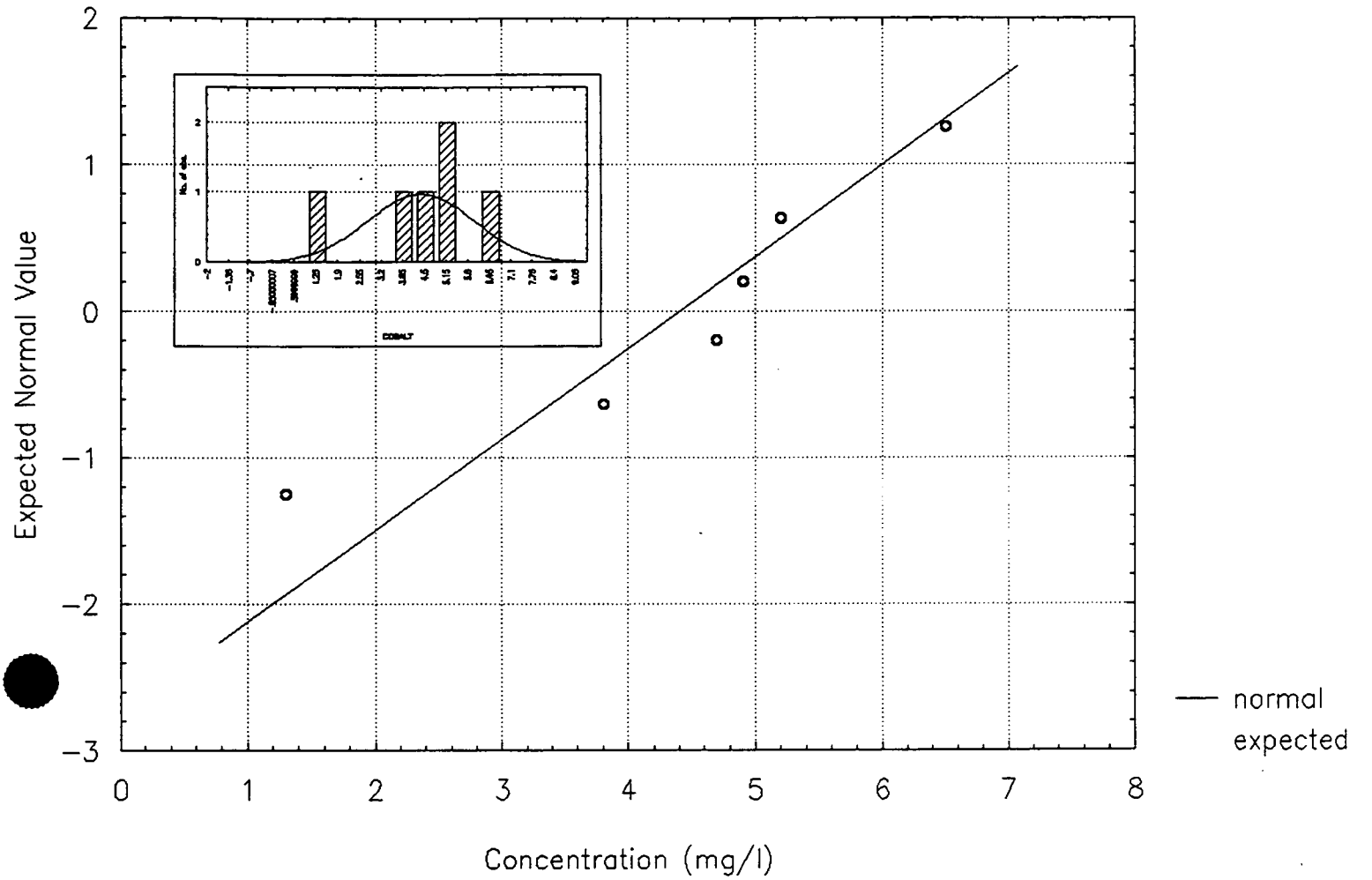


Normal Probablility Plot for
Total Aluminum
in Background Sediments

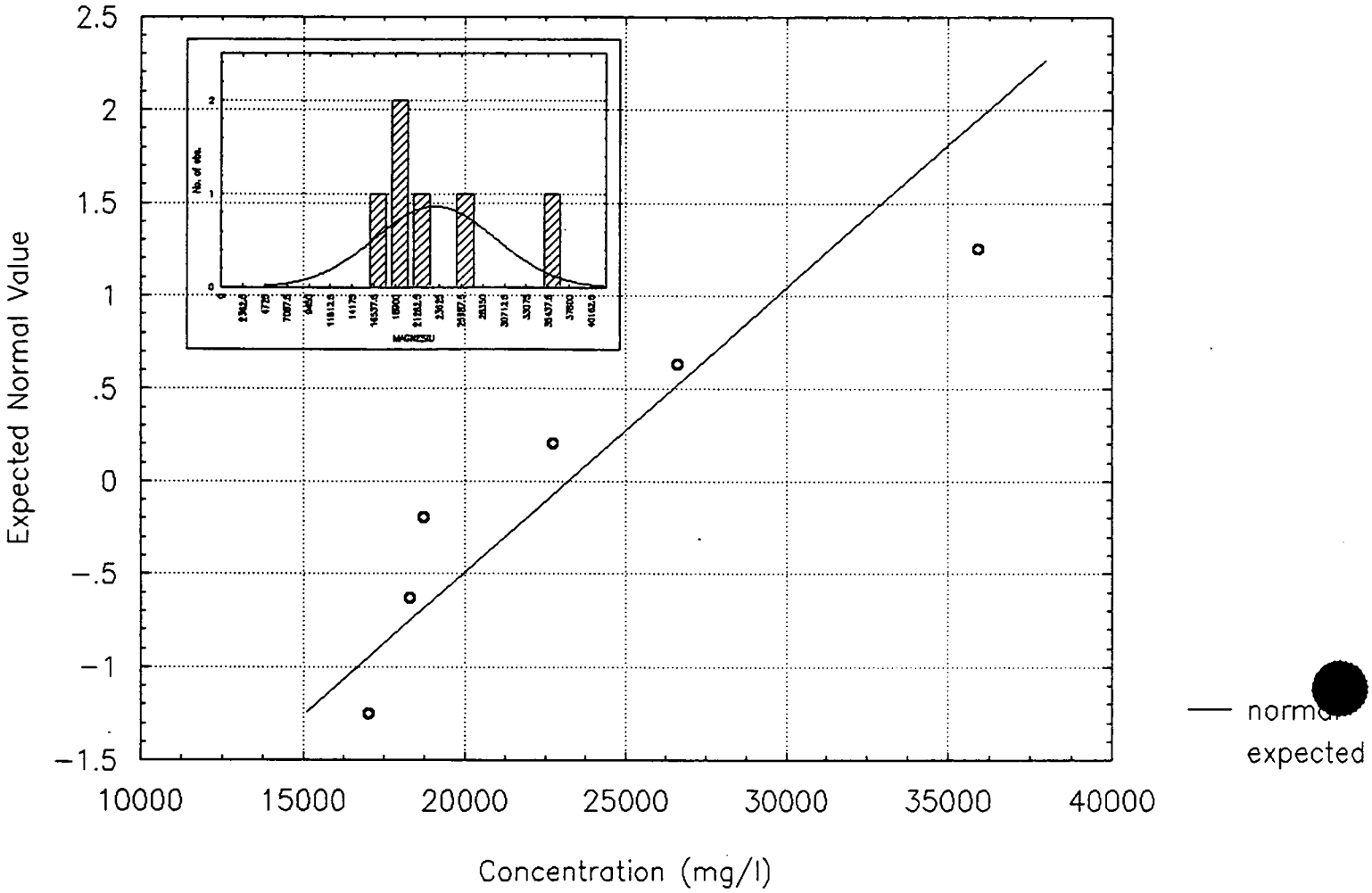


000745

Normal Probablility Plot for
Total Cobalt
in Background Sediments

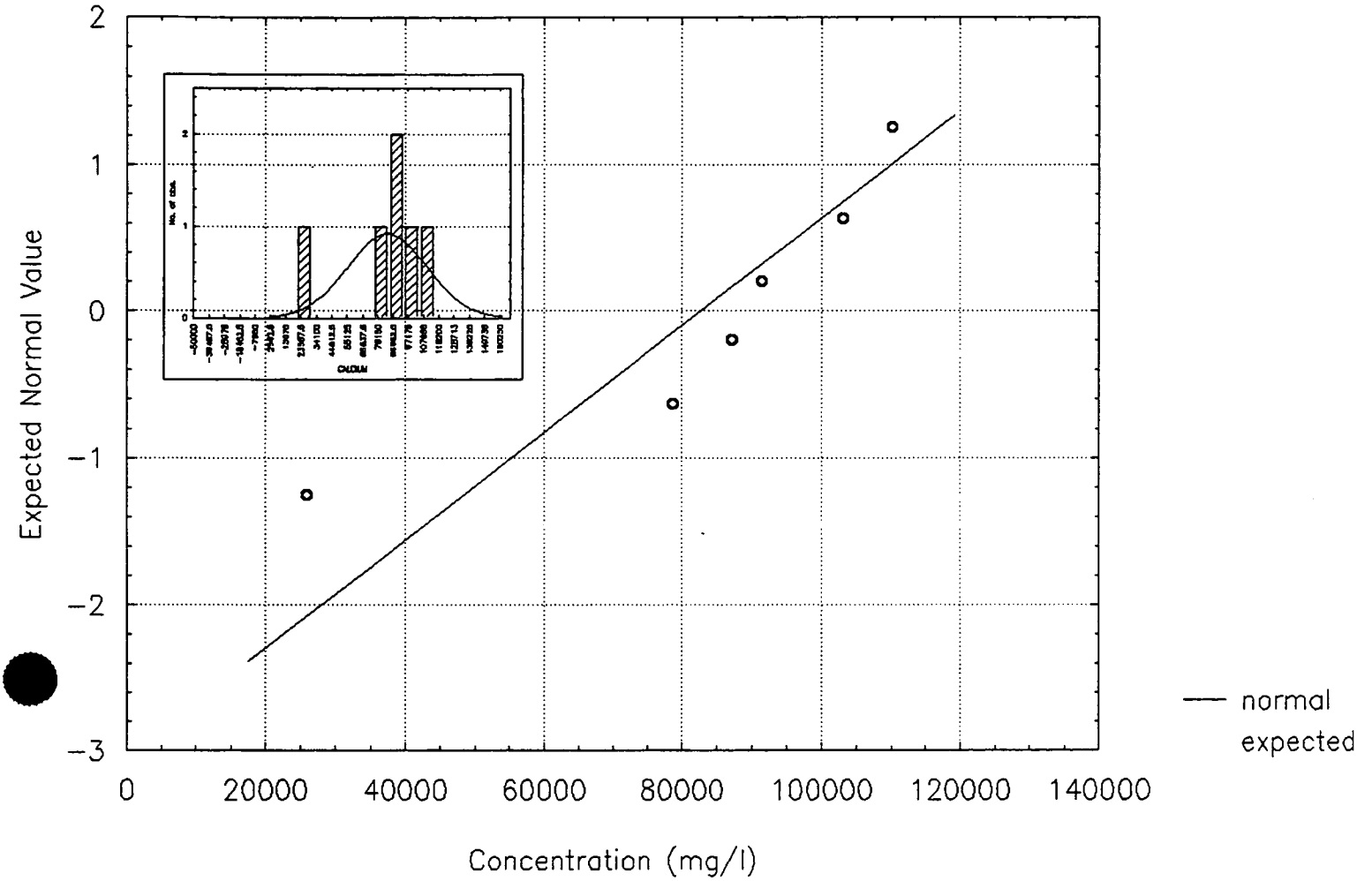


Normal Probablility Plot for
Total Magnesium
in Background Sediments

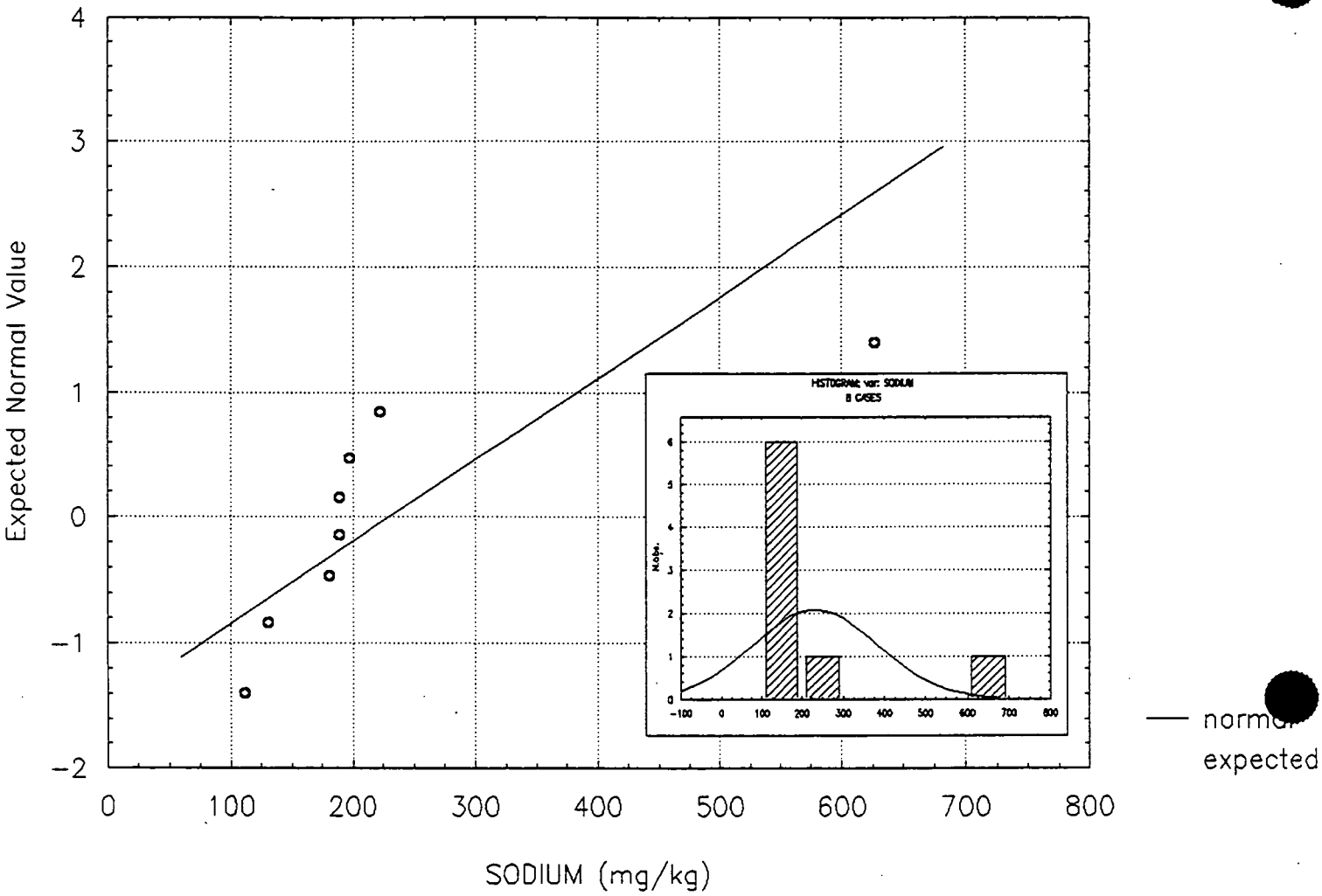


000747

Normal Probablility Plot for
Total Calcium
in Background Sediments

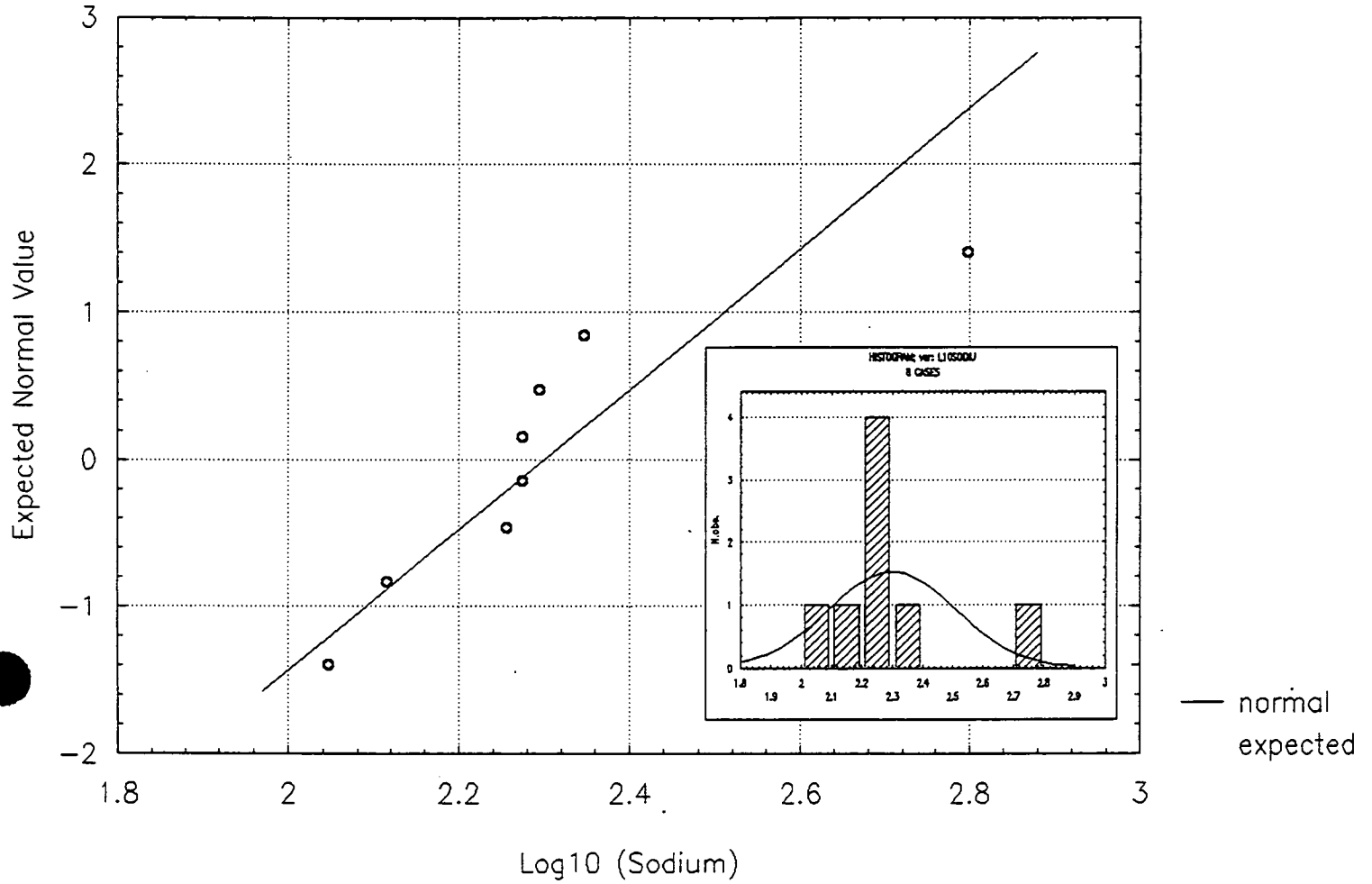


Normal Probablility Plot for Sodium
in Background Sediment Samples

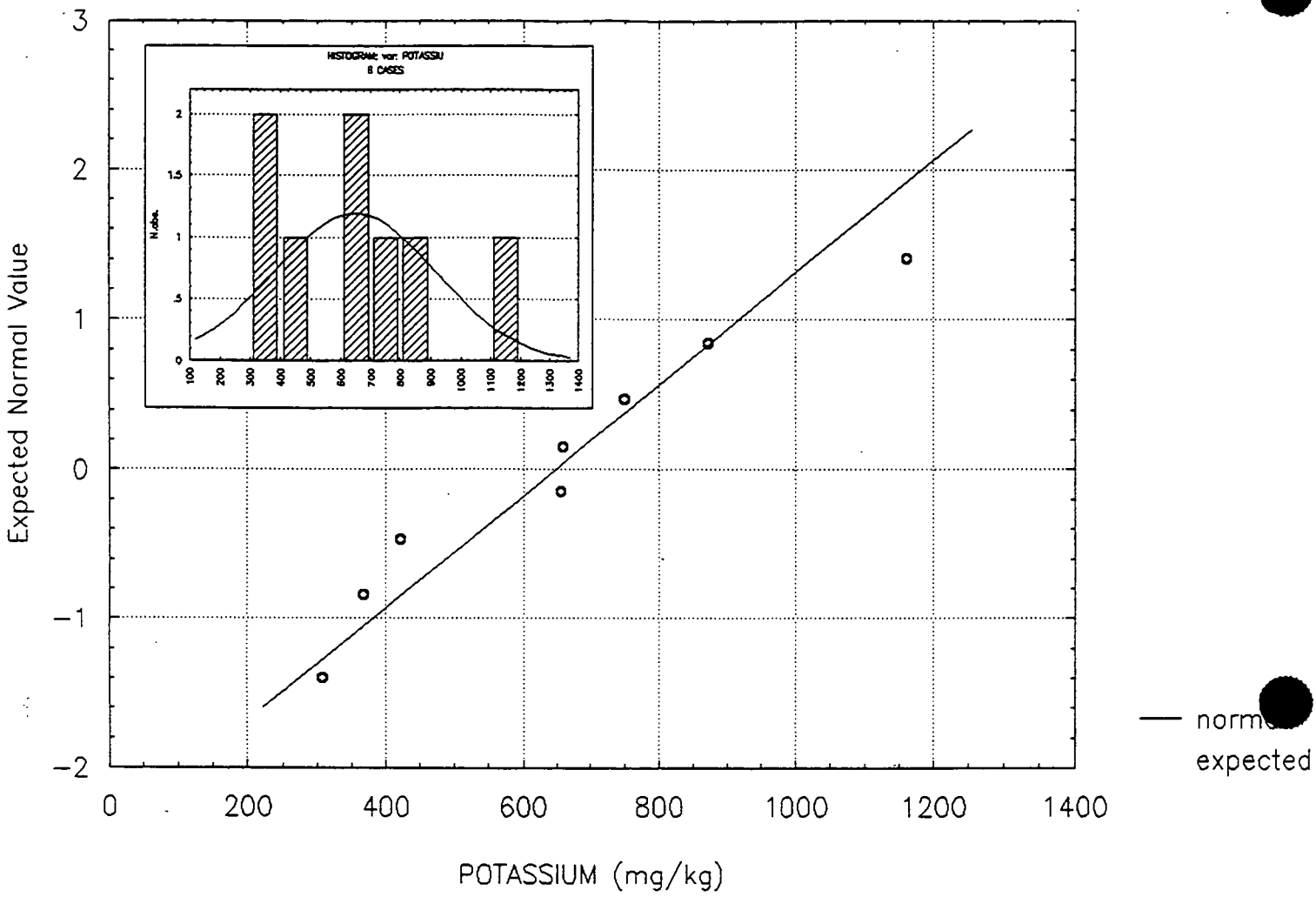


000749

Normal Probablility Plot for the Log Base 10 Transform of Sodium in the Background Sediment Samples



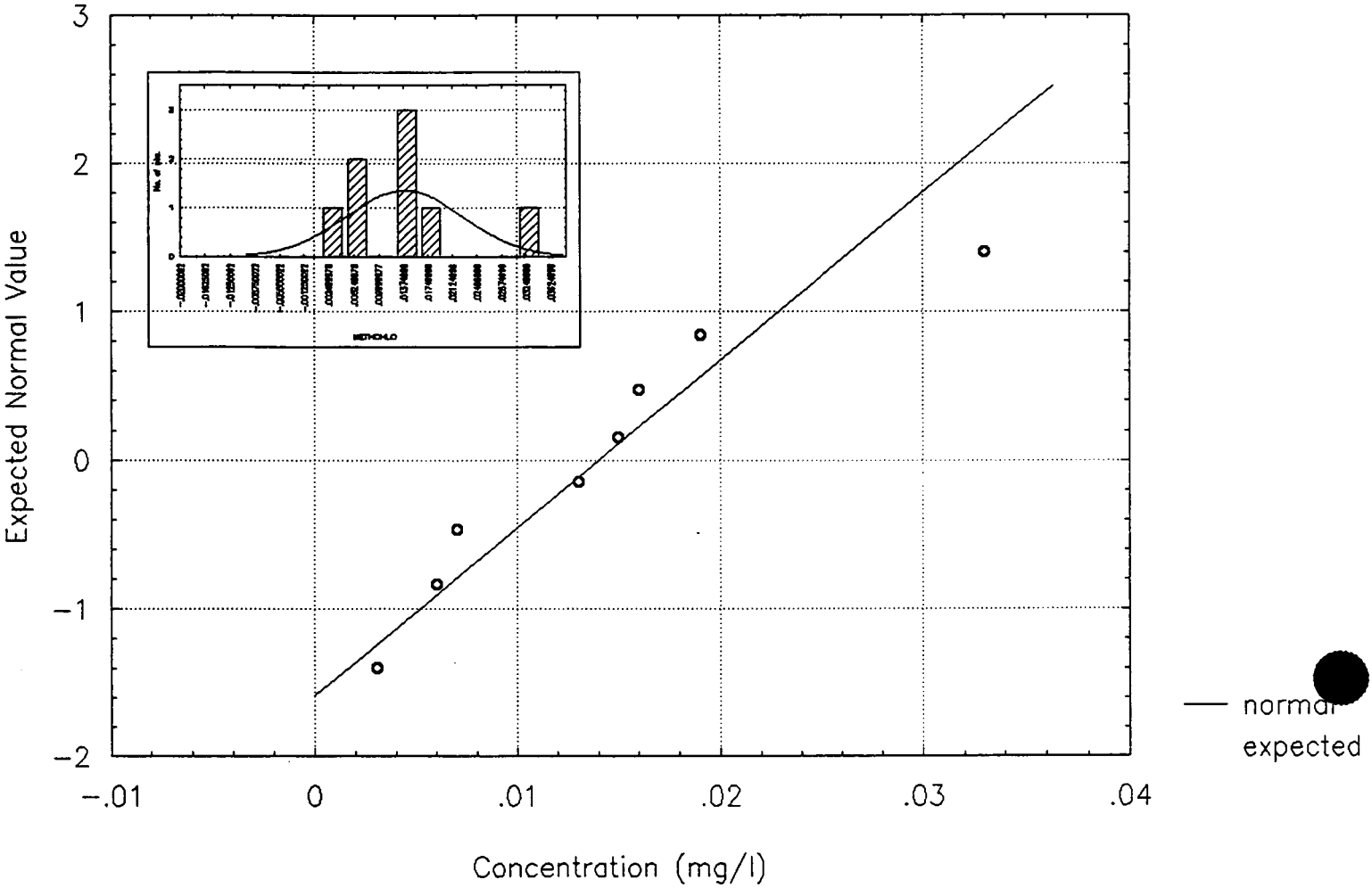
Normal Probablility Plot for Potassium
in Background Sediment Samples



000751

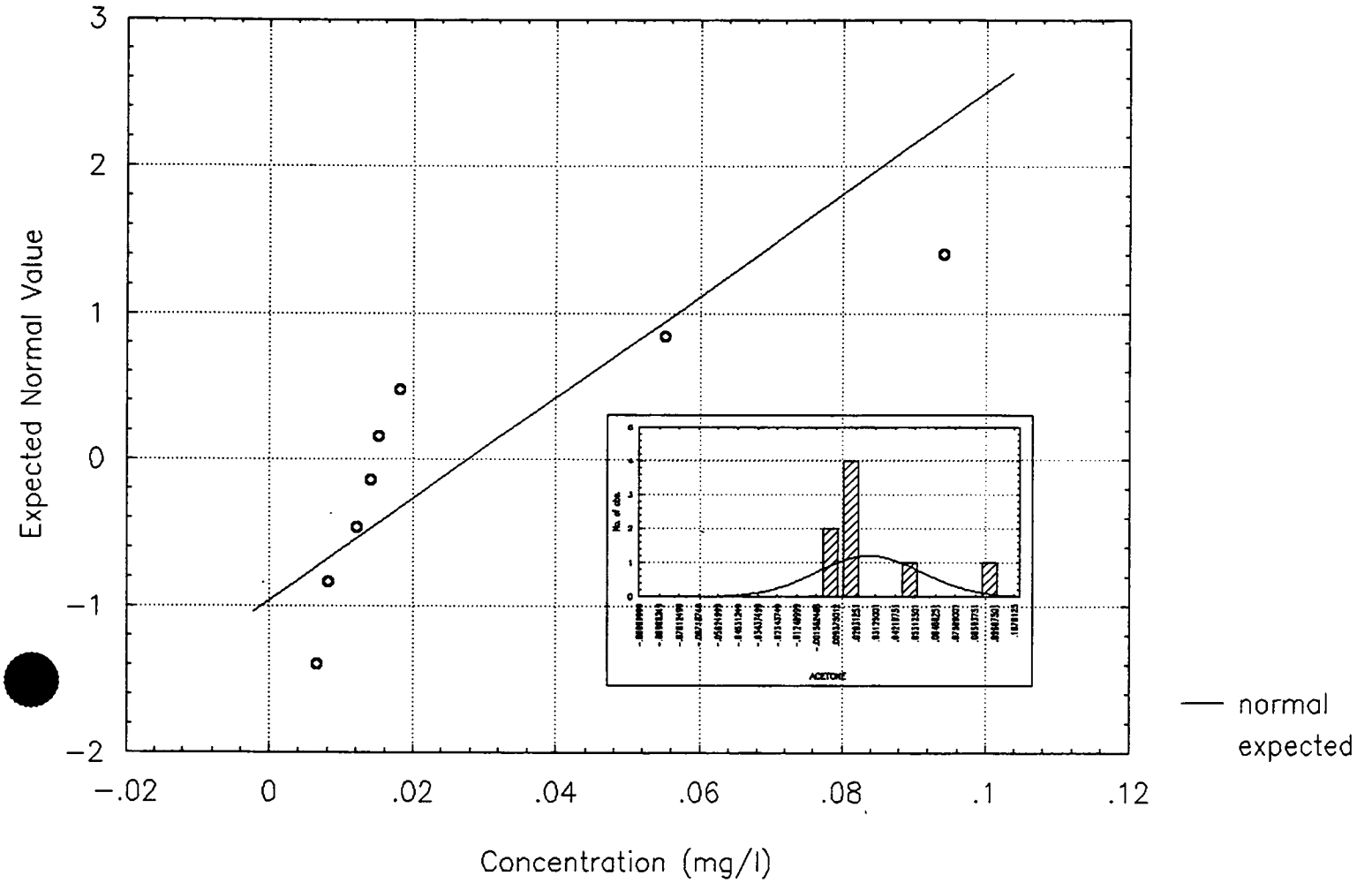
VOLATILES

Normal Probablility Plot for
Methylene Chloride
in Background Sediments

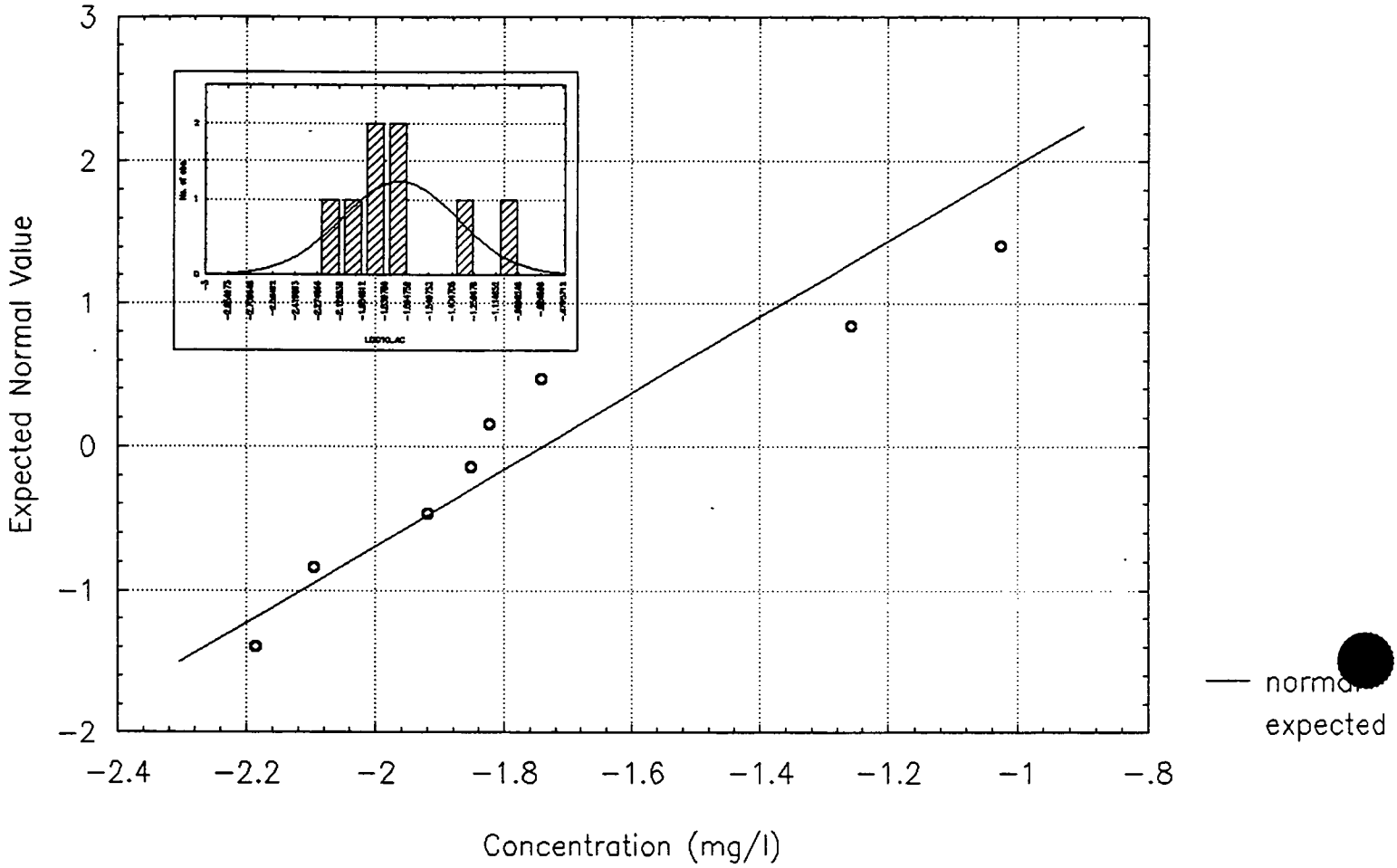


000753

Normal Probablility Plot for
Acetone
in Background Sediments



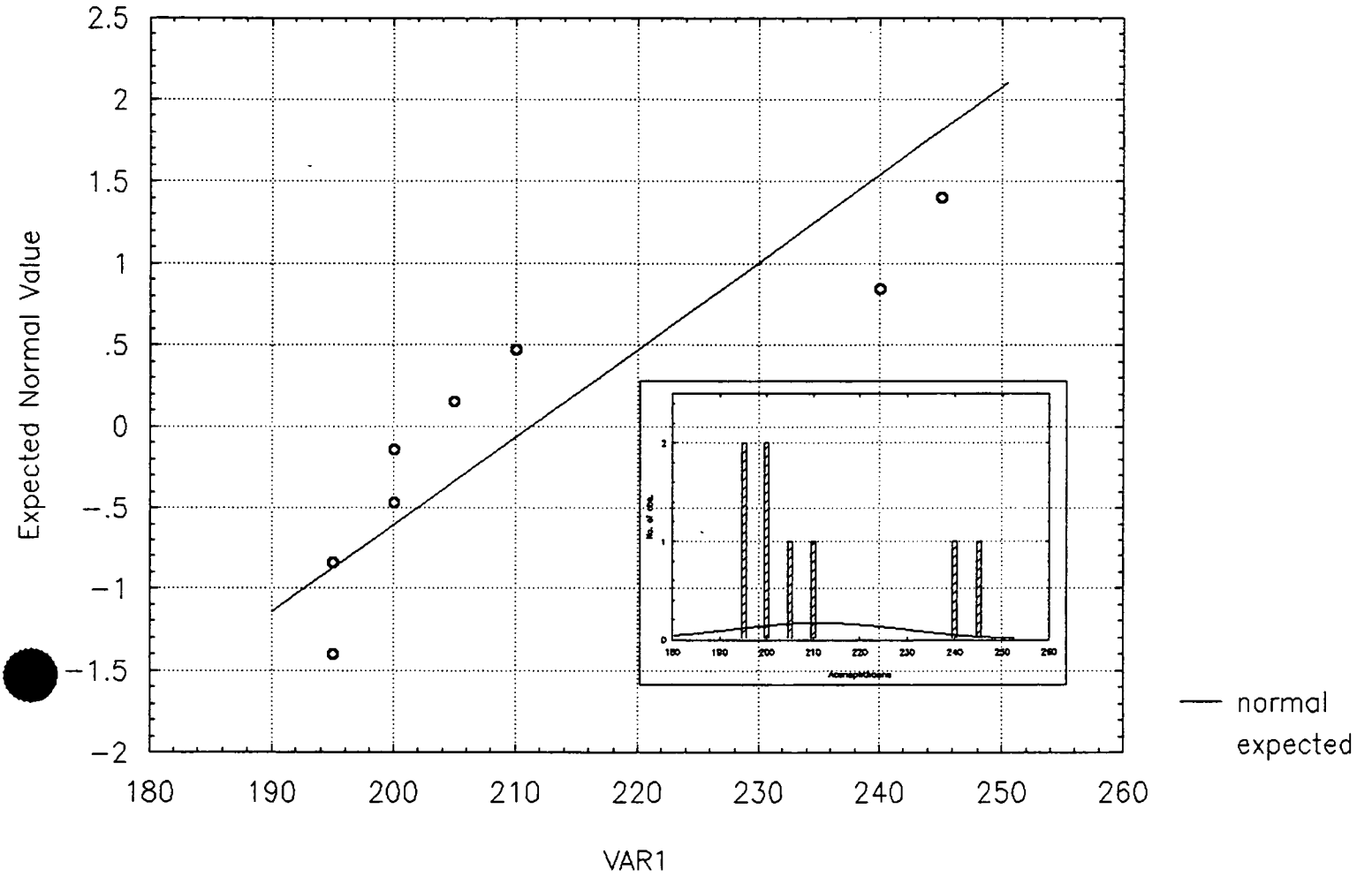
Normal Probablility Plot for
Log Base 10 fo
Acetone
in Background Sediments



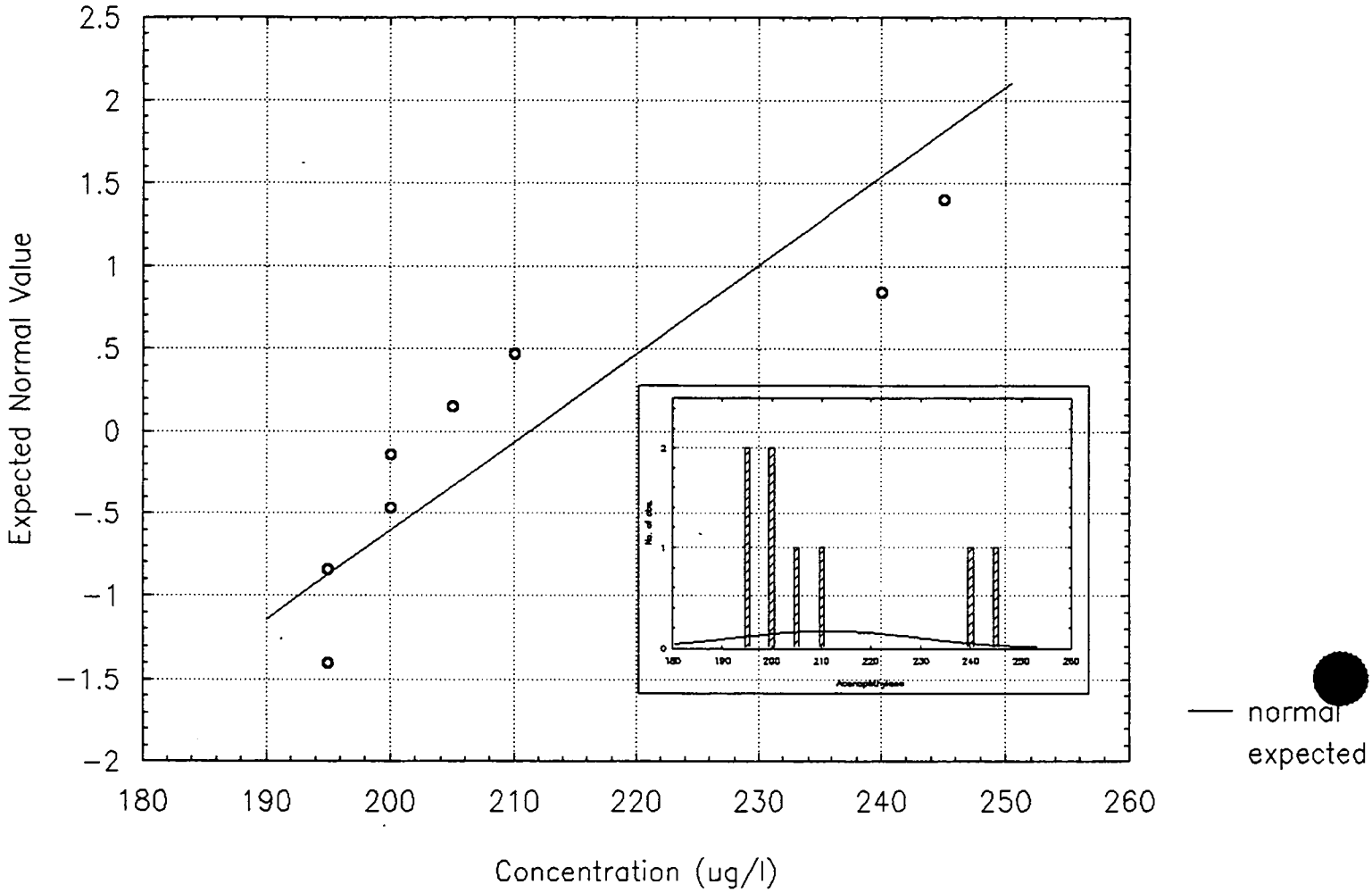
000755

SEMIVOLATILES

Normal Probablility Plot of
Acenaphthene
in Background Soil Samples

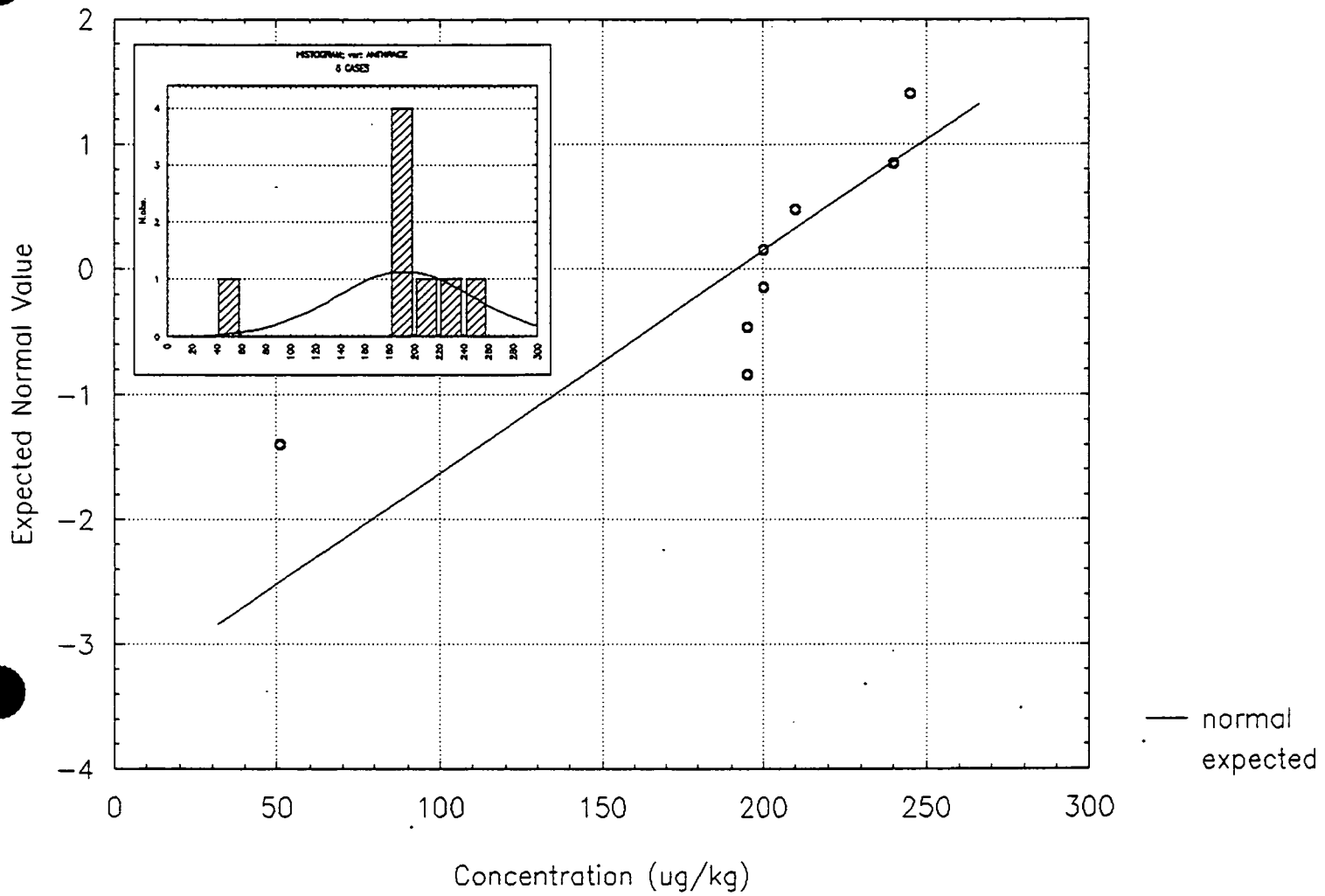


Normal Probablility Plot of
Acenaphthylene
in Background Soil Samples

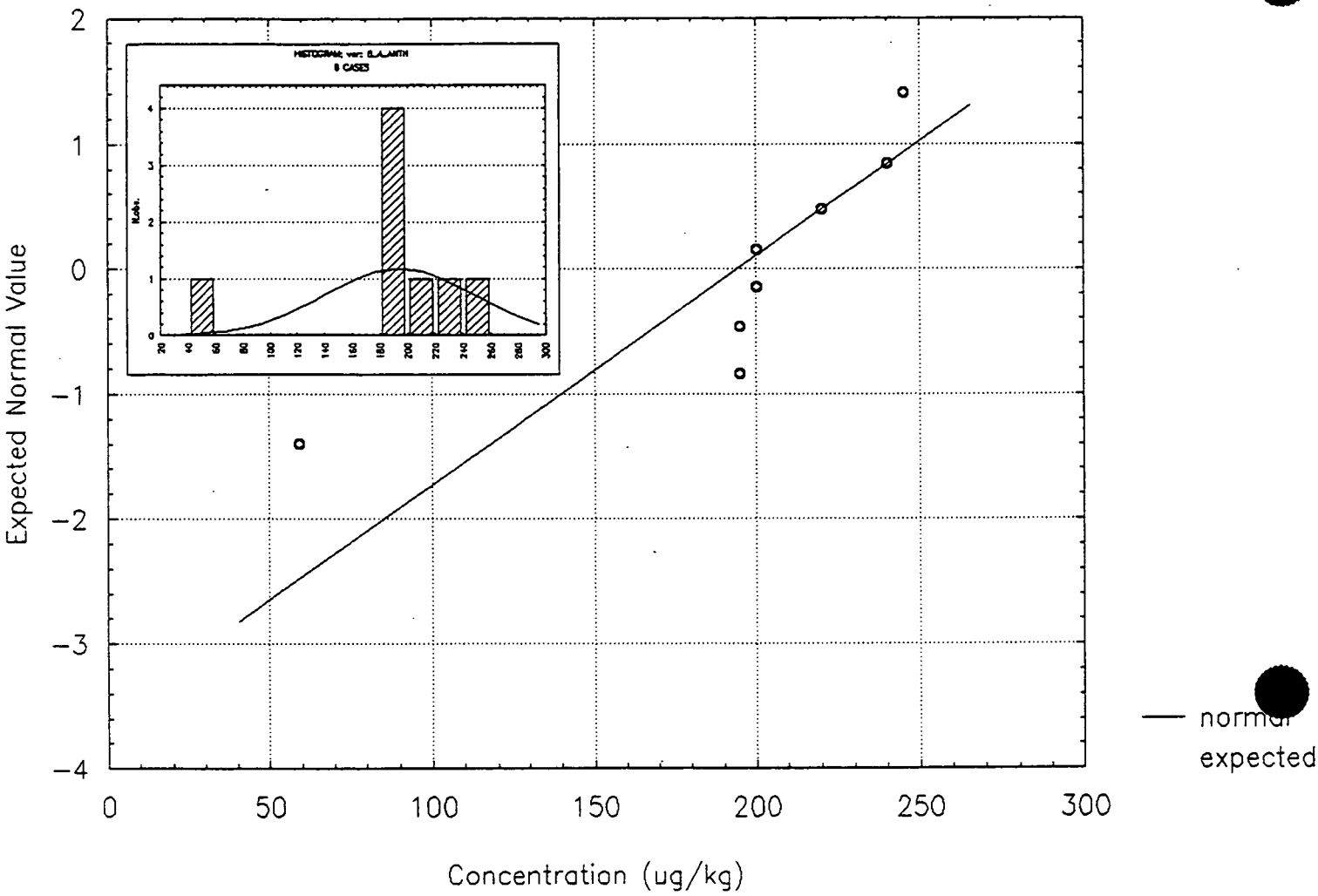


000758

Normal Probablility Plot for Anthracene
in Background Sediment Samples

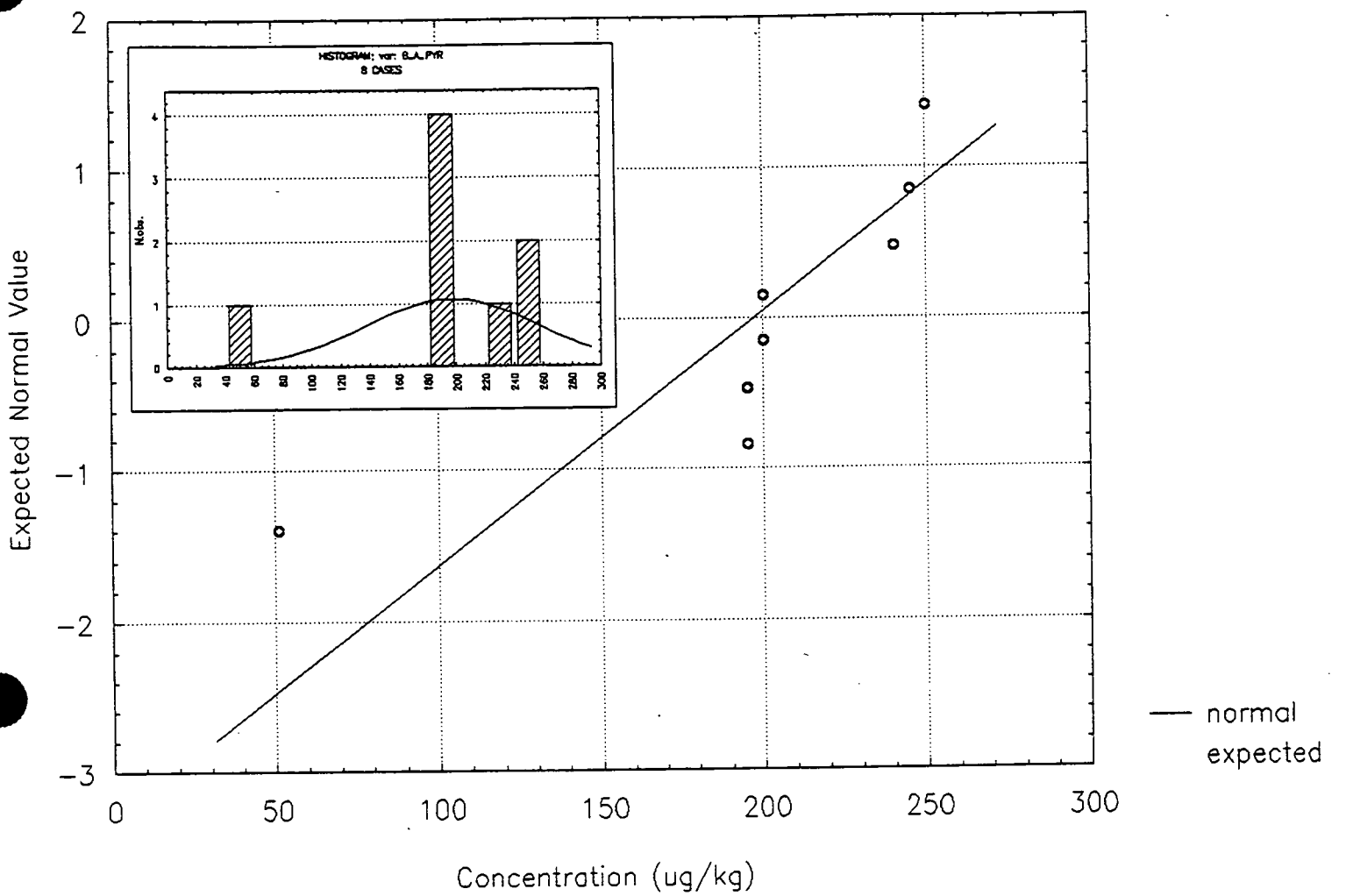


Normal Probablility Plot for Benzo(a)anthracene
in Background Sediment Samples

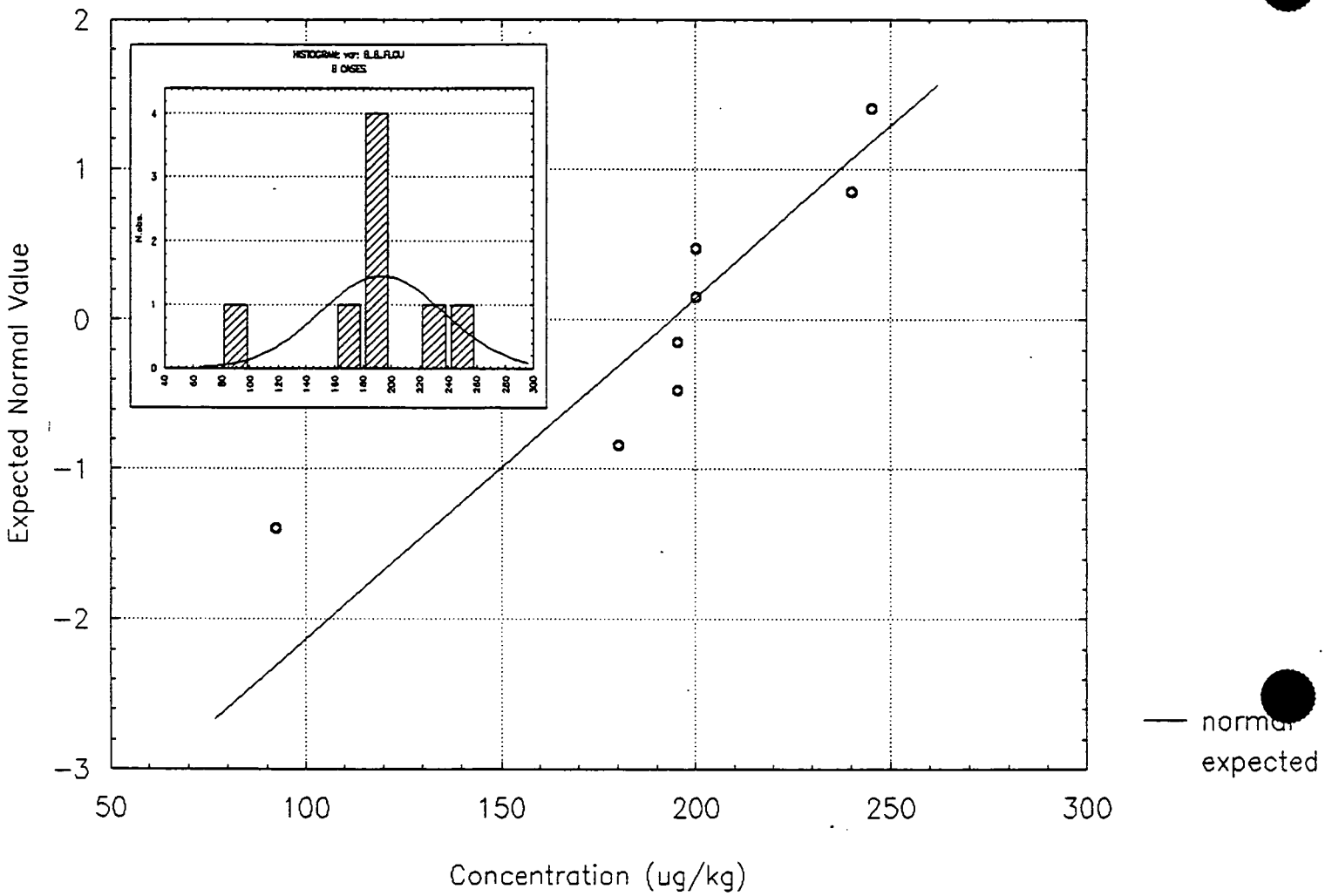


000760

Normal Probablility Plot for Benzo(a)Pyrene
in Background Sediment Samples

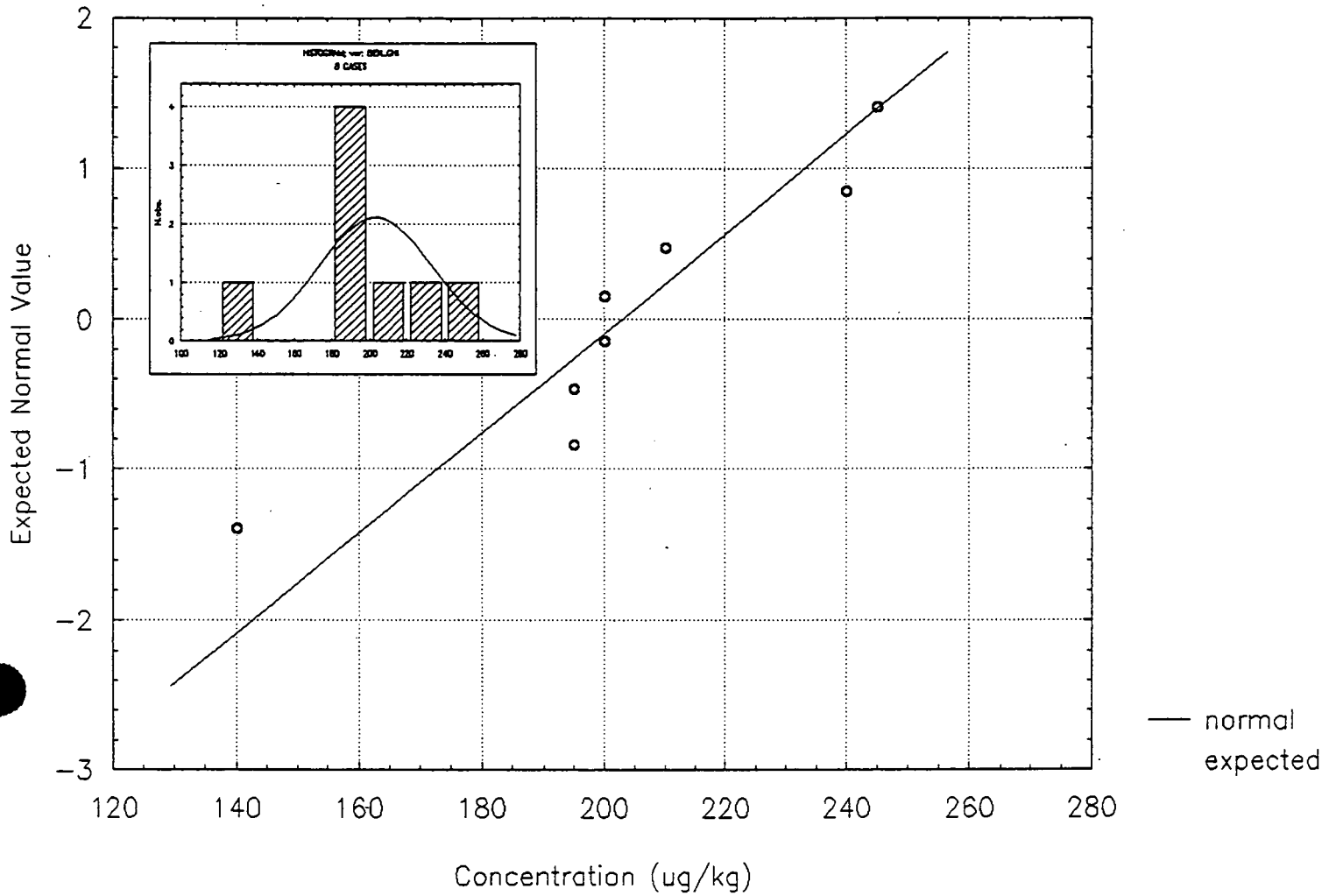


Normal Probablility Plot for Benzo(b)fluoranthene
in Background Sediment Samples

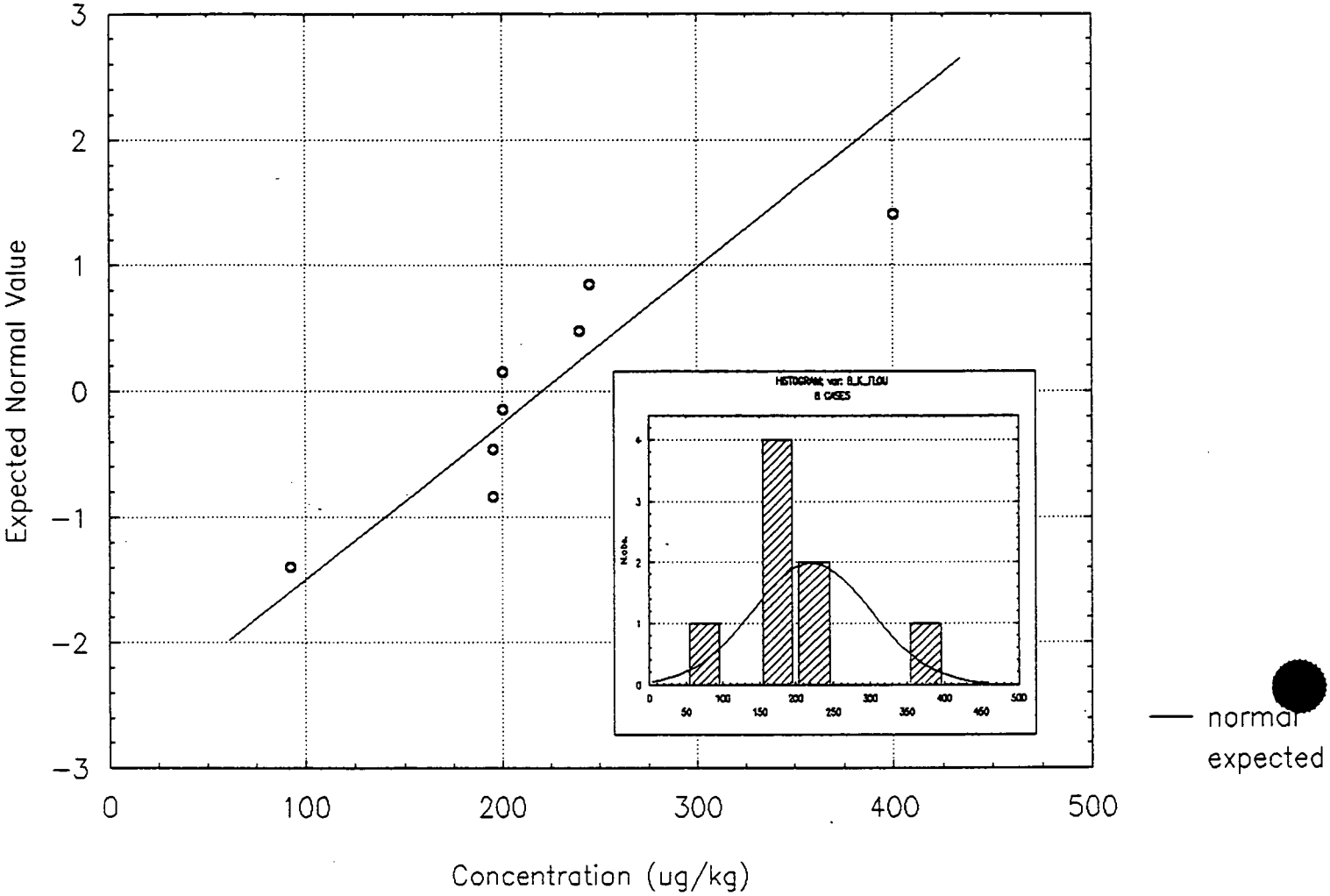


000762

Normal Probablility Plot for Benzo(ghi)perylene
in Background Sediment Samples

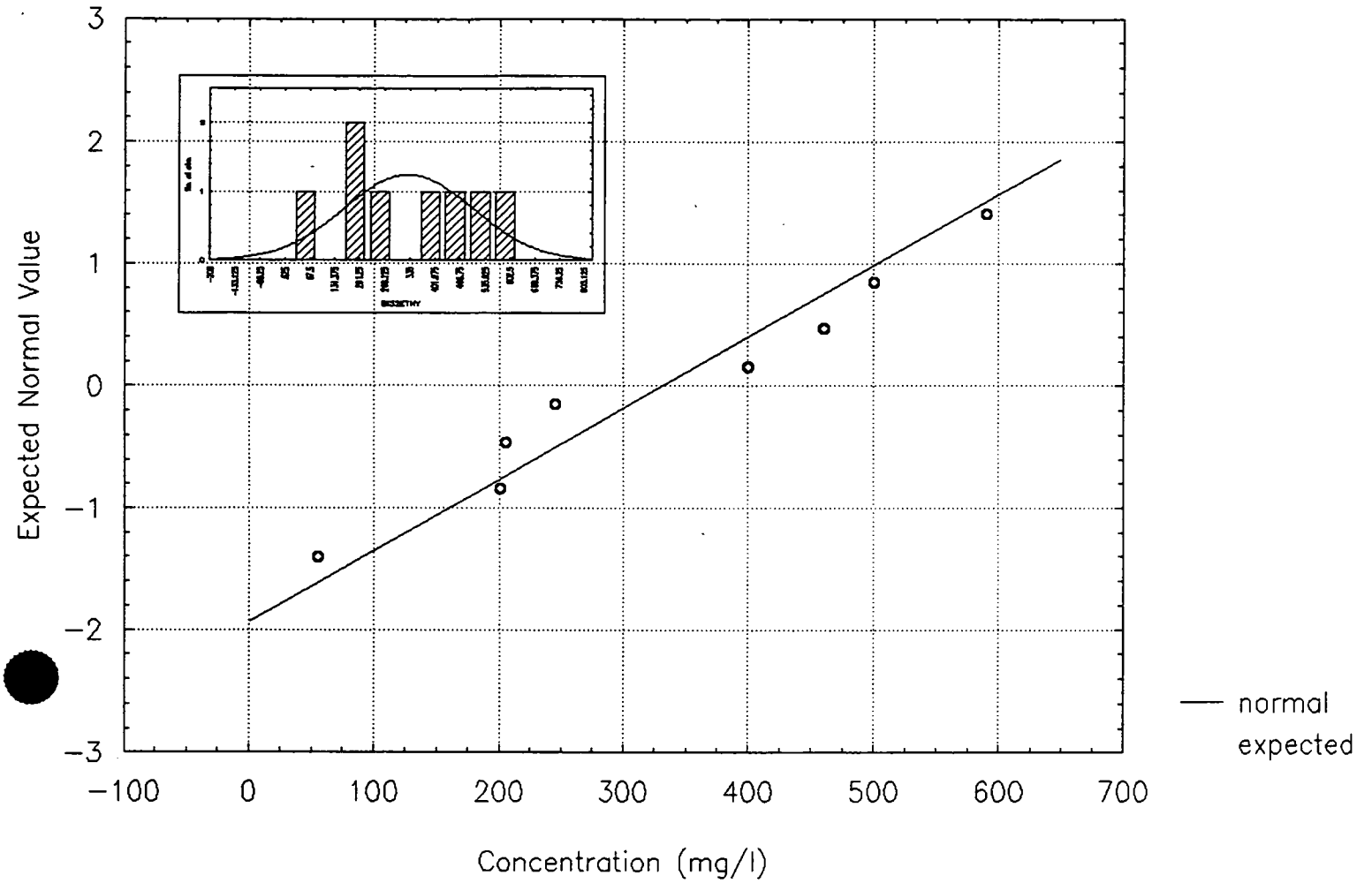


Normal Probablility Plot for Benzo(k)fluoranthene
in Background Sediment Samples

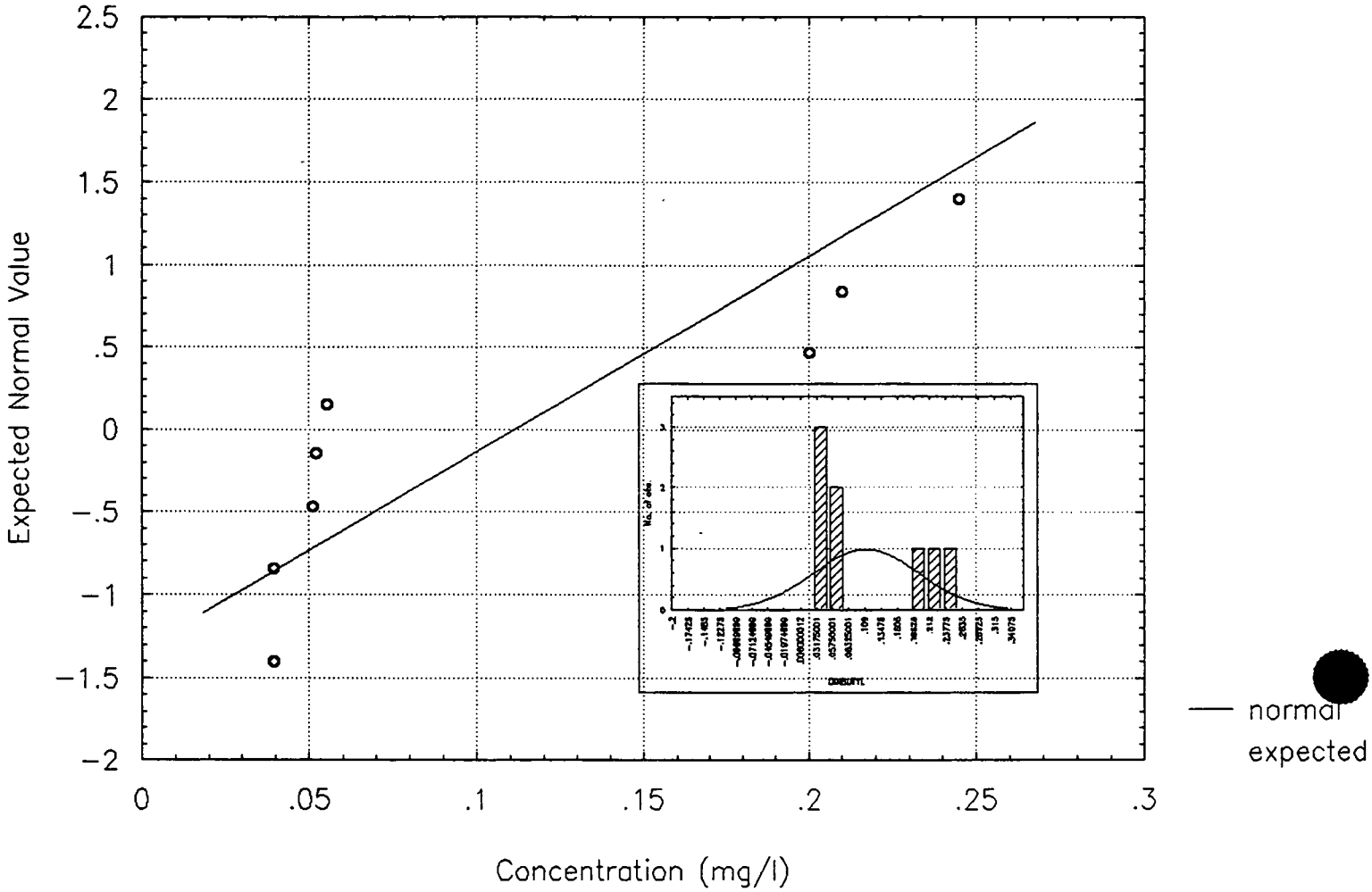


000764

Normal Probablility Plot for
bis(2-ethylhexyl)phthalate
in Background Sediments

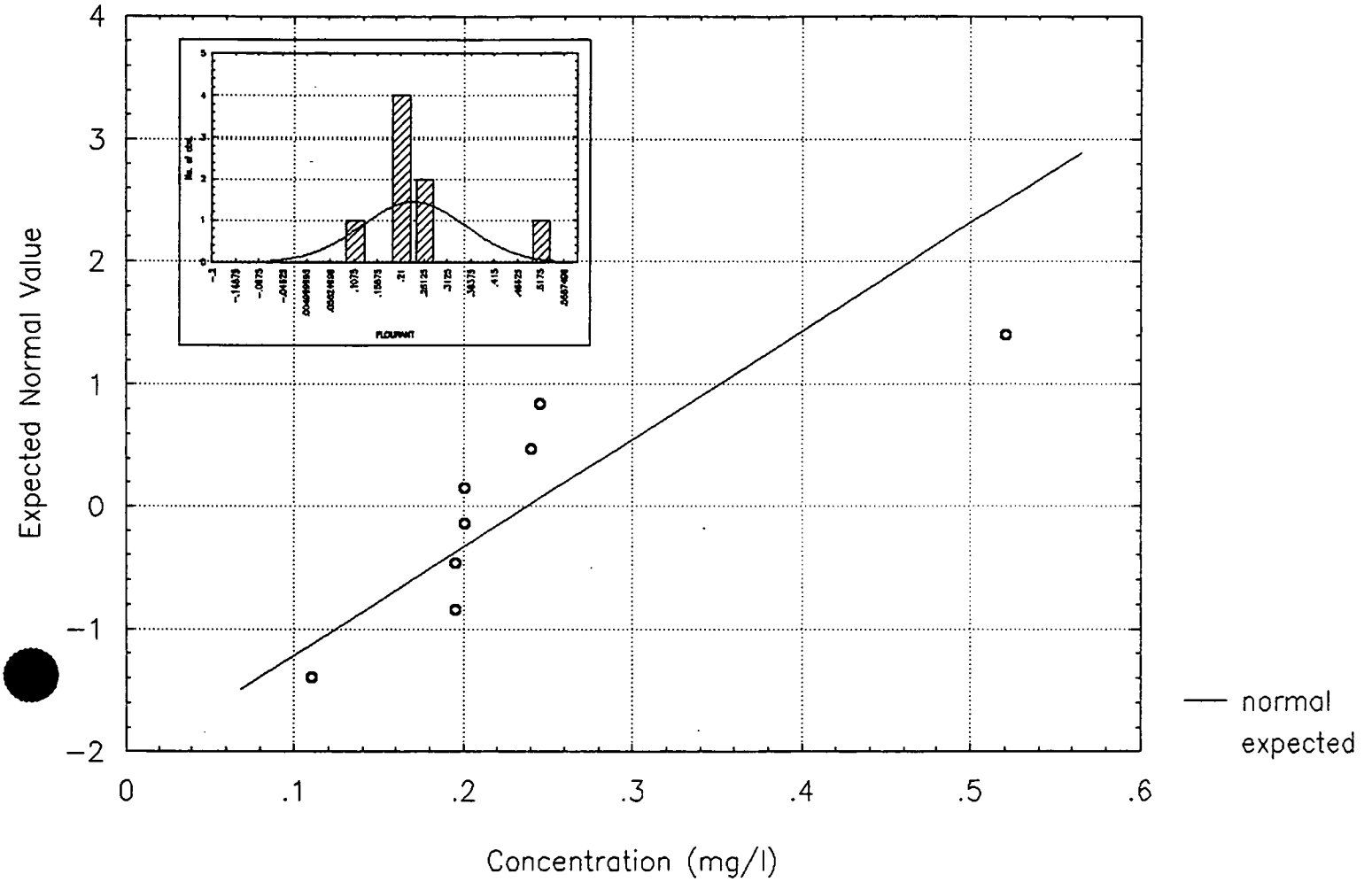


Normal Probablility Plot for
Di-n-butyl phthalate
in Background Sediments

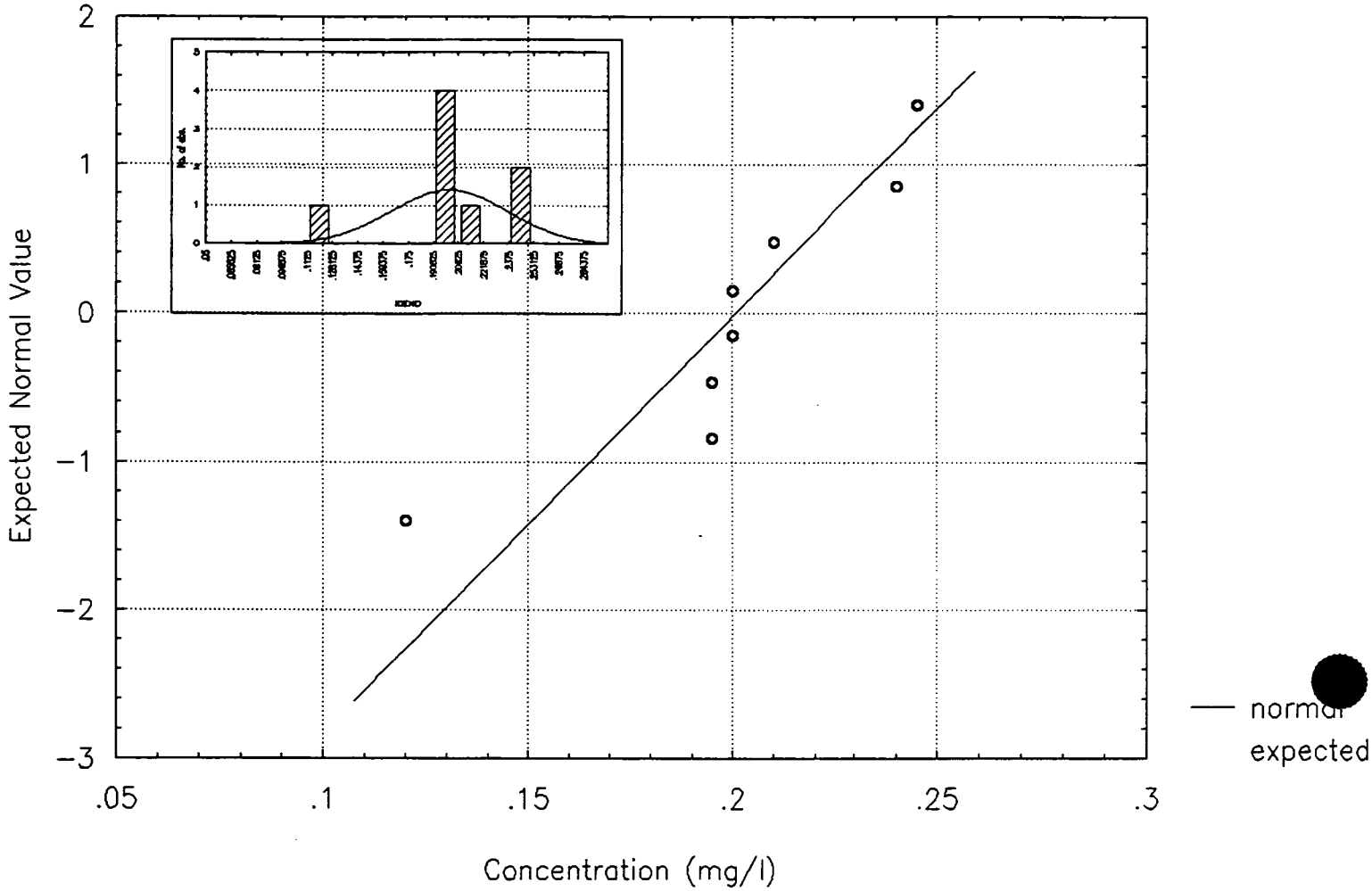


000766

Normal Probablility Plot for
Flouranthene
in Background Sediments

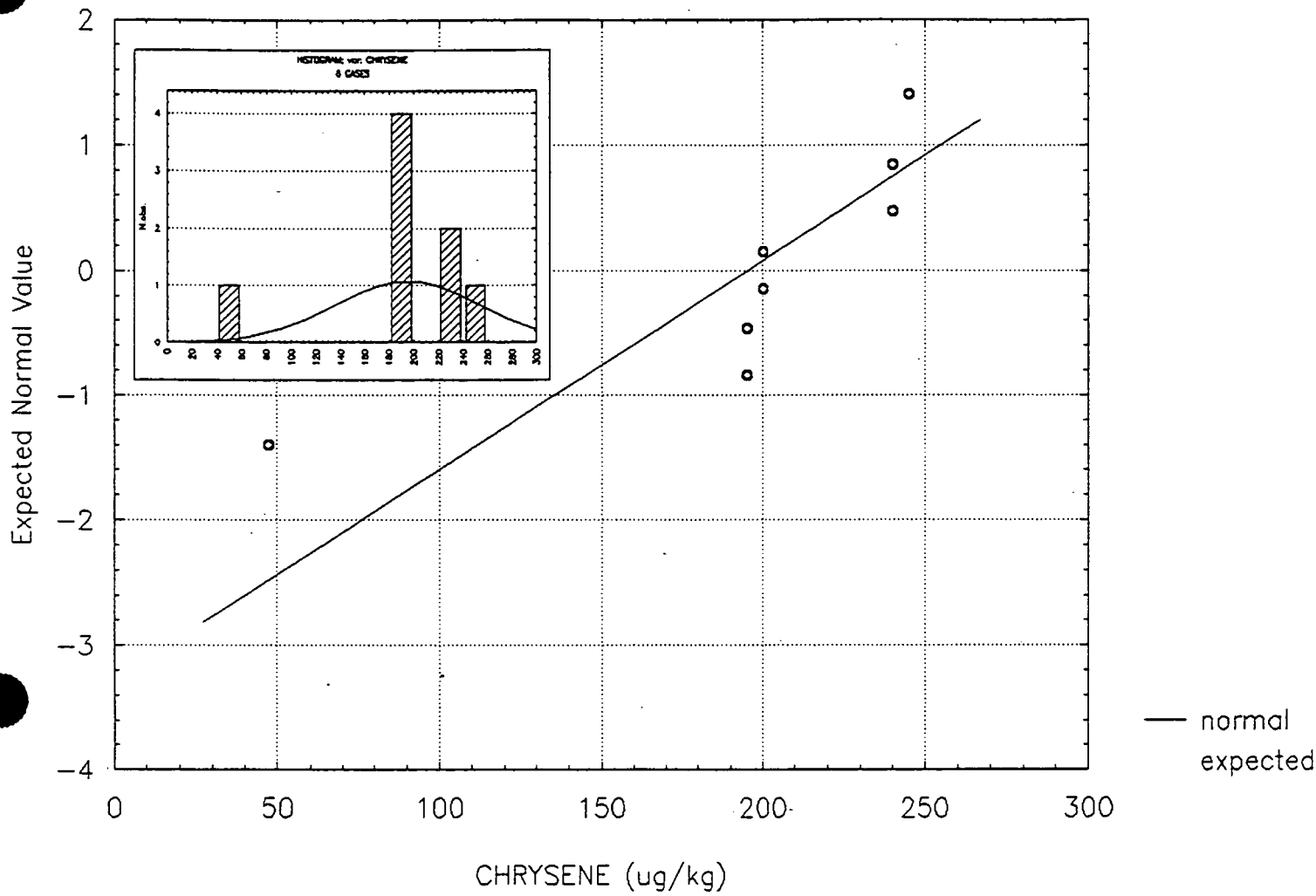


Normal Probablility Plot for
Indeno(1,2,3-cd)pyrene
in Background Sediments

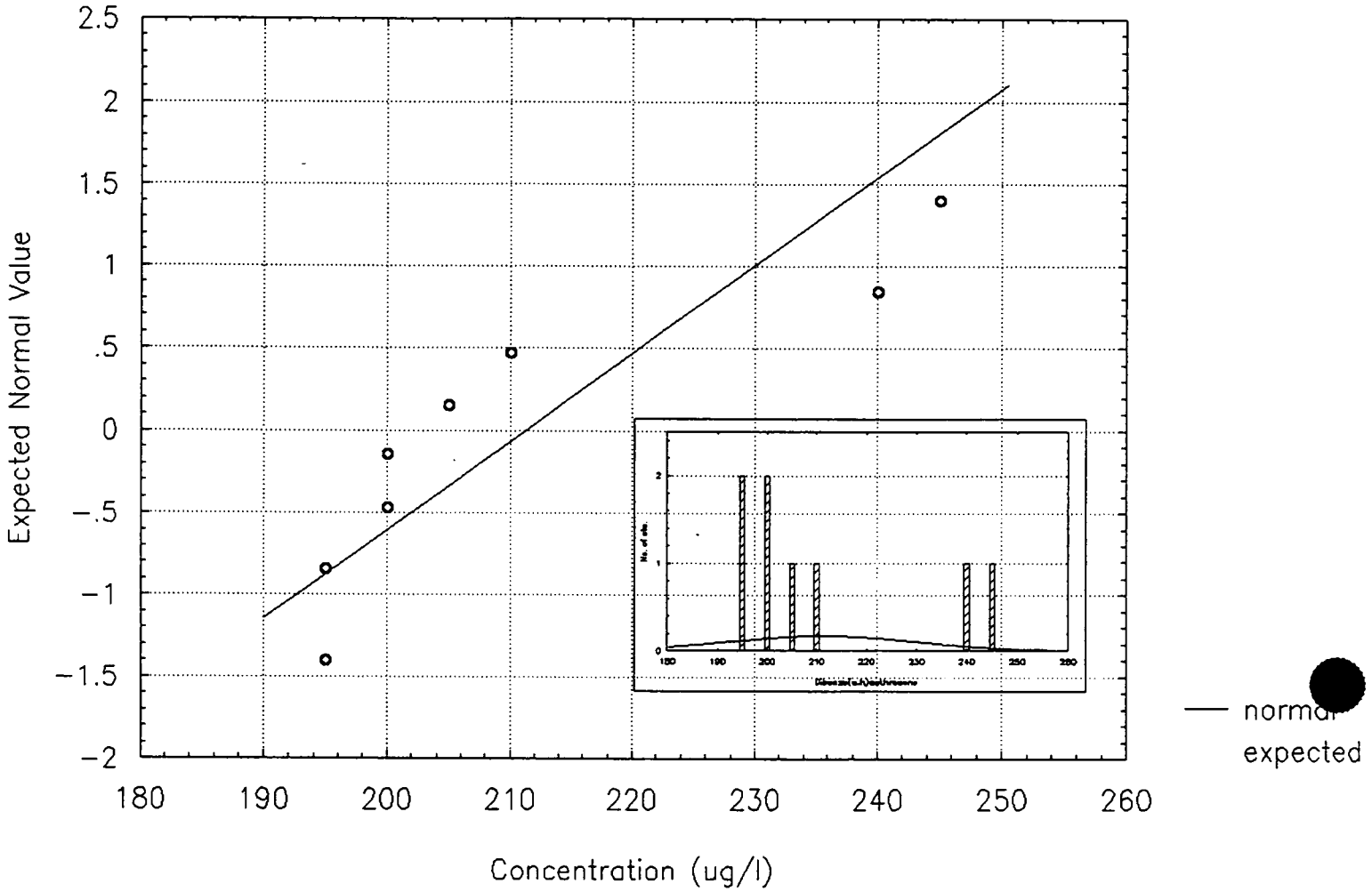


000768

Normal Probablility Plot for Chrysene
in Background Sediment Samples

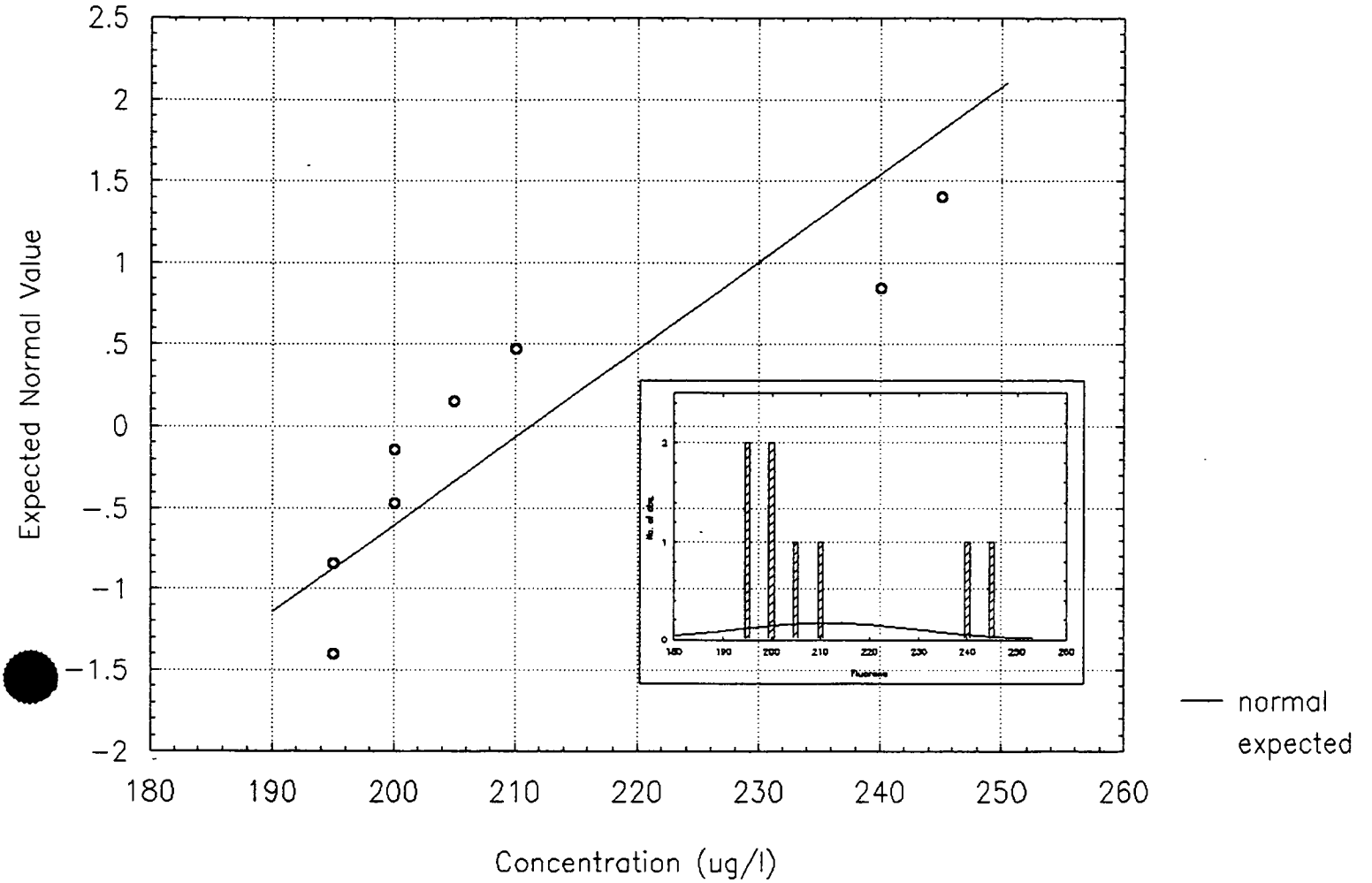


Normal Probablility Plot of
Dibenzo(a,h)anthracene
in Background Soil Samples

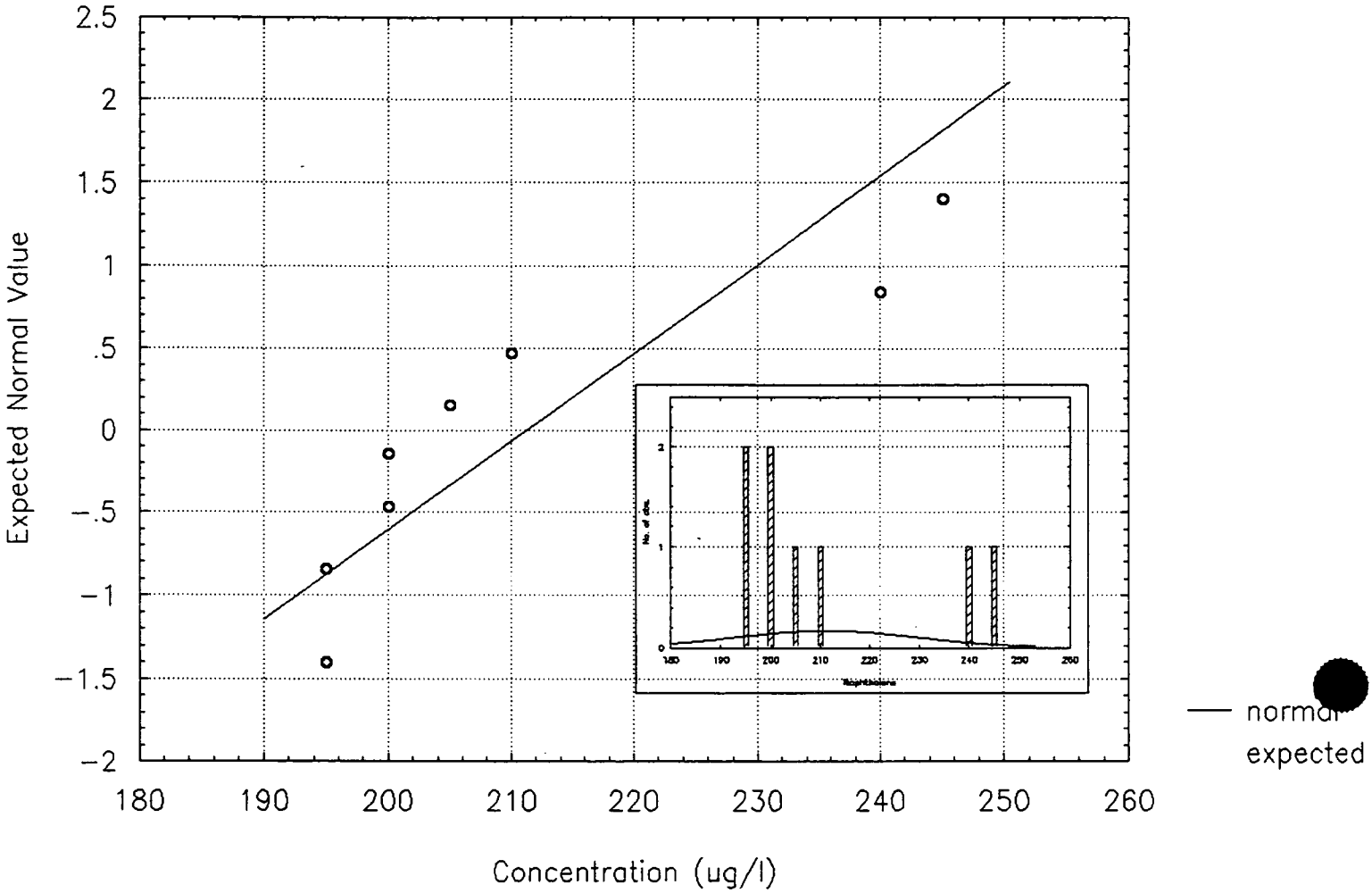


000770

Normal Probablility Plot of
Fluorene
in Background Soil Samples

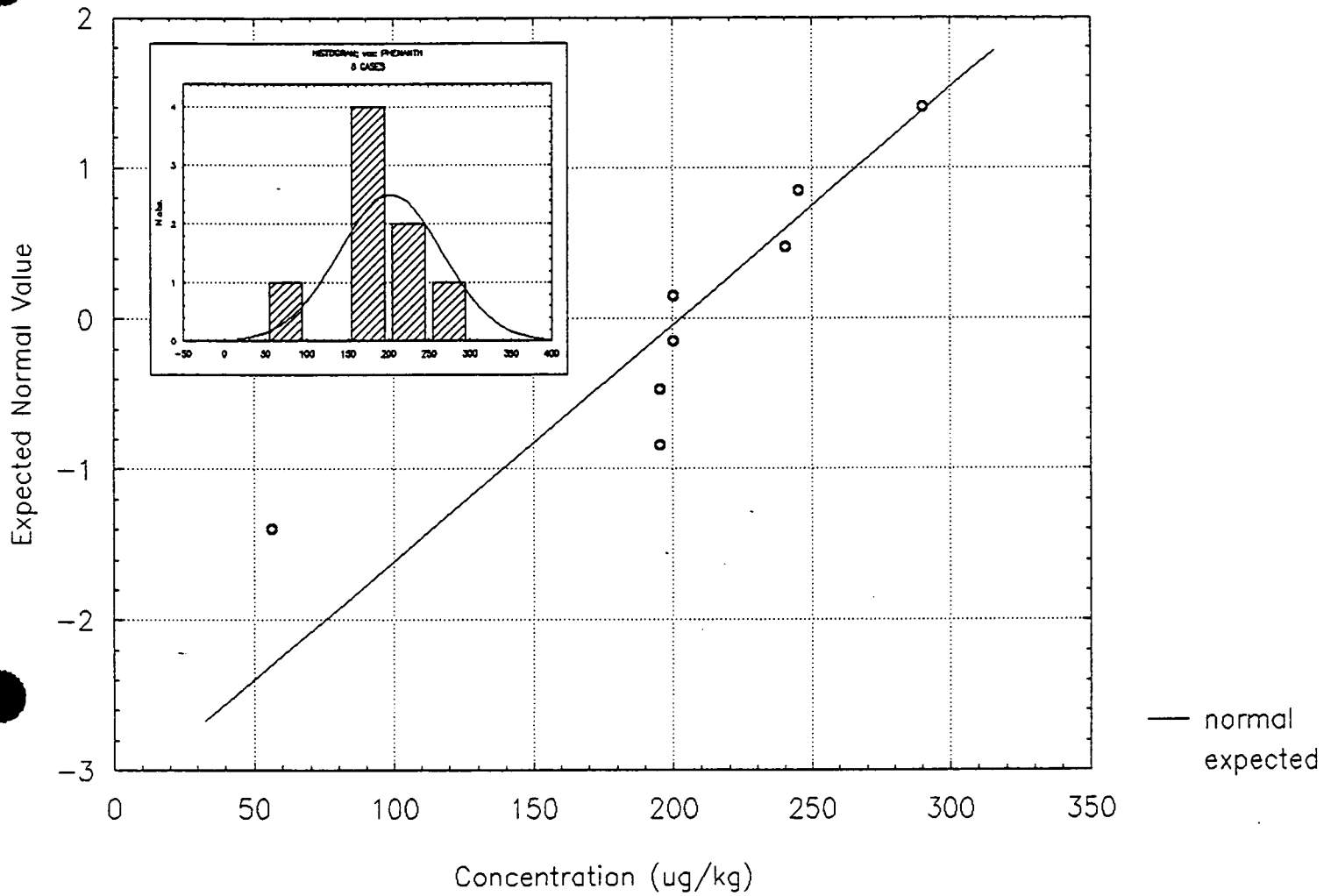


Normal Probablility Plot of
Naphthalene
in Background Soil Samples

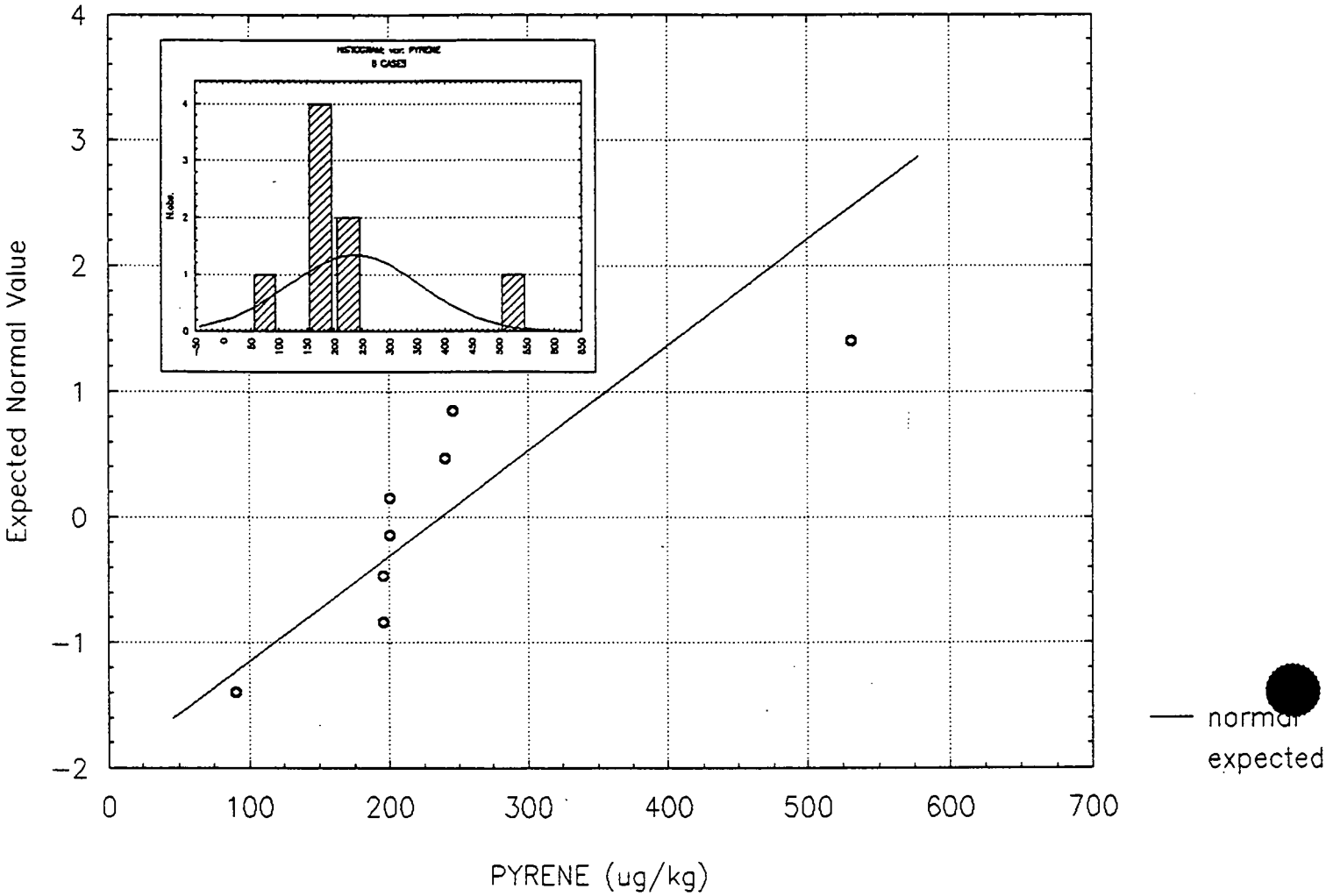


000772

Normal Probablility Plot for Phenanthrene
in Background Sediment Samples

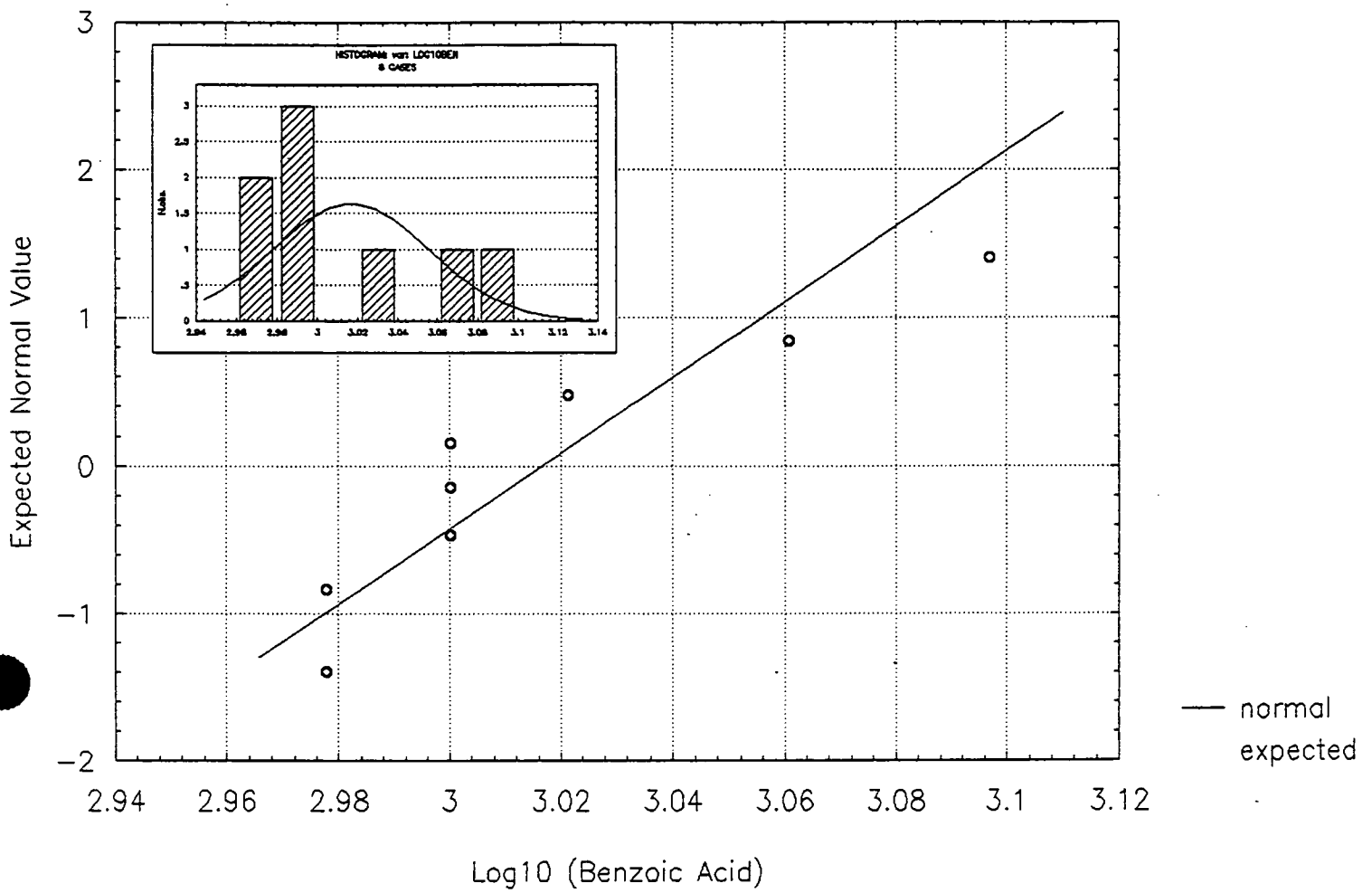


Normal Probablility Plot for Pyrene
in Background Sediment Samples

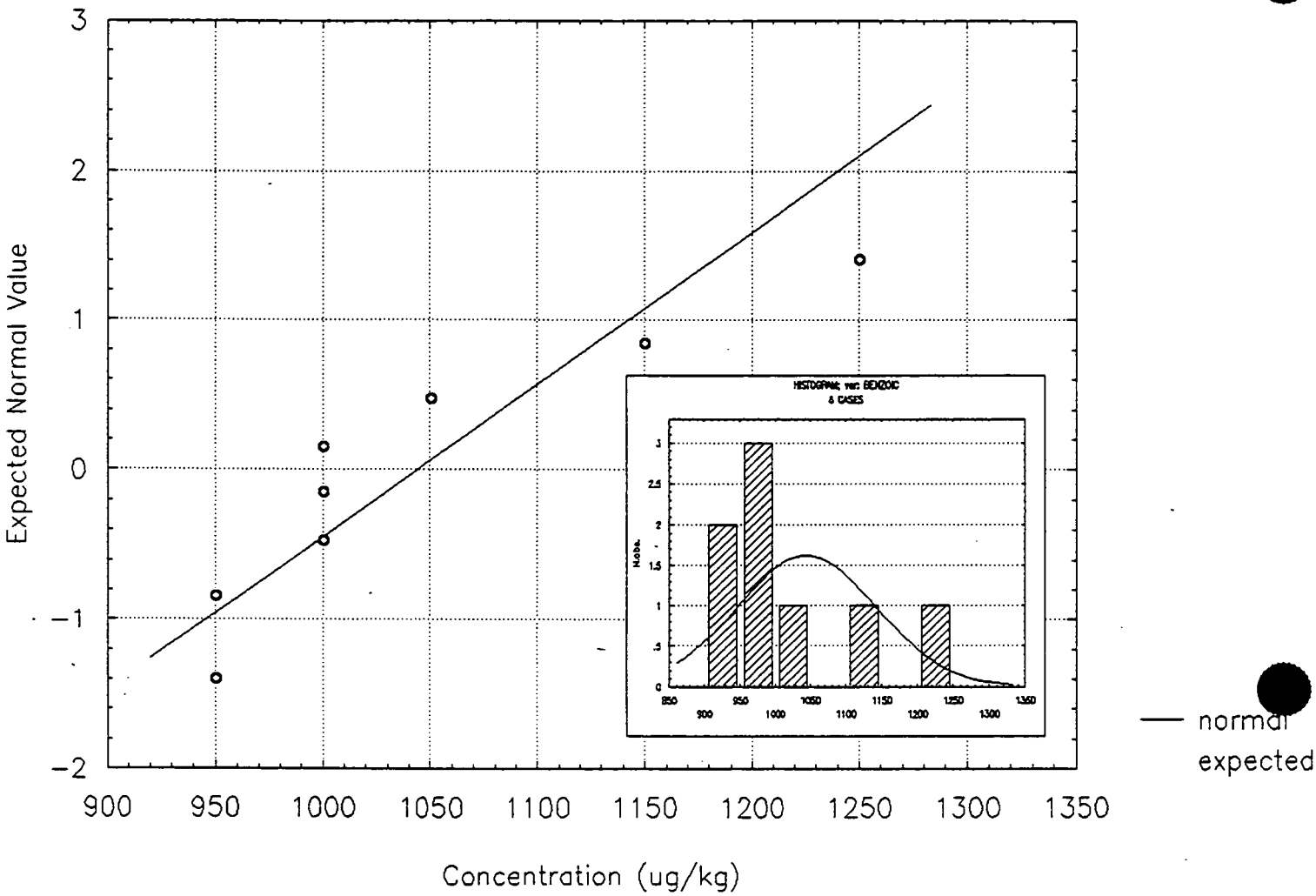


000774

Normal Probablility Plot for the Log Base 10 Transform of Benzoic Acid in the Background Sediment Samples



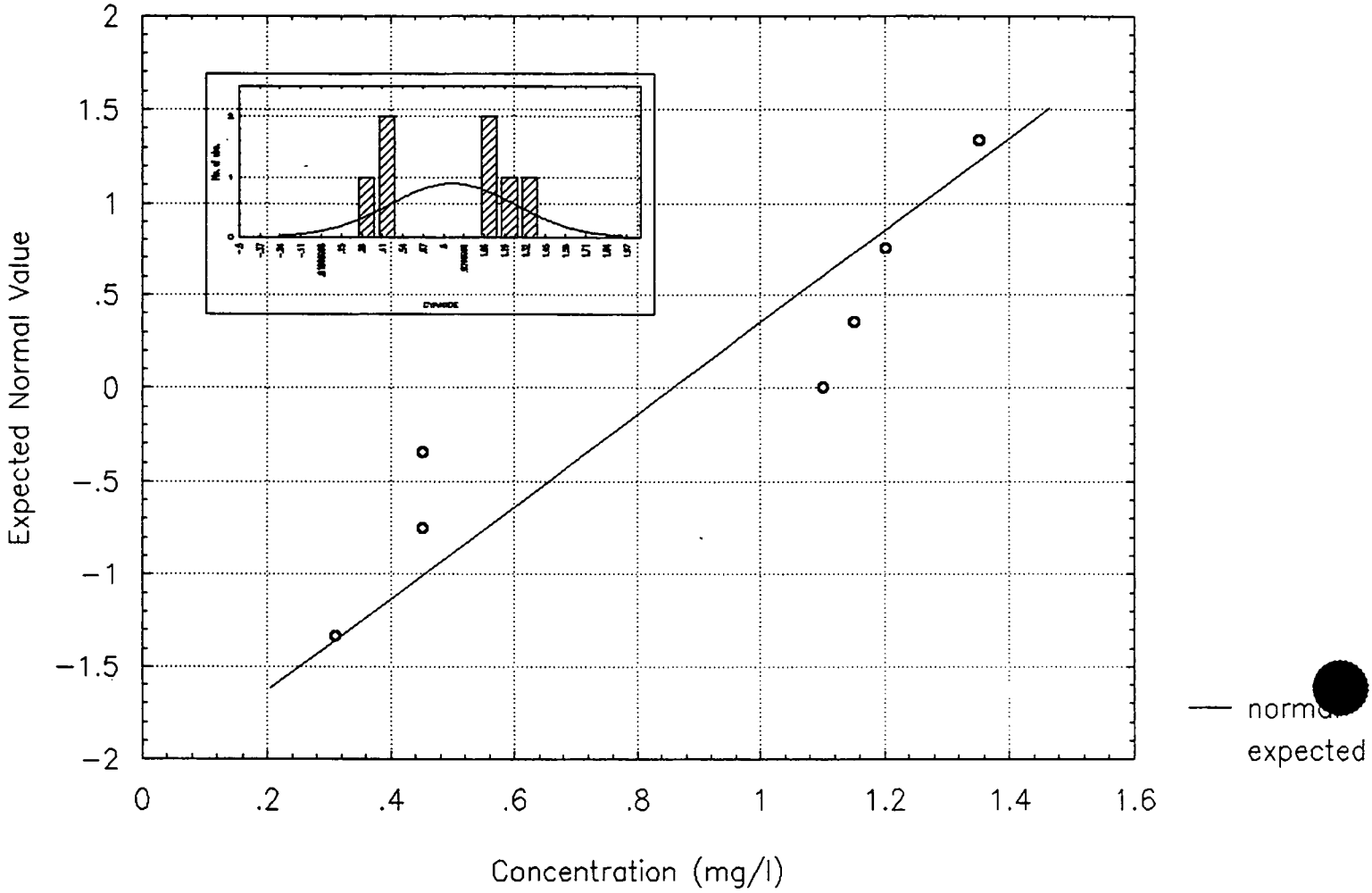
Normal Probablility Plot for Benzoic Acid
in Background Sediment Samples



000776

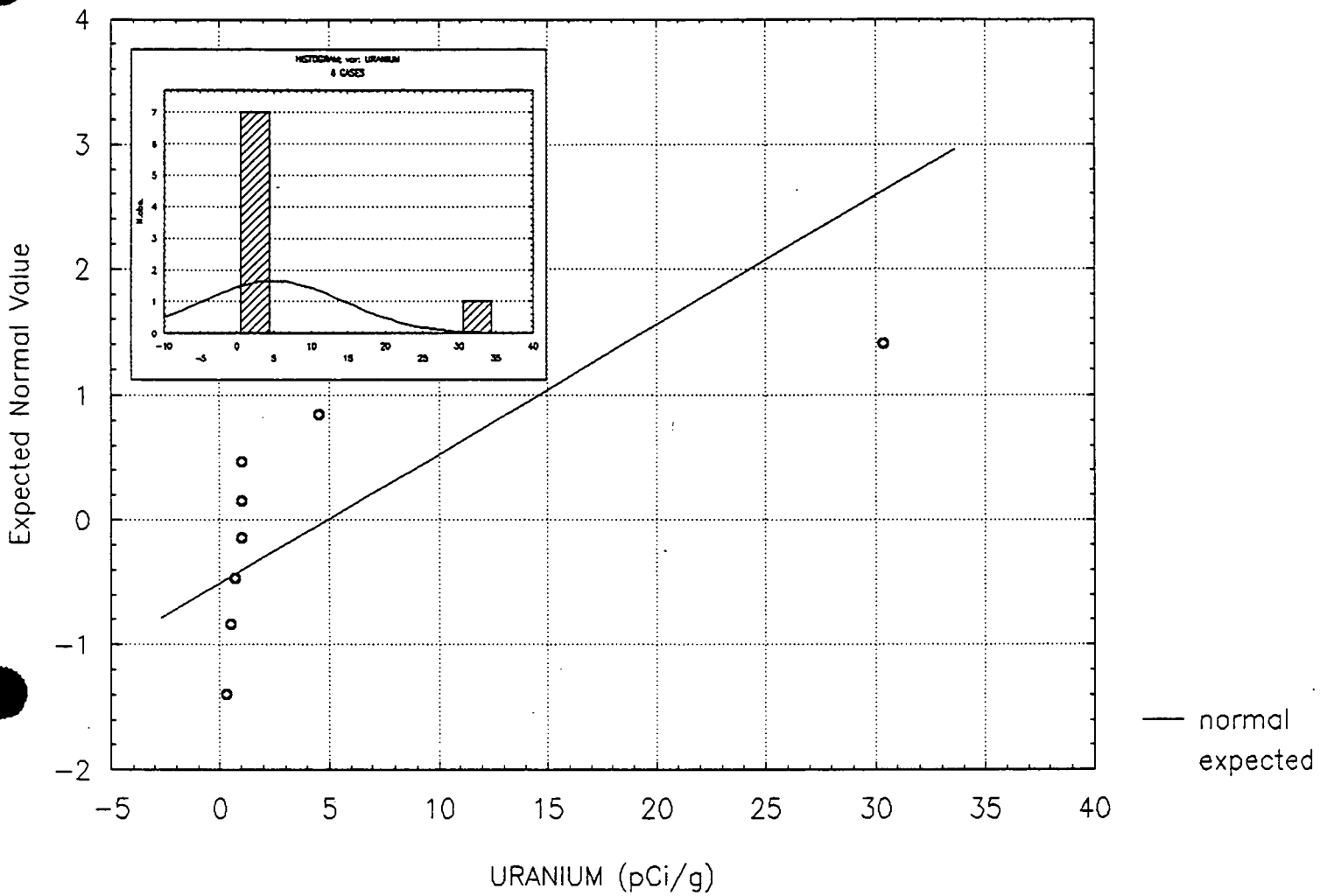
GENERAL PARAMETERS

Normal Probablility Plot for
Cyanide
in Background Sediments

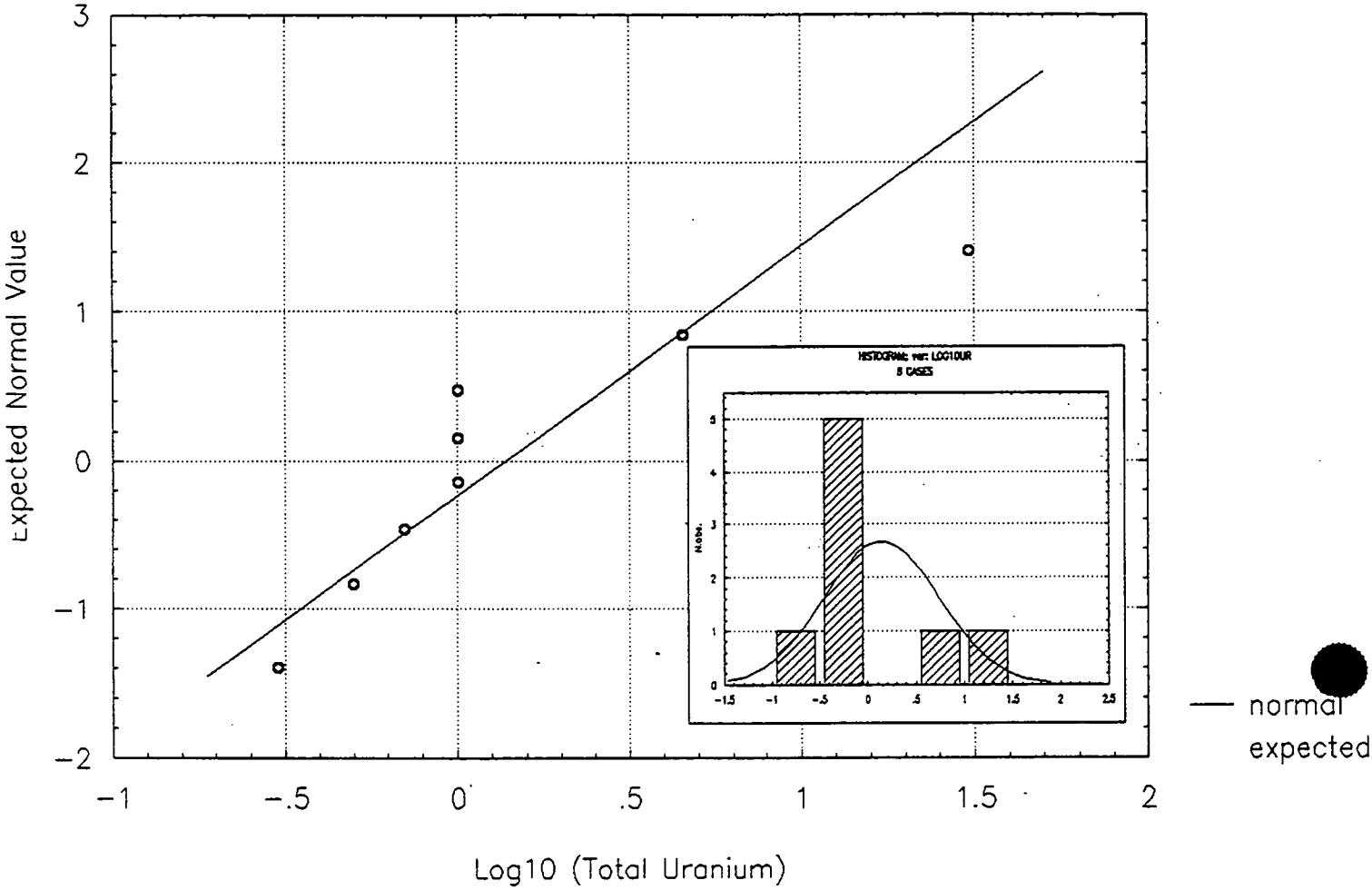


000778

Normal Probablility Plot for Total
Uranium in Background Sediment Samples

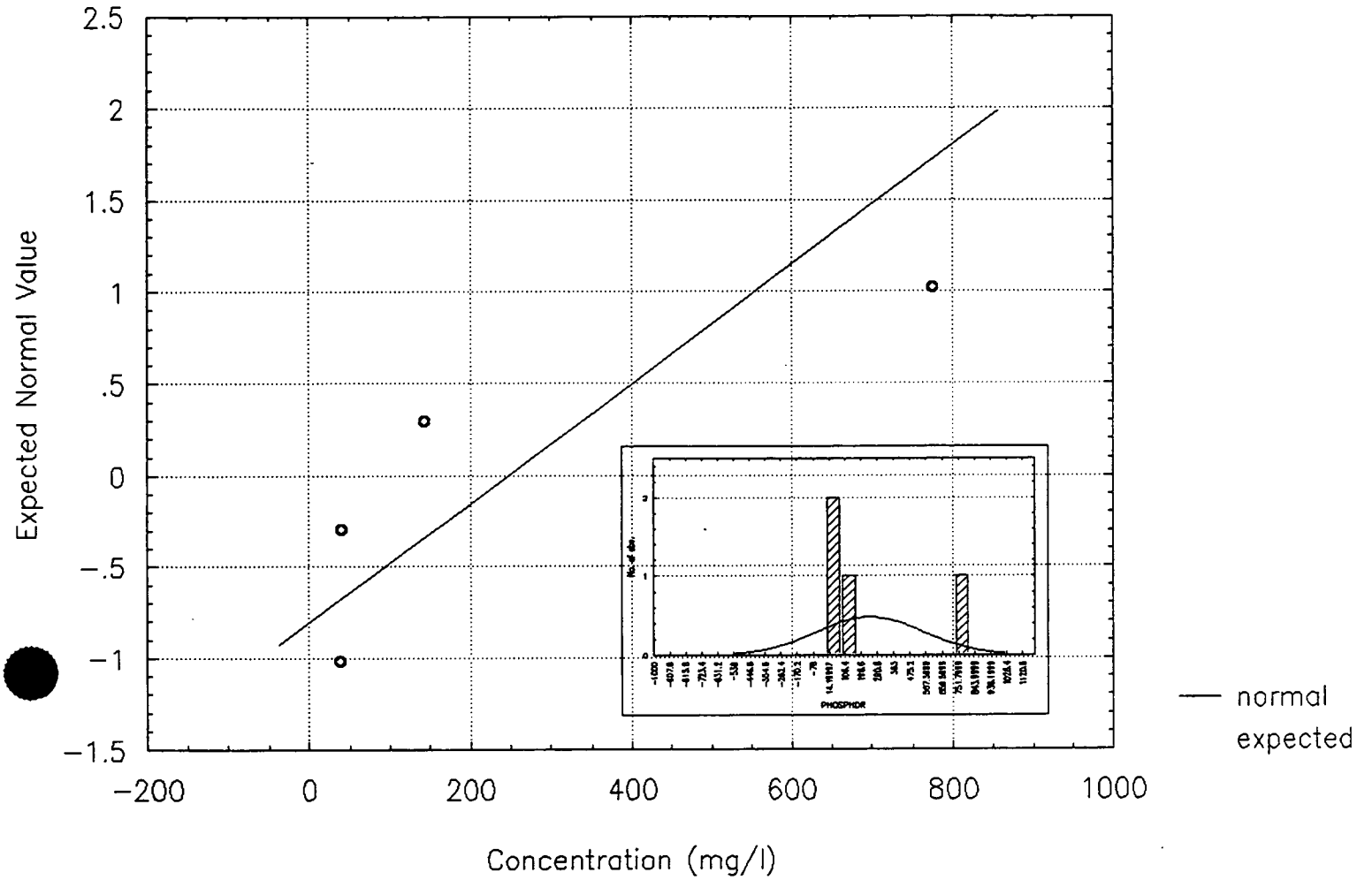


Normal Probablility Plot for the Log
Base 10 Transform of Total Uranium in
Background Sediment Samples



000780

Normal Probablility Plot for
Total Phosphorus
In Background Sediments



APPENDIX I

DATA SUFFICIENCY TABLES - ALL MEDIA

BACKGROUND DETERMINATION IN SOILS - STATISTICAL SUMMARY DATA SUFFICIENCY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG			n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	COV
	Dist.	Mean	S.D.	n	T		B	B/MEAN		
Dissolved Metals										
Antimony (Dis.)	N/A	N/A	N/A			N/A				
Arsenic (Dis.)	N/A	N/A	N/A			N/A				
Beryllium (Dis.)	N/A	N/A	N/A			N/A				
Cadmium (Dis.)	N/A	N/A	N/A			N/A				
Chromium (Dis.)	N/A	N/A	N/A			N/A				
Copper (Dis)	N/A	N/A	N/A			N/A				
Lead (Dis.)	N/A	N/A	N/A			N/A				
Mercury (Dis.)	N/A	N/A	N/A			N/A				
Nickel (Dis.)	N/A	N/A	N/A			N/A				
Selenium (Dis.)	N/A	N/A	N/A			N/A				
Silver (Dis.)	N/A	N/A	N/A			N/A				
Thallium (Dis.)	N/A	N/A	N/A			N/A				
Zinc (Dis.)	N/A	N/A	N/A			N/A				
Barium (Dis.)	N/A	N/A	N/A			N/A				
Iron (Dis.)	N/A	N/A	N/A			N/A				
Manganese (Dis.)	N/A	N/A	N/A			N/A				
Vanadium (Dis.)	N/A	N/A	N/A			N/A				
Aluminum (Dis.)	N/A	N/A	N/A			N/A				
Cobalt (Dis.)	N/A	N/A	N/A			N/A				
Magnesium (Dis.)	N/A	N/A	N/A			N/A				
Calcium (Dis.)	N/A	N/A	N/A			N/A				
Sodium (Dis.)	N/A	N/A	N/A			N/A				
Potassium (Dis.)	N/A	N/A	N/A			N/A				
Total Metals (mg/kg)										
Antimony (Tot.)	Normal	2.48	0.098	16	2.523	2.73	0.052	0.021	Y	3.95%
Arsenic (Tot.)	Normal	4.91	1.12	16	2.523	7.74	0.596	0.121	Y	22.81%
Beryllium (Tot.)	Normal	0.59	0.17	16	2.523	1.02	0.091	0.153	Y	28.81%
Cadmium (Tot.)	Normal	0.486	0.138	16	2.523	0.83	0.073	0.151	Y	28.40%
Chromium (Tot.)	Normal	14.68	3.48	16	2.523	23.46	1.853	0.126	Y	23.71%
Copper (Tot.)	Normal	16.89	4.55	16	2.523	28.37	2.423	0.143	Y	26.94%
Lead (Tot.)	Log Base 10	1.32	0.29	16	2.523	112.63	0.154	0.117	Y	21.97%
Mercury (Tot.)	Normal	0.079	0.047	16	2.523	0.20	0.025	0.317	Y	59.49%
Nickel (Tot.)	Normal	17.12	4.99	16	2.523	29.71	2.657	0.155	Y	29.15%
Selenium (Tot.)	Normal	0.524	0.74	16	2.523	2.39	0.394	0.752	N	141.22%
Silver (Tot.)						ND				
Thallium (Tot.)						ND				
Zinc (Tot.)	Log Base 10	1.84	0.21	16	2.523	234.33	0.112	0.061	Y	11.41%
Barium (Tot.)	Normal	87.38	32.53	16	2.523	169.45	17.322	0.198	Y	37.23%
Iron (Tot.)	Normal	18354.38	4156.49	16	2.523	28841.20	2213.331	0.121	Y	22.65%
Manganese (Tot.)	Normal	909.5	274.15	16	2.523	1601.18	145.985	0.161	Y	30.14%
Vanadium (Tot.)	Normal	22.36	4.82	16	2.523	34.52	2.567	0.115	Y	21.56%
Aluminum (Tot.)	Normal	11509.38	2871.42	16	2.523	18753.97	1529.031	0.133	Y	24.95%
Cobalt (Tot.)	Normal	8.27	1.92	16	2.523	13.11	1.022	0.124	Y	23.22%
Magnesium (Tot.)	Log Base 10	3.745	0.279	16	2.523	28113.63	0.149	0.040	Y	7.45%

BACKGROUND DETERMINATION IN SOILS - STATISTICAL SUMMARY DATA SUFFICIENCY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG			n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	COV
	Dist.	Mean	S.D.	n	T		B	B/MEAN		
Calcium (Tot.)	Log Base 10	4.046	0.407	16	2.523	118266.30	0.217	0.054	Y	10.06%
Sodium (Tot.)	Normal	150.63	24.43	16	2.523	212.27	13.009	0.086	Y	16.22%
Potassium (Tot.)	Normal	1802.31	684.15	16	2.523	3528.42	364.310	0.202	Y	37.96%
Volatile Organics (mg/kg)										
Acrolein						ND				
Acrylonitrile						ND				
Benzene	Normal	0.00297	0.00022	16	2.523	0.00353	0.000	0.039	Y	7.41%
Bromoform						ND				
Carbon tetrachloride						ND				
Chlorobenzene						ND				
Dibromochloromethane						ND				
Chloroethane						ND				
Chloroform	Normal	0.00297	0.00022	16	2.523	0.00353	0.000	0.039	Y	7.41%
Bromodichloromethane						ND				
1,1-Dichloroethane						ND				
1,2-Dichloroethane						ND				
1,1-Dichloroethene						ND				
1,2-Dichloropropane						ND				
Cis-1,3-Dichloropropene						ND				
Ethylbenzene	Normal	0.00297	0.00022	16	2.523	0.00353	0.000	0.039	Y	7.41%
Bromomethane	Normal	0.00569	0.00036	16	2.523	0.00660	0.000	0.034	Y	6.33%
Chloromethane	Normal	0.00569	0.00036	16	2.523	0.00660	0.000	0.034	Y	6.33%
Methylene chloride	Log Base 10	1.263	0.62	16	2.523	0.672	0.330	0.261	Y	49.09%
1,1,2,2-Tetrachloroethane						ND				
Tetrachloroethene	Normal	0.00297	0.00022	16	2.523	0.00353	0.000	0.039	Y	7.41%
Toluene	Normal	0.00297	0.00022	16	2.523	0.00353	0.000	0.039	Y	7.41%
1,1,1-Trichloroethane						ND				
1,1,2-Trichloroethane						ND				
Trichloroethene						ND				
Vinyl chloride						ND				
Trans-1,3-Dichloropropene	Normal	0.00297	0.00022	16	2.523	0.00353	0.000	0.039	Y	7.41%
Styrene	Normal	0.00297	0.00022	16	2.523	0.00353	0.000	0.039	Y	7.41%
Acetone	Log Base 10	1.277	0.443	16	2.523	0.248	0.236	0.185	Y	34.69%
2-Butanone	Normal	0.00569	0.00036	16	2.523	0.00660	0.000	0.034	Y	6.33%
Carbon disulfide						ND				
2-Hexanone						ND				
4-Methyl-2-pentanone						ND				
Vinyl acetate						ND				
Xylenes (Total)	Normal	0.00297	0.00022	16	2.523	0.00353	0.000	0.039	Y	7.41%
1,2-Dichloroethene(Total)	Normal	0.00297	0.00022	16	2.523	0.00353	0.000	0.039	Y	7.41%
Isopropylbenzene	Normal	0.00297	0.00022	16	2.523	0.00353	0.000	0.039	Y	7.41%
Semi-Volatile Organics (mg/kg)										
Acenaphthene	Log Base 10	2.2702	0.0246	16	2.523	0.215	0.013	0.006	Y	1.08%
Acenaphthylene	Log Base 10	2.2702	0.0246	16	2.523	0.215	0.013	0.006	Y	1.08%
Anthracene	Normal	0.1819	0.022	16	2.523	0.237	0.012	0.064	Y	12.09%

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BACKGROUND DETERMINATION IN SOILS - STATISTICAL SUMMARY DATA SUFFICIENCY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG			n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	
	Dist.	Mean	S.D.	n	T		B	B/MEAN		COV
Benzo(a)anthracene	Log Base 10	2.12	0.26	16	2.523	0.597	0.138	0.065	Y	12.26%
Benzo(a)pyrene	Log Base 10	2.13	0.32	16	2.523	0.866	0.170	0.080	Y	15.02%
Benzo(b)fluoranthene	Log Base 10	2.25	0.41	16	2.523	1.925	0.218	0.097	Y	18.22%
Benzo(g,h,i)perylene	Log Base 10	2.247	0.211	16	2.523	0.602	0.112	0.050	Y	9.39%
Benzo(k)fluoranthene	Log Base 10	2.21	0.44	16	2.523	2.090	0.234	0.106	Y	19.91%
bis(2-Chloroethoxy)methane						ND				
bis(2-Chloroethyl)ether						ND				
bis(2-Chloroisopropyl)ether						ND				
bis(2-Ethylhexyl)phthalate	Normal	0.333	0.108	16	2.523	0.605	0.058	0.173	Y	32.43%
4-Bromophenyl phenyl ether						ND				
Butyl benzyl phthalate	Log Base 10	2.2702	0.0246	16	2.523	0.215	0.013	0.006	Y	1.08%
2-Chloronaphthalene						ND				
4-Chlorophenyl phenyl ether						ND				
Chrysene	Log Base 10	2.14	0.31	16	2.523	0.836	0.165	0.077	Y	14.49%
Dibenzo(a,h)anthracene	Normal	0.1925	0.0257	16	2.523	0.257	0.014	0.071	Y	13.35%
1,2-Dichlorobenzene						ND				
1,3-Dichlorobenzene						ND				
1,4-Dichlorobenzene						ND				
3-3-Dichlorobenzidine						ND				
Diethyl phthalate						ND				
Dimethyl phthalate	Log Base 10	2.2702	0.0246	16	2.523	0.215	0.013	0.006	Y	1.08%
Di-n-butyl phthalate	Log Base 10	2.2702	0.0246	16	2.523	0.215	0.013	0.006	Y	1.08%
2,4-Dinitrotoluene	Log Base 10	2.2702	0.0246	16	2.523	0.215	0.013	0.006	Y	1.08%
2,6-Dinitrotoluene						ND				
Di-n-octyl phthalate	Log Base 10	2.2702	0.0246	16	2.523	0.215	0.013	0.006	Y	1.08%
Fluoranthene	Normal	0.1928	0.124	16	2.523	0.506	0.066	0.342	Y	64.32%
Fluorene	Log Base 10	2.2702	0.0246	16	2.523	0.215	0.013	0.006	Y	1.08%
Hexachlorobenzene						ND				
Hexachlorobutadiene						ND				
Hexachlorocyclopentadiene						ND				
Hexachloroethane						ND				
Indeno(1,2,3-cd)pyrene	Log Base 10	2.19	0.25	16	2.523	0.662	0.133	0.061	Y	11.42%
Isophorone						ND				
Naphthalene	Log Base 10	2.2702	0.0246	16	2.523	0.215	0.013	0.006	Y	1.08%
Nitrobenzene						ND				
N-Nitroso-di-n-propylamine						ND				
N-Nitrosodiphenylamine(1)						ND				
Phenanthrene	Normal	0.1263	0.0658	16	2.523	0.292	0.035	0.277	Y	52.10%
Pyrene	Normal	0.1871	0.1259	16	2.523	0.505	0.067	0.358	Y	67.29%
1,2,4-Trichlorobenzene						ND				
Benzyl alcohol	Log Base 10	2.2702	0.0246	16	2.523	0.215	0.013	0.006	Y	1.08%
4-Chloroaniline						ND				
Dibenzofuran	Log Base 10	2.2702	0.0246	16	2.523	0.215	0.013	0.006	Y	1.08%
2-Methylnaphthalene	Log Base 10	2.2702	0.0246	16	2.523	0.215	0.013	0.006	Y	1.08%
2-Nitroaniline						ND				

BACKGROUND DETERMINATION IN SOILS - STATISTICAL SUMMARY DATA SUFFICIENCY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG			n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	COV
	Dist.	Mean	S.D.	n	T		B	B/MEAN		
3-Nitroaniline						ND				
4-Nitroaniline						ND				
2-Chlorophenol						ND				
2,4-Dichlorophenol						ND				
2,4-Dimethylphenol	Log Base 10	2.2702	0.0246	16	2.523	0.215	0.013	0.006	Y	1.08%
4,6-Dinitro-2-methylphenol	Normal	0.9031	0.0591	16	2.523	1.052	0.031	0.035	Y	6.54%
2,4-Dinitrophenol	Normal	0.9031	0.0591	16	2.523	1.052	0.031	0.035	Y	6.54%
2-Nitrophenol						ND				
4-Nitrophenol	Normal	0.9031	0.0591	16	2.523	1.052	0.031	0.035	Y	6.54%
4-Chloro-3-methylphenol	Log Base 10	2.2702	0.0246	16	2.523	0.215	0.013	0.006	Y	1.08%
Pentachlorophenol	Normal	0.8468	0.2204	16	2.523	1.403	0.117	0.139	Y	26.03%
Phenol	Log Base 10	2.2702	0.0246	16	2.523	0.215	0.013	0.006	Y	1.08%
2,4,6-Trichlorophenol						ND				
2-Methylphenol	Log Base 10	2.2702	0.0246	16	2.523	0.215	0.013	0.006	Y	1.08%
4-Methylphenol	Log Base 10	2.2702	0.0246	16	2.523	0.215	0.013	0.006	Y	1.08%
Benzoic acid	Normal	1.806	0.118	16	2.523	2.104	0.063	0.035	Y	6.53%
2,4,5-Trichlorophenol	Normal	0.9031	0.0591	16	2.523	1.052	0.031	0.035	Y	6.54%
Pesticides (mg/kg)										
Aldrin						ND				
Alpha-BHC						ND				
Beta-BHC	Normal	0.00899	0.00049	16	2.523	0.010	0.000	0.029	Y	5.45%
Gamma-BHC (Lindane)						ND				
Delta-BHC						ND				
4,4'-DDT	Normal	0.02734	0.04715	16	2.523	0.146	0.025	0.918	N	172.46%
4,4'-DDE	Normal	0.06322	0.14374	16	2.523	0.426	0.077	1.211	N	227.36%
4,4'-DDD	Normal	0.01794	0.001	16	2.523	0.020	0.001	0.030	Y	5.57%
Dieldrin	Normal	0.01794	0.001	16	2.523	0.020	0.001	0.030	Y	5.57%
Endosulfan I	Normal	0.00449	0.00025	16	2.523	0.005	0.000	0.030	Y	5.57%
Endosulfan II						ND				
Endosulfan sulfate	Normal	0.01794	0.001	16	2.523	0.020	0.001	0.030	Y	5.57%
Endrin	Normal	0.00897	0.0005	16	2.523	0.010	0.000	0.030	Y	5.57%
Heptachlor						ND				
Heptachlor epoxide	Normal	0.00449	0.00025	16	2.523	0.005	0.000	0.030	Y	5.57%
PCB-1242						ND				
PCB-1254						ND				
PCB-1221						ND				
PCB-1232						ND				
PCB-1248						ND				
PCB-1260	Normal	0.1794	0.00998	16	2.523	0.205	0.005	0.030	Y	5.56%
PCB-1016	Normal	0.0899	0.00491	16	2.523	0.102	0.003	0.029	Y	5.46%
Toxaphene						ND				
p,p'-Methoxychlor	Normal	0.04494	0.00246	16	2.523	0.051	0.001	0.029	Y	5.47%
Endrin ketone	Normal	0.01794	0.001	16	2.523	0.020	0.001	0.030	Y	5.57%
Alpha chlordane						ND				
Gamma chlordane						ND				

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BACKGROUND DETERMINATION IN SOILS - STATISTICAL SUMMARY DATA SUFFICIENCY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG	B	B/MEAN	n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	COV
	Dist.	Mean	S.D.	n	T					
General Parameters (mg/kg)										
Cyanide						N/A				
Ammonia (N), Distillation	Log Base 10	1.554	0.31	16	2.523	216.835	0.165	0.106	Y	19.95%
BOD(O2) - 5 day						N/A				
Carbon, Total Organic (C)						N/A				
COD(O2)						N/A				
Chloride (Cl)	Normal	5	0	16	2.523	5.000	0.000	0.000	Y	0.00%
Hardness, Total (as CaCO3)						N/A				
Nitrate (as N)						N/A				
Nitrogen, Kjeldahl (N)						N/A				
pH	Normal	7.2	0.402	16	2.523	8.214	0.214	0.030	Y	5.58%
Phosphorus, Dissolved						N/A				
Solids, Dissolved at 180C						N/A				
Solids, Suspended at 103C						N/A				
Oil and Grease						N/A				
Petroleum Hydrocarbons						N/A				
Sulfate, Turbid	Log Base 10	2.314	0.54	16	2.523	4747.008	0.268	0.124	Y	23.34%
Surfactants (MBAS)						N/A				
Phosphorus, Total	Log Base 10	2.336	0.449	16	2.523	2943.249	0.239	0.102	Y	19.22%
Radiological Parameters (pCi/g										
Gross Alpha	Normal	8.79	2.44	16	2.523	14.946	1.299	0.148	Y	27.76%
Gross Beta	Normal	18.94	4.51	16	2.523	30.319	2.402	0.127	Y	23.81%
Uranium, Total	Normal	0.63	0.21	16	2.523	1.160	0.112	0.178	Y	33.33%
Potassium-40	Normal	13.02	3.68	16	2.523	22.305	1.960	0.151	Y	28.26%
Miscellaneous										
Specific Conductivity						N/A				
Oxygen, Dissolved						N/A				
Temperature						N/A				

BACKGROUND DETERMINATION IN GROUNDWATER - STATISTICAL SUMMARY OF DATA SUFFICIENCY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG	t	B	(ABS) B/MEAN	n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	(ABS) COV
	Dist.	Mean	S.D.	n	T						
Dissolved Metals (mg/l)											
Antimony (Dis.)	Normal	0.0144	0.0038	35	2.166	0.0226	2.04	1.31E-03	0.09	Y	26.4%
Arsenic (Dis.)	Normal	0.0017	0.00054	33	2.188	0.003	2.04	1.92E-04	0.11	Y	31.8%
Beryllium (Dis.)	Normal	0.001	0.00104	35	2.166	0.003	2.04	3.59E-04	0.36	Y	104.0%
Cadmium (Dis.)	Normal	0.0019	0.00077	36	2.158	0.004	2.04	2.62E-04	0.14	Y	40.5%
Chromium (Dis.)	Normal	0.0026	0.00072	36	2.158	0.004	2.04	2.45E-04	0.09	Y	27.7%
Copper (Dis)	Log Base 10	0.7	0.5	36	2.158	0.060	2.04	1.70E-01	0.24	Y	71.4%
Lead (Dis.)	Log Base 10	0.5	0.61	62	2.005	0.053	2	1.55E-01	0.31	Y	122.0%
Mercury (Dis.)	Normal	0.0001	0.00011	61	2.005	0.0003	2	2.82E-05	0.28	Y	110.0%
Nickel (Dis.)	Normal	0.0107	0.00758	36	2.158	0.027	2.04	2.58E-03	0.24	Y	70.8%
Selenium (Dis.)	Normal	0.0017	0.00084	29	2.234	0.004	2.05	3.20E-04	0.19	Y	49.4%
Silver (Dis.)	Log Base 10	0.3	0.37	33	2.188	0.013	2.04	1.31E-01	0.44	Y	123.3%
Thallium (Dis.)	Normal	0.0025	0.00262	35	2.166	0.008	2.04	9.03E-04	0.36	Y	104.8%
Zinc (Dis.)	Log Base 10	1.1	0.61	37	2.15	0.258	2.04	2.05E-01	0.19	Y	55.5%
Barium (Dis.)	Normal	0.0692	0.0261	62	2.005	0.122	2	6.63E-03	0.10	Y	37.7%
Iron (Dis.)	Log Base 10	2.1	1.11	60	2.006	21.216	2	2.87E-01	0.14	Y	52.9%
Manganese (Dis.)	Normal	0.186	0.1752	62	2.005	0.537	2	4.45E-02	0.24	Y	94.2%
Vanadium (Dis.)	Normal	0.0068	0.0093	35	2.166	0.027	2.04	3.21E-03	0.47	Y	136.8%
Aluminum (Dis.)	Log Base 10	1.8	0.36	40	2.125	0.367	2.03	1.16E-01	0.06	Y	20.0%
Cobalt (Dis.)	Normal	0.003	0.0018	35	2.166	0.007	2.04	6.21E-04	0.21	Y	60.0%
Magnesium (Dis.)	Normal	25.4516	4.0585	62	2.005	33.589	2	1.03E+00	0.04	Y	15.9%
Calcium (Dis.)	Normal	100.0661	19.19334	62	2.005	138.549	2	4.88E+00	0.05	Y	19.2%
Sodium (Dis.)	Log Base 10	4.2	0.29	62	2.005	60.457	2	7.37E-02	0.02	Y	6.9%
Potassium (Dis.)	Log Base 10	3.4	0.15	62	2.005	5.021	2	3.81E-02	0.01	Y	4.4%
Total Metals (mg/l)											
Antimony (Tot.)	Normal	0.0124	0.0013	21	2.371	0.015	2.09	5.93E-04	0.05	Y	10.5%
Arsenic (Tot.)	Log Base 10	0.4	0.49	25	2.292	0.033	2.06	2.02E-01	0.50	Y	122.5%
Beryllium (Tot.)	Normal	0.0023	0.002	22	2.35	0.007	2.08	8.87E-04	0.39	Y	87.0%
Cadmium (Tot.)	Normal	0.0015	0.00073	23	2.329	0.003	2.07	3.15E-04	0.21	Y	48.7%
Chromium (Tot.)	Log Base 10	0.9	0.6	25	2.292	0.188	2.06	2.47E-01	0.27	Y	66.7%
Copper (Tot.)	Log Base 10	1.1	0.52	25	2.292	0.196	2.06	2.14E-01	0.19	Y	47.3%
Lead (Tot.)	Log Base 10	0.6	0.53	24	2.309	0.067	2.07	2.24E-01	0.37	Y	88.3%
Mercury (Tot.)	N/A					N/A					
Nickel (Tot.)	Log Base 10	1	0.5	24	2.309	0.143	2.07	2.11E-01	0.21	Y	50.0%
Selenium (Tot.)						ND					
Silver (Tot.)						ND					
Thallium (Tot.)						ND					
Zinc (Tot.)	Log Base 10	1.5	0.49	25	2.292	0.420	2.06	2.02E-01	0.13	Y	32.7%
Barium (Tot.)	Normal	0.0898	0.0412	25	2.292	0.184	2.06	1.70E-02	0.19	Y	45.9%
Iron (Tot.)	Log Base 10	3.3	0.86	25	2.292	186.690	2.06	3.54E-01	0.11	Y	26.1%
Manganese (Tot.)	Log Base 10	2.2	0.81	25	2.292	11.390	2.06	3.34E-01	0.15	Y	36.8%
Vanadium (Tot.)	Normal	0.0133	0.0124	24	2.309	0.042	2.07	5.24E-03	0.39	Y	93.2%
Aluminum (Tot.)	Log Base 10	2.5	0.76	24	2.309	17.982	2.07	3.21E-01	0.13	Y	30.4%
Cobalt (Tot.)	Normal	0.007	0.0058	21	2.371	0.021	2.09	2.65E-03	0.38	Y	82.9%
Magnesium (Tot.)	Normal	33.28	18.831	25	2.292	76.441	2.06	7.76E+00	0.23	Y	56.6%

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BACKGROUND DETERMINATION IN GROUNDWATER - STATISTICAL SUMMARY OF DATA SUFFICIENCY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG				n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	
	Dist.	Mean	S.D.	n	T		t	B	(ABS) B/MEAN		(ABS) COV
Calcium (Tot.)	Normal	112.334	54.9	25	2.292	238.165	2.06	2.26E+01	0.20	Y	48.9%
Sodium (Tot.)	Log Base 10	4.2	0.47	25	2.292	189.339	2.06	1.94E-01	0.05	Y	11.2%
Potassium (Tot.)	Normal	3.483	1.118	25	2.292	6.045	2.06	4.61E-01	0.13	Y	32.1%
Volatile Organics (mg/l)											
Acrolein	N/A					0.0125					
Acrylonitrile	N/A					0.0125					
Benzene	Normal	0.001	0.0002	27	2.263	0.00145	2.06	7.93E-05	0.08	Y	20.0%
Bromoform	Normal	0.001	0.0002	27	2.263	0.00145	2.06	7.93E-05	0.08	Y	20.0%
Carbon tetrachloride						ND					
Chlorobenzene						ND					
Dibromochloromethane						ND					
Chloroethane						ND					
Chloroform	Normal	0.001	0.0002	27	2.263	0.00145	2.06	7.93E-05	0.08	Y	20.0%
Bromodichloromethane						ND					
1,1-Dichloroethane	Normal	0.001	0.0002	27	2.263	0.00145	2.06	7.93E-05	0.08	Y	20.0%
1,2-Dichloroethane	Normal	0.001	0.0002	27	2.263	0.00145	2.06	7.93E-05	0.08	Y	20.0%
1,1-Dichloroethene						ND					
1,2-Dichloropropane						ND					
Cis-1,3-Dichloropropene						ND					
Ethylbenzene	Normal	0.001	0.0002	27	2.263	0.00145	2.06	7.93E-05	0.08	Y	20.0%
Bromomethane	Normal	0.001	0.0002	27	2.263	0.00145	2.06	7.93E-05	0.08	Y	20.0%
Chloromethane	Normal	0.001	0.0002	27	2.263	0.00145	2.06	7.93E-05	0.08	Y	20.0%
Methylene chloride	Log Base 10	0.2111	0.4043	29	2.234	0.013	2.05	1.54E-01	0.73	N	191.5%
1,1,2,2-Tetrachloroethane						ND					
Tetrachloroethene	Normal	0.001	0.0002	27	2.263	0.00145	2.06	7.93E-05	0.08	Y	20.0%
Toluene	Normal	0.001	0.0002	27	2.263	0.00145	2.06	7.93E-05	0.08	Y	20.0%
1,1,1-Trichloroethane	Normal	0.001	0.0001	27	2.263	0.00123	2.06	3.96E-05	0.04	Y	10.0%
1,1,2-Trichloroethane						ND					
Trichloroethene	Normal	0.001	0.0002	27	2.263	0.00145	2.06	7.93E-05	0.08	Y	20.0%
Vinyl chloride	Normal	0.001	0.0002	27	2.263	0.00145	2.06	7.93E-05	0.08	Y	20.0%
Trans-1,3-Dichloropropene						ND					
Styrene						ND					
Acetone	Normal	0.0026	0.0003	27	2.263	0.00328	2.06	1.19E-04	0.05	Y	11.5%
2-Butanone											
Carbon disulfide						ND					
2-Hexanone	Normal	0.0026	0.0003	27	2.263	0.00328	2.06	1.19E-04	0.05	Y	11.5%
4-Methyl-2-pentanone	N/A	0.001			N/A	0.001					
Vinyl acetate						ND					
Xylenes (Total)	Normal	0.0011	0.0004	27	2.263	0.00201	2.06	1.59E-04	0.14	Y	36.4%
1,2-Dichloroethene(Total)	Normal	0.001	0.0002	27	2.263	0.00145	2.06	7.93E-05	0.08	Y	20.0%
Isopropylbenzene	Normal	0.0025	0.0018	27	2.263	0.00657	2.06	7.14E-04	0.29	Y	72.0%
Semi-Volatile Organics (mg/l)											
Acenaphthene											
Acenaphthylene											
Anthracene	Normal										

BACKGROUND DETERMINATION IN GROUNDWATER - STATISTICAL SUMMARY OF DATA SUFFICIENCY

PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG				n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	
	Dist.	Mean	S.D.	n	T		t	B	(ABS) B/MEAN		(ABS) COV
Benzo(a)anthracene											
Benzo(a)pyrene											
Benzo(b)fluoranthene											
Benzo(g,h,i)perylene											
Benzo(k)fluoranthene											
bis(2-Chloroethoxy)methane						ND					
bis(2-Chloroethyl)ether						ND					
bis(2-Chloroisopropyl)ether	Normal										
bis(2-Ethylhexyl)phthalate	Log Base 10	0.06934	0.41229	29	2.234	0.010	2.05	1.57E-01	2.26	N	594.6%
4-Bromophenyl phenyl ether						ND					
Butyl benzyl phthalate						ND					
2-Chloronaphthalene						ND					
4-Chlorophenyl phenyl ether						ND					
Chrysene						ND					
Dibenzo(a,h)anthracene	Normal										
1,2-Dichlorobenzene	Normal	0.0012	0.0011	28	2.249	0.004	2.05	4.26E-04	0.36	Y	91.7%
1,3-Dichlorobenzene											
1,4-Dichlorobenzene	Normal										
3-3-Dichlorobenzidine						ND					
Diethyl phthalate											
Dimethyl phthalate											
Di-n-butyl phthalate											
2,4-Dinitrotoluene	Normal	0.0006	0.0007	28	2.249	0.002	2.05	2.71E-04	0.45	Y	116.7%
2,6-Dinitrotoluene						ND					
Di-n-octyl phthalate	Normal	0.001	0.0002	28	2.249	0.001	2.05	7.75E-05	0.08	Y	20.0%
Fluoranthene											
Fluorene											
Hexachlorobenzene	Normal	0.0012	0.0011	28	2.249	0.004	2.05	4.26E-04	0.36	Y	91.7%
Hexachlorobutadiene						ND					
Hexachlorocyclopentadiene						ND					
Hexachloroethane						ND					
Indeno(1,2,3-cd)pyrene						ND					
Isophorone											
Naphthalene											
Nitrobenzene						ND					
N-Nitroso-di-n-propylamine						ND					
N-Nitrosodiphenylamine(1)						ND					
Phenanthrene											
Pyrene											
1,2,4-Trichlorobenzene						ND					
Benzyl alcohol											
4-Chloroaniline						ND					
Dibenzofuran											
2-Methylnaphthalene											
2-Nitroaniline						ND					

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BACKGROUND DETERMINATION IN GROUNDWATER - STATISTICAL SUMMARY OF DATA SUFFICIENCY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG	t	B	(ABS) B/MEAN	n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	(ABS) COV
	Dist.	Mean	S.D.	n	T						
3-Nitroaniline	Normal	0.0001	0.0002	28	2.249	0.001	2.05	7.75E-05	0.77	N	200.0%
4-Nitroaniline											
2-Chlorophenol						ND					
2,4-Dichlorophenol						ND					
2,4-Dimethylphenol											
4,6-Dinitro-2-methylphenol						ND					
2,4-Dinitrophenol						ND					
2-Nitrophenol						ND					
4-Nitrophenol											
4-Chloro-3-methylphenol											
Pentachlorophenol											
Phenol											
2,4,6-Trichlorophenol						ND					
2-Methylphenol											
4-Methylphenol											
Benzoic acid											
2,4,5-Trichlorophenol						ND					
Pesticides (mg/l)											
Aldrin											
Alpha-BHC											
Beta-BHC						ND					
Gamma-BHC (Lindane)						ND					
Delta-BHC											
4,4'-DDT											
4,4'-DDE											
4,4'-DDD											
Dieldrin											
Endosulfan I						ND					
Endosulfan II											
Endosulfan sulfate											
Endrin											
Heptachlor											
Heptachlor epoxide											
PCB-1242						ND					
PCB-1254						ND					
PCB-1221						ND					
PCB-1232											
PCB-1248						ND					
PCB-1260						ND					
PCB-1016						ND					
Toxaphene						ND					
p,p'-Methoxychlor											
Endrin ketone											
Alpha chlordane						ND					
Gamma chlordane						ND					

BACKGROUND DETERMINATION IN GROUNDWATER - STATISTICAL SUMMARY OF DATA SUFFICIENCY
PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG	t	B	(ABS) B/MEAN	n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	(ABS) COV
	Dist.	Mean	S.D.	n	T						
General Parameters (mg/l)											
Cyanide						N/A					
Ammonia (N), Distillation	Log Base 10	1.8	0.4	70	2	0.398	2	9.56E-02	0.05	Y	22.2%
BOD(O2) - 5 day						N/A					
Carbon, Total Organic (C)	Log Base 10	3.5	0.48	40	2.125	33.113	2.03	1.54E-01	0.04	Y	13.7%
COD(O2)						N/A					
Chloride (Cl)	Log Base 10	4.5	0.25	92	2	100.000	1.985	5.17E-02	0.01	Y	5.6%
Hardness, Total (as CaCO3)						N/A					
Nitrate (as N)	Log Base 10	-0.6	1.05	61	2.005	0.032	2	2.69E-01	0.45	Y	175.0%
Nitrogen, Kjeldahl (N)	Normal	30.2	94.8	10	2.911	306.163	2.26	6.78E+01	2.24	N	313.9%
pH	Normal	7.2	0.27	38	2.141	7.778	2.03	8.89E-02	0.01	Y	3.8%
Phosphorus, Dissolved	Log Base 10	1.6	0.52	68	2	0.437	2	1.26E-01	0.08	Y	32.5%
Solids, Dissolved at 180C	Normal	435.327	97.822	55	2.035	634.395	2.01	2.65E+01	0.06	Y	22.5%
Solids, Suspended at 103C						N/A					
Oil and Grease						N/A					
Petroleum Hydrocarbons						N/A					
Sulfate, Turbid	Normal	71.842	25.608	91	2	123.058	1.99	5.34E+00	0.07	Y	35.6%
Surfactants (MBAS)	Normal	0.1793	0.1373	29	2.234	0.486	2.05	5.23E-02	0.29	Y	76.6%
Phosphorus, Total	Log Base 10	2.2	0.75	19	2.523	12.367	2.1	3.61E-01	0.16	Y	34.1%
Radiological Parameters (pCi/l)											
Gross Alpha	Log Base 10	1.233	0.732	46	2.09	579.269	2.01	2.17E-01	0.18	Y	59.4%
Gross Beta	Log Base 10	1.384	0.564	46	2.09	365.393	2.01	1.67E-01	0.12	Y	40.8%
Uranium, Total	Log Base 10	0.701	1.0369	55	2.035	647.279	2	2.80E-01	0.40	Y	147.9%
Potassium-40	Log Base 10	1.752	0.2439	36	2.158	189.817	2.06	8.37E-02	0.05	Y	13.9%
Miscellaneous											
Specific Conductivity	Normal	651.3	136.55	27	2.263	960.313	2.06	5.41E+01	0.08	Y	21.0%
Oxygen, Dissolved						N/A					
Temperature						N/A					

000792

BACKGROUND DETERMINATION IN SURFACE WATERS - STATISTICAL SUMMARY OF DATA SUFFICIENCY

PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG	t	B	(ABS) B/MEAN	n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	(ABS) COV
	Dist.	Mean	S.D.	n	T						
Dissolved Metals (mg/l)											
Antimony (Dis.)	Normal	0.00555	0.00478	5	4.202	0.0256	2.78	0.0059	1.0708	N	86.1%
Arsenic (Dis.)						ND					
Beryllium (Dis.)	Normal	0.00166	0.0019	5	4.202	0.0096	2.78	0.0024	1.4230	N	114.5%
Cadmium (Dis.)						ND					
Chromium (Dis.)	Normal	0.0097	0.007	9	3.031	0.0309	2.31	0.0054	0.5557	N	72.2%
Copper (Dis)	Normal	0.0063	0.00376	9	3.031	0.0177	2.31	0.0029	0.4596	Y	59.7%
Lead (Dis.)	Normal	0.00341	0.00361	9	3.031	0.0144	2.31	0.0028	0.8152	N	105.9%
Mercury (Dis.)						ND					
Nickel (Dis.)						ND					
Selenium (Dis.)						ND					
Silver (Dis.)						ND					
Thallium (Dis.)						ND					
Zinc (Dis.)	N/A					N/A					
Barium (Dis.)	Normal	0.04266	0.01213	9	3.031	0.0794	2.31	0.0093	0.2189	Y	28.4%
Iron (Dis.)	Log Base 10	-0.7795	0.6568	9	3.031	16.2653	2.31	0.5057	0.6488	N	84.3%
Manganese (Dis.)	Normal	0.0255	0.01257	9	3.031	0.0636	2.31	0.0097	0.3796	Y	49.3%
Vanadium (Dis.)	Normal	0.008513	0.005467	8	3.188	0.0259	2.37	0.0046	0.5381	N	64.2%
Aluminum (Dis.)	Log Base 10	-0.8151	0.61496	8	3.188	13.976	2.37	0.5153	0.6322	N	75.4%
Cobalt (Dis.)	Normal	0.0038	0.00168	5	4.202	0.0109	2.78	0.0021	0.5496	N	44.2%
Magnesium (Dis.)	Normal	18.096	5.176	8	3.188	34.5971	2.37	4.3371	0.2397	Y	28.6%
Calcium (Dis.)	Normal	71.288	18.815	8	3.188	131.2702	2.37	15.7655	0.2212	Y	26.4%
Sodium (Dis.)	Normal	10.468	2.925	8	3.188	19.7929	2.37	2.4509	0.2341	Y	27.9%
Potassium (Dis.)	Normal	2.42	1.0637	9	3.031	5.6441	2.31	0.8190	0.3385	Y	44.0%
Total Metals (mg/l)											
Antimony (Tot.)	N/A					N/A					
Arsenic (Tot.)						ND					
Beryllium (Tot.)						ND					
Cadmium (Tot.)						ND					
Chromium (Tot.)						ND					
Copper (Tot.)						ND					
Lead (Tot.)	N/A					N/A					
Mercury (Tot.)						ND					
Nickel (Tot.)						ND					
Selenium (Tot.)						ND					
Silver (Tot.)						ND					
Thallium (Tot.)						ND					
Zinc (Tot.)	N/A					N/A					
Barium (Tot.)	N/A					N/A					
Iron (Tot.)	N/A					N/A					
Manganese (Tot.)	N/A					N/A					
Vanadium (Tot.)						ND					
Aluminum (Tot.)	N/A					N/A					
Cobalt (Tot.)						ND					
Magnesium (Tot.)	N/A					N/A					
Calcium (Tot.)	N/A					N/A					
Sodium (Tot.)	N/A					N/A					
Potassium (Tot.)	N/A					N/A					

BACKGROUND DETERMINATION IN SURFACE WATERS - STATISTICAL SUMMARY OF DATA SUFFICIENCY

PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG	t	B	(ABS) B/MEAN	n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	(ABS) COV
	Dist.	Mean	S.D.	n	T						
Volatile Organics (mg/l)											
Acrolein						ND					
Acrylonitrile	N/A					N/A					
Benzene						ND					
Bromoform						ND					
Carbon tetrachloride						ND					
Chlorobenzene						ND					
Dibromochloromethane						ND					
Chloroethane						ND					
Chloroform						ND					
Bromodichloromethane						ND					
1,1-Dichloroethane						ND					
1,2-Dichloroethane	Normal	0.0022	0.00067	5	4.202	0.0050	2.78	0.0008	0.3786	Y	30.5%
1,1-Dichloroethene						ND					
1,2-Dichloropropane						ND					
Cis-1,3-Dichloropropene						ND					
Ethylbenzene						ND					
Bromomethane						ND					
Chloromethane	Normal	0.0042	0.0018	5	4.202	0.0118	2.78	0.0022	0.5328	N	42.9%
Methylene chloride	Normal	0.00234	0.0017	5	4.202	0.0095	2.78	0.0021	0.9032	N	72.6%
1,1,2,2-Tetrachloroethane						ND					
Tetrachloroethene						ND					
Toluene						ND					
1,1,1-Trichloroethane						ND					
1,1,2-Trichloroethane						ND					
Trichloroethene						ND					
Vinyl chloride						ND					
Trans-1,3-Dichloropropene						ND					
Styrene						ND					
Acetone	Normal	0.00458	0.00102	6	3.707	0.0084	2.57	0.0011	0.2337	Y	22.3%
2-Butanone						ND					
Carbon disulfide						ND					
2-Hexanone						ND					
4-Methyl-2-pentanone						ND					
Vinyl acetate						ND					
Xylenes (Total)						ND					
1,2-Dichloroethene(Total)						ND					
Isopropylbenzene						ND					
Semi-Volatile Organics (mg/l)											
Acenaphthene						ND					
Acenaphthylene						ND					
Anthracene						ND					
Benzo(a)anthracene						ND					
Benzo(a)pyrene						ND					
Benzo(b)fluoranthene						ND					
Benzo(g,h,i)perylene						ND					
Benzo(k)fluoranthene						ND					
bis(2-Chloroethoxy)methane						ND					

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BACKGROUND DETERMINATION IN SURFACE WATERS - STATISTICAL SUMMARY OF DATA SUFFICIENCY

PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG	t	B	(ABS) B/MEAN	n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	(ABS) COV
	Dist.	Mean	S.D.	n	T						
bis(2-Chloroethyl)ether						ND					
bis(2-Chloroisopropyl)ether						ND					
bis(2-Ethylhexyl)phthalate	Normal	0.0035	0.00212	5	4.202	0.0124	2.78	0.0026	0.7531	N	60.6%
4-Bromophenyl phenyl ether						ND					
Butyl benzyl phthalate						ND					
2-Chloronaphthalene						ND					
4-Chlorophenyl phenyl ether						ND					
Chrysene						ND					
Dibenzo(a,h)anthracene						ND					
1,2-Dichlorobenzene						ND					
1,3-Dichlorobenzene						ND					
1,4-Dichlorobenzene						ND					
3-3-Dichlorobenzidine						ND					
Diethyl phthalate						ND					
Dimethyl phthalate						ND					
Di-n-butyl phthalate						ND					
2,4-Dinitrotoluene						ND					
2,6-Dinitrotoluene						ND					
Di-n-octyl phthalate						ND					
Flouranthene						ND					
Fluorene						ND					
Hexachlorobenzene						ND					
Hexachlorobutadiene						ND					
Hexachlorocyclopentadiene						ND					
Hexachloroethane						ND					
Indeno(1,2,3-cd)pyrene						ND					
Isophorone						ND					
Naphthalene						ND					
Nitrobenzene						ND					
N-Nitroso-di-n-propylamine						ND					
N-Nitrosodiphenylamine(1)						ND					
Phenanthrene						ND					
Pyrene						ND					
1,2,4-Trichlorobenzene						ND					
Benzyl alcohol						ND					
4-Chloroaniline						ND					
Dibenzofuran						ND					
2-Methylnaphthalene						ND					
2-Nitroaniline						ND					
3-Nitroaniline						ND					
4-Nitroaniline						ND					
2-Chlorophenol						ND					
2,4-Dichlorophenol						ND					
2,4-Dimethylphenol						ND					
4,6-Dinitro-2-methylphenol						ND					
2,4-Dinitrophenol						ND					
2-Nitrophenol						ND					
4-Nitrophenol						ND					

BACKGROUND DETERMINATION IN SURFACE WATERS - STATISTICAL SUMMARY OF DATA SUFFICIENCY

PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG				n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	
	Dist.	Mean	S.D.	n	T		t	B	(ABS) B/MEAN		(ABS) COV
4-Chloro-3-methylphenol						ND					
Pentachlorophenol						ND					
Phenol						ND					
2,4,6-Trichlorophenol						ND					
2-Methylphenol						ND					
4-Methylphenol						ND					
Benzoic acid						ND					
2,4,5-Trichlorophenol						ND					
Pesticides (mg/l)											
Aldrin						ND					
Alpha-BHC						ND					
Beta-BHC						ND					
Gamma-BHC (Lindane)						ND					
Delta-BHC						ND					
4,4'-DDT						ND					
4,4'-DDE						ND					
4,4'-DDD						ND					
Dieldrin						ND					
Endosulfan I						ND					
Endosulfan II						ND					
Endosulfan sulfate						ND					
Endrin						ND					
Heptachlor						ND					
Heptachlor epoxide						ND					
PCB-1242						ND					
PCB-1254						ND					
PCB-1221						ND					
PCB-1232						ND					
PCB-1248						ND					
PCB-1260						ND					
PCB-1016						ND					
Toxaphene	Normal	0.00032	0.000246	5	4.202	0.0014	2.78	0.0003	0.9558	N	76.9%
p,p'-Methoxychlor						ND					
Endrin ketone						ND					
Alpha chlordane						ND					
Gamma chlordane						ND					
General Parameters (mg/l)											
Cyanide						N/A					
Ammonia (N), Distillation	Log Base 10	-0.7768	0.5567	9	3.031	8.139	2.31	0.4287	0.5518	N	71.7%
BOD(O2) - 5 day						N/A					
TOC						N/A					
COD(O2)						N/A					
Chloride (Cl)	Normal	20.353	7.165	9	3.031	42.070	2.31	5.5171	0.2711	Y	35.2%
Hardness, Total (as CaCO3)	N/A					N/A					
Nitrate (as N)						N/A					
Nitrogen, Kjeldahl (N)						N/A					
pH	N/A					N/A					
Phosphorus, Dissolved	N/A					N/A					

000796

BACKGROUND DETERMINATION IN SURFACE WATERS - STATISTICAL SUMMARY OF DATA SUFFICIENCY

PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG	t	B	(ABS) B/MEAN	n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	(ABS) COV
	Dist.	Mean	S.D.	n	T						
Solids, Dissolved at 180C	N/A					N/A					
Solids, Suspended at 103C						N/A					
Oil and Grease						N/A					
Petroleum Hydrocarbons						N/A					
Sulfate, Turbid	Normal	50.213	10.956	9	3.031	83.421	2.31	8.4361	0.1680	Y	21.8%
Surfactants (MBAS)						N/A					
Phosphorus, Total	Normal	0.2344	0.1985	9	3.031	0.836	2.31	0.1528	0.6521	N	84.7%
Radiological Parameters (pCi/l)											
Gross Alpha	N/A					N/A					
Gross Beta	N/A					N/A					
Uranium, Total	Normal	8.257	5.434	7	3.399	26.727	2.45	5.0320	0.6094	N	65.8%
Potassium-40	N/A					N/A					
Miscellaneous											
Specific Conductivity						N/A					
Oxygen, Dissolved						N/A					
Temperature						N/A					

BACKGROUND DETERMINATION IN SEDIMENTS - STATISTICAL SUMMARY OF DATA SUFFICIENCY

PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG	t	B	(ABS) B/MEAN	n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	(ABS) COV
	Dist.	Mean	S.D.	n	T						
Dissolved Metals (mg/kg)											
Antimony (Dis.)						N/A					
Arsenic (Dis.)						N/A					
Beryllium (Dis.)						N/A					
Cadmium (Dis.)						N/A					
Chromium (Dis.)						N/A					
Copper (Dis)						N/A					
Lead (Dis.)						N/A					
Mercury (Dis.)						N/A					
Nickel (Dis.)						N/A					
Selenium (Dis.)						N/A					
Silver (Dis.)						N/A					
Thallium (Dis.)						N/A					
Zinc (Dis.)						N/A					
Barium (Dis.)						N/A					
Iron (Dis.)						N/A					
Manganese (Dis.)						N/A					
Vanadium (Dis.)						N/A					
Aluminum (Dis.)						N/A					
Cobalt (Dis.)						N/A					
Magnesium (Dis.)						N/A					
Calcium (Dis.)						N/A					
Sodium (Dis.)						N/A					
Potassium (Dis.)						N/A					
Total Metals (mg/kg)											
Antimony (Tot.)	Normal	3.175	4.867	4	5.145	28.22	3.18	7.74	2.44	N	1.53
Arsenic (Tot.)	Normal	4.62	2.58	6	3.707	14.18	2.57	2.71	0.59	N	0.56
Beryllium (Tot.)	Normal	0.37	0.2	6	3.707	1.11	2.57	0.21	0.57	N	0.54
Cadmium (Tot.)	Normal	2.353	2.258	8	3.188	9.55	2.57	2.05	0.87	N	0.96
Chromium (Tot.)	Normal	13.4	6.75	6	3.707	38.42	2.57	7.08	0.53	N	0.50
Copper (Tot.)	Normal	10.6	2.72	6	3.707	20.68	2.57	2.85	0.27	Y	0.26
Lead (Tot.)	Normal	13.1	6.88	4	5.145	48.50	2.57	8.84	0.67	N	0.53
Mercury (Tot.)	N/A					N/A					
Nickel (Tot.)	Normal	14.35	4.53	6	3.707	31.14	2.57	4.75	0.33	Y	0.32
Selenium (Tot.)	Log Base 10	-0.54	0.29	7	3.399	2.79	2.57	0.28	0.52	N	0.54
Silver (Tot.)						ND					
Thallium (Tot.)						ND					
Zinc (Tot.)	Normal	20.23	7.98	6	3.707	49.81	2.57	8.37	0.41	Y	0.39
Barium (Tot.)	Normal	23.03	5.66	6	3.707	44.01	2.57	5.94	0.26	Y	0.25
Iron (Tot.)	Log Base 10	3.84	0.08	6	3.707	13694.94	2.57	0.08	0.02	Y	0.02
Manganese (Tot.)	Normal	352.17	55.55	6	3.707	558.09	2.57	58.28	0.17	Y	0.16
Vanadium (Tot.)	Normal	11.48	4.81	6	3.707	29.31	2.57	5.05	0.44	Y	0.42
Aluminum (Tot.)	Normal	2853.33	1174.8	6	3.707	7208.31	2.57	1232.60	0.43	Y	0.41
Cobalt (Tot.)	Normal	4.4	1.75	6	3.707	10.89	2.57	1.84	0.42	Y	0.40
Magnesium (Tot.)	Normal	23200	7152.6	6	3.707	49714.69	2.57	7504.49	0.32	Y	0.31
Calcium (Tot.)	Normal	82683.3	29982.2	6	3.707	193827.32	2.57	31457.27	0.38	Y	0.36
Sodium (Tot.)	Log Base 10	2.37	0.21	6	3.707	1407.57	2.57	0.22	0.09	Y	0.09
Potassium (Tot.)	Normal	648.5	285.25	6	3.707	1705.92	2.57	299.28	0.46	Y	0.44

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BACKGROUND DETERMINATION IN SEDIMENTS - STATISTICAL SUMMARY OF DATA SUFFICIENCY

PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG	t	B	(ABS) B/MEAN	n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	(ABS) COV
	Dist.	Mean	S.D.	n	T						
Volatile Organics (mg/kg)											
Acrolein						ND					
Acrylonitrile						ND					
Benzene						ND					
Bromoform						ND					
Carbon tetrachloride						ND					
Chlorobenzene						ND					
Dibromochloromethane						ND					
Chloroethane						ND					
Chloroform						ND					
Bromodichloromethane						ND					
1,1-Dichloroethane						ND					
1,2-Dichloroethane						ND					
1,1-Dichloroethene						ND					
1,2-Dichloropropane						ND					
Cis-1,3-Dichloropropene						ND					
Ethylbenzene						ND					
Bromomethane						ND					
Chloromethane						ND					
Methylene chloride	Normal	0.014	0.0095	8	3.188	0.04	2.37	0.01	0.57	N	0.68
1,1,2,2-Tetrachloroethane						ND					
Tetrachloroethene						ND					
Toluene						ND					
1,1,1-Trichloroethane						ND					
1,1,2-Trichloroethane						ND					
Trichloroethene						ND					
Vinyl chloride						ND					
Trans-1,3-Dichloropropene						ND					
Styrene						ND					
Acetone	Log Base 10	-1.739	0.3999	8	3.188	0.34	2.37	0.34	0.19	Y	0.23
2-Butanone						ND					
Carbon disulfide						ND					
2-Hexanone						ND					
4-Methyl-2-pentanone						ND					
Vinyl acetate						ND					
Xylenes (Total)						ND					
1,2-Dichloroethene(Total)						ND					
Isopropylbenzene						ND					
Semi-Volatile Organics (mg/kg)											
Acenaphthene	Normal	0.2113	0.02	8	3.188	0.28	2.37	0.02	0.08	Y	0.09
Acenaphthylene	Normal	0.2113	0.02	8	3.188	0.28	2.37	0.02	0.08	Y	0.09
Anthracene	Normal	0.192	0.0603	8	3.188	0.38	2.37	0.05	0.26	Y	0.31
Benzo(a)anthracene	Normal	0.1943	0.0582	8	3.188	0.38	2.37	0.05	0.25	Y	0.30
Benzo(a)pyrene	Normal	0.197	0.0636	8	3.188	0.40	2.37	0.05	0.27	Y	0.32
Benzo(b)fluoranthene	Normal	0.1934	0.0469	8	3.188	0.34	2.37	0.04	0.20	Y	0.24
Benzo(g,h,i)perylene	Normal	0.2031	0.0323	8	3.188	0.31	2.37	0.03	0.13	Y	0.16
Benzo(k)fluoranthene	Normal	0.2209	0.0861	8	3.188	0.50	2.37	0.07	0.33	Y	0.39
bis(2-Chloroethoxy)methane						ND					

BACKGROUND DETERMINATION IN SEDIMENTS - STATISTICAL SUMMARY OF DATA SUFFICIENCY

PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG				n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	
	Dist.	Mean	S.D.	n	T		t	B	(ABS) B/MEAN		(ABS) COV
bis(2-Chloroethyl)ether						ND					
bis(2-Chloroisopropyl)ether						ND					
bis(2-Ethylhexyl)phthalate	Normal	0.3319	0.1827	8	3.188	0.914	2.37	0.15	0.46	Y	0.55
4-Bromophenyl phenyl ether						ND					
Butyl benzyl phthalate						ND					
2-Chloronaphthalene						ND					
4-Chlorophenyl phenyl ether						ND					
Chrysene	Normal	0.1953	0.0638	8	3.188	0.399	2.37	0.05	0.27	Y	0.33
Dibenzo(a,h)anthracene	Normal	0.2113	0.02	8	3.188	0.275	2.37	0.02	0.08	Y	0.09
1,2-Dichlorobenzene						ND					
1,3-Dichlorobenzene						ND					
1,4-Dichlorobenzene						ND					
3-3-Dichlorobenzidine						ND					
Diethyl phthalate						ND					
Dimethyl phthalate						ND					
Di-n-butyl phthalate	Normal	0.1114	0.0897	8	3.188	0.397	2.37	0.08	0.67	N	0.81
2,4-Dinitrotoluene						ND					
2,6-Dinitrotoluene						ND					
Di-n-octyl phthalate						ND					
Flouranthene	Normal	0.2381	0.121	8	3.188	0.624	2.37	0.10	0.43	Y	0.51
Fluorene	Normal	0.2113	0.02	8	3.188	0.275	2.37	0.02	0.08	Y	0.09
Hexachlorobenzene						ND					
Hexachlorobutadiene						ND					
Hexachlorocyclopentadiene						ND					
Hexachloroethane						ND					
Indeno(1,2,3-cd)pyrene	Normal	0.2006	0.03812	8	3.188	0.322	2.37	0.03	0.16	Y	0.19
Isophorone						ND					
Naphthalene	Normal	0.2113	0.02	8	3.188	0.275	2.37	0.02	0.08	Y	0.09
Nitrobenzene						ND					
N-Nitroso-di-n-propylamine						ND					
N-Nitrosodiphenylamine(1)						ND					
Phenanthrene	Normal	0.2026	0.0681	8	3.188	0.420	2.37	0.06	0.28	Y	0.34
Pyrene	Normal	0.2369	0.1275	8	3.188	0.643	2.37	0.11	0.45	Y	0.54
1,2,4-Trichlorobenzene						ND					
Benzyl alcohol						ND					
4-Chloroaniline						ND					
Dibenzofuran	Normal	0.2113	0.02	8	3.188	0.275	2.37	0.02	0.08	Y	0.09
2-Methylnaphthalene	Normal	0.2113	0.02	8	3.188	0.275	2.37	0.02	0.08	Y	0.09
2-Nitroaniline						ND					
3-Nitroaniline						ND					
4-Nitroaniline						ND					
2-Chlorophenol						ND					
2,4-Dichlorophenol						ND					
2,4-Dimethylphenol						ND					
4,6-Dinitro-2-methylphenol						ND					
2,4-Dinitrophenol						ND					
2-Nitrophenol						ND					
4-Nitrophenol						ND					

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BACKGROUND DETERMINATION IN SEDIMENTS - STATISTICAL SUMMARY OF DATA SUFFICIENCY

PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG				n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	
	Dist.	Mean	S.D.	n	T		t	B	(ABS) B/MEAN		(ABS) COV
4-Chloro-3-methylphenol						ND					
Pentachlorophenol						ND					
Phenol						ND					
2,4,6-Trichlorophenol						ND					
2-Methylphenol						ND					
4-Methylphenol						NA					
Benzoic acid	Normal	1.0438	0.105	8	3.188	1.379	2.37	0.09	0.08	Y	0.10
2,4,5-Trichlorophenol						ND					
Pesticides (mg/kg)											
Aldrin						ND					
Alpha-BHC						ND					
Beta-BHC						ND					
Gamma-BHC (Lindane)						ND					
Delta-BHC						ND					
4,4'-DDT						ND					
4,4'-DDE						ND					
4,4'-DDD						ND					
Dieldrin						ND					
Endosulfan I						ND					
Endosulfan II						ND					
Endosulfan sulfate						ND					
Endrin						ND					
Heptachlor						ND					
Heptachlor epoxide						ND					
PCB-1242						ND					
PCB-1254						ND					
PCB-1221						ND					
PCB-1232						ND					
PCB-1248						ND					
PCB-1260						ND					
PCB-1016						ND					
Toxaphene						ND					
p,p'-Methoxychlor						ND					
Endrin ketone						ND					
Alpha chlordane						ND					
Gamma chlordane						ND					
General Parameters (mg/kg)											
Cyanide	Normal	0.859	0.435	7	3.399	2.338	2.45	0.40	0.47	Y	0.51
Ammonia (N), Distillation	Normal	49.168	35.645	4	5.145	232.562	3.18	56.68	1.15	N	0.72
BOD(O2) - 5 day						NA					
Carbon, Total Organic (C)						NA					
COD(O2)						NA					
Chloride (Cl)	Normal	102.275	97.439	4	5.145	603.599	3.18	154.93	1.51	N	0.95
Hardness, Total (as CaCO3)						NA					
Nitrate (as N)						NA					
Nitrogen, Kjeldahl (N)						NA					
pH						NA					
Phosphorus, Dissolved						NA					

BACKGROUND DETERMINATION IN SEDIMENTS - STATISTICAL SUMMARY OF DATA SUFFICIENCY

PADDYS RUN ROAD SITE

CHEMICAL	STATISTICS					BG	t	B	(ABS) B/MEAN	n OK? IF(B/MEAN)< 0.5 THEN "Y", ELSE "N"	(ABS) COV
	Dist.	Mean	S.D.	n	T						
Solids, Dissolved at 180C						NA					
Solids, Suspended at 103C						NA					
Oil and Grease						NA					
Petroleum Hydrocarbons						NA					
Sulfate, Turbid	Normal	410.56	213.6	4	5.415	1567.204	3.18	339.62	0.83	N	0.52
Surfactants (MBAS)						NA					
Phosphorus, Total	Normal	248.28	354.53	4	5.145	2072.337	3.18	563.70	2.27	N	1.43
Radiological Parameters (pCi/g)											
Gross Alpha						NA					
Gross Beta						NA					
Uranium, Total	Log Base 10	0.1445	0.6372	8	3.188	149.932	2.37	0.53	3.69	N	4.41
Potassium-40						NA					
Miscellaneous											
Specific Conductivity						NA					
Oxygen, Dissolved						NA					
Temperature						NA					

000802

APPENDIX J

SENSITIVITY ANALYSIS CALCULATIONS - GROUNDWATER

Background Groundwater Sensitivity Analyses

	WITH DOE DATA					WITHOUT DOE DATA					
Constituent	n	Mean	S.D.	T	UTL (pg/l)	n	Mean	S.D.	T	UTL (pg/l)	% Diff. (+)
DISSOLVED METALS											
Antimony (Dis)	35	14.4	3.75	2.166	22.52	28	15.5	3.48	2.249	23.33	3.57%
Arsenic (Dis)	33	1.7	0.54	2.188	2.88	25	1.5	0.43	2.292	2.49	-13.74%
Beryllium (Dis)	35	1	1.04	2.166	3.25	28	0.5	0	2.249	0.50	-84.63%
Cadmium (Dis)	36	1.9	0.77	2.158	3.56	28	2.3	0.25	2.249	2.86	-19.64%
Chromium (Dis)	36	2.6	0.72	2.158	4.15	28	2.9	0.42	2.249	3.84	-7.44%
Copper (Dis)	36	11.1	18.1	2.158	50.16	28	10.4	19.88	2.249	55.11	9.87%
Nickel (Dis)	36	10.7	7.58	2.158	27.06	28	12.5	7.69	2.249	29.79	10.12%
Selenium (Dis)	29	1.7	0.84	2.234	3.58	21	1.5	0.85	2.371	3.52	-1.71%
Silver (Dis)	33	2.6	2.53	2.188	8.14	25	3.2	2.58	2.292	9.11	12.02%
Thallium (Dis)	35	2.5	2.62	2.166	8.17	28	1.9	2.58	2.249	7.70	-5.78%
Zinc (Dis)	37	42.1	91.89	2.15	239.68	26	53.4	108.06	2.278	299.56	24.99%
Barium (Dis)	62	69.2	26.07	2.006	121.50	51	62.5	53.98	2.059	173.64	42.92%
Iron (Dis)	60	814.1	1056.55	2.006	2933.54	49	764.2	961.63	2.0866	2770.74	-5.55%
Manganese (Dis)	62	186	175.21	2.006	537.47	51	189.7	173.4	2.059	546.73	1.72%
Vanadium (Dis)	35	6.8	9.25	2.166	26.84	28	2.2	0.6	2.249	3.55	-86.77%
Aluminum (Dis)	40	78.5	59.27	2.125	204.45	30	67.4	45.02	2.22	167.34	-18.15%
Cobalt (Dis)	35	3	1.77	2.166	6.83	28	2.8	0.65	2.249	4.26	-37.64%
Lead (Dis)	62	11.6	25.3	2.006	62.35	51	13.6	27.42	2.059	70.06	12.36%
Mercury (Dis)	61	0.1	0.11	2.006	0.32	51	0.1	0.12	2.059	0.35	8.24%
Magnesium (Dis)	62	25451.6	4058.465	2.006	33592.88	51	25437.3	4062.36	2.059	33801.70	0.62%
Calcium (Dis)	62	100066.1	19193.34	2.006	138567.94	51	100311.8	19530.89	2.059	140525.90	1.41%
Sodium (Dis)	62	20619.4	18598.16	2.006	57929.31	51	21923.5	19986.31	2.059	63075.31	8.88%
Potassium (Dis)	62	2719.9	963.07	2.006	4651.82	51	2795.8	981.67	2.059	4817.06	3.55%
log Antimony	35	1.1	0.11	2.166	3.81	28	1.2	0.1	2.249	4.16	9.05%
log Arsenic	33	0.2	0.13	2.198	1.63	25	0.2	0.11	2.292	1.57	-3.31%
log Beryllium	35	-0.2	0.3	2.166	1.57	28	-0.3	0	2.249	0.74	-52.75%
log Cadmium	36	0.2	0.28	2.166	2.24	28	0.3	0.05	2.249	1.51	-32.57%
log Chromium	36	0.4	0.16	2.166	2.11	28	0.5	0.06	2.249	1.89	-10.56%
log Copper	36	0.7	0.5	2.166	5.95	28	0.6	0.5	2.249	5.61	-5.68%
log Nickel	36	0.9	0.33	2.166	5.03	28	1	0.32	2.249	5.58	11.06%
log Selenium	29	0.2	0.18	2.234	1.83	21	0.1	0.16	2.371	1.62	-11.55%
log Silver	33	0.3	0.37	2.188	3.03	25	0.4	0.21	2.292	2.41	-20.41%
log Thallium	35	0.3	0.28	2.166	2.48	28	0.2	0.21	2.249	1.96	-20.88%
log Zinc	37	1.1	0.61	2.15	11.15	26	1.1	0.72	2.278	15.49	38.91%
log Barium	62	1.8	0.2	2.006	9.04	51	1.8	0.2	2.059	9.13	1.07%
log Iron	60	2.1	1.11	2.006	75.69	49	2	1.15	2.0866	81.42	7.57%
log Manganese	62	1.7	1	2.006	40.69	51	1.7	1.05	2.051	47.16	15.90%
log Vanadium	35	0.6	0.44	2.166	4.73	28	0.3	0.08	2.249	1.62	-65.81%
log Aluminum	40	1.8	0.36	2.125	13.00	30	1.7	0.37	2.22	12.45	-4.27%
log Cobalt	35	0.4	0.15	2.166	2.06	28	0.4	0.1	2.249	1.87	-9.52%
log Lead	62	0.5	0.61	2.006	5.61	51	0.5	0.66	2.059	6.42	14.49%
Log Mercury	61	-0.9	0.2	2.006	0.61	51	-0.9	0.22	2.059	0.64	5.31%
Log Magnesium	62	4.4	0.07	2.006	93.73	51	4.4	0.07	2.059	94.08	0.37%
log Calcium	62	5	0.09	2.006	177.78	51	5	0.09	2.059	178.63	0.48%
log Sodium	62	4.2	0.29	2.006	119.31	51	4.2	0.28	2.059	118.69	-0.52%
log Potassium	62	3.4	0.15	2.006	40.48	51	3.4	0.14	2.059	39.98	-1.26%
TOTAL METALS											
Antimony (Tot)	21	12.4	1.3	2.371	15.48	15	12.4	1.55	2.566	16.38	5.78%
Arsenic (Tot)	25	7	15.25	2.292	41.95	15	7.4	17.12	2.566	51.33	22.35%
Beryllium (Tot)	22	2.3	2	2.35	7.00	15	1	0.73	2.566	2.87	-58.95%
Cadmium (Tot)	23	1.5	0.73	2.329	3.20	15	2	0	2.566	2.00	-37.50%
Chromium (Tot)	25	21.2	41.11	2.292	115.42	15	17.3	22.66	2.566	75.45	-34.64%

Background Groundwater Sensitivity Analyses

	WITH DOE DATA					WITHOUT DOE DATA					
Constituent	n	Mean	S.D.	T	UTL (ug/l)	n	Mean	S.D.	T	UTL (ug/l)	% Diff. (+)
Copper (Tot)	25	21.4	21.83	2.292	71.43	15	20.1	23.23	2.566	79.71	11.58%
Lead (Tot)	24	11.5	23.39	2.309	65.51	14	15.6	29.69	2.614	93.21	42.29%
Mercury (Tot)	23	0.1	0	2.329	0.10	15	0.1	0	2.566	0.10	0.00%
Nickel (Tot)	24	19	32.86	2.309	94.87	15	24.9	40.08	2.566	127.75	34.65%
Zinc (Tot)	25	66.1	93.35	2.292	280.06	15	67.9	114.86	2.566	362.63	36.63%
Barium (Tot)	25	89.8	41.16	2.292	184.14	15	83	52.73	2.566	218.31	18.55%
Iron (Tot)	25	7791.3	15151.65	2.292	42518.88	15	8209.6	17146.85	2.566	52208.42	22.79%
Manganese (Tot)	25	436.7	499.26	2.292	1581.05	15	483.1	575.93	2.566	1960.94	24.03%
Vanadium (Tot)	24	13.3	12.42	2.309	41.98	15	6.3	10.65	2.566	33.63	-19.89%
Aluminum (Tot)	24	1436.5	2838.97	2.309	7991.68	15	1345.9	2790.94	2.566	8507.45	6.45%
Cobalt (Tot)	21	7	5.84	2.371	20.85	15	4.8	5.51	2.566	18.94	-9.15%
Magnesium (Tot)	25	33280	18831	2.292	76440.65	15	32120	20624.57	2.566	85042.65	11.25%
Calcium (Tot)	25	112344	54900	2.292	238174.80	15	115454.1	61879.07	2.566	274235.79	15.14%
Sodium (Tot)	25	23395.7	22177.54	2.292	74226.62	15	24712.8	27444.4	2.566	95135.13	28.17%
Potassium (Tot)	25	3483.1	1118.01	2.292	6045.58	15	3276.4	1016.82	2.566	5885.56	-2.65%
log Antimony	21	1.1	0.05	2.371	3.38	15	1.1	0.05	2.566	3.42	0.98%
log Arsenic	25	0.4	0.49	2.292	4.59	15	0.5	0.47	2.566	5.51	20.07%
log Beryllium	22	0.2	0.45	2.35	3.52	15	-0.1	0.29	2.566	1.90	-45.85%
log Cadmium	23	0.1	0.29	2.329	2.17	15	0.3	0	2.566	1.35	-37.84%
log Chromium	25	0.9	0.6	2.292	9.73	15	0.9	0.58	2.566	10.89	11.97%
log Copper	25	1.1	0.52	2.292	9.89	15	1	0.61	2.566	13.00	31.45%
log Lead	24	0.6	0.53	2.309	6.20	14	0.7	0.64	2.614	10.73	73.18%
log Mercury	23	-1	0	2.029	0.37	15	-1	0	2.566	0.37	0.00%
log Nickel	24	1	0.5	2.309	8.62	15	1.1	0.5	2.566	10.84	25.67%
log Zinc	25	1.5	0.49	2.292	13.78	15	1.6	0.55	2.566	20.31	47.44%
log Barium	25	1.9	0.39	2.292	16.34	15	1.8	0.49	2.566	21.27	30.14%
log Iron	25	3.3	0.86	2.292	194.63	15	3.3	0.88	2.566	259.32	33.24%
log Manganese	25	2.2	0.81	2.292	57.77	15	2.2	0.9	2.566	90.87	57.28%
log Vanadium	24	0.8	0.55	2.309	7.92	15	0.5	0.42	2.566	4.84	-38.87%
log Aluminum	24	2.5	0.76	2.309	70.45	15	2.5	0.76	2.566	85.64	21.57%
log Cobalt	21	0.7	0.34	2.371	4.51	15	0.6	0.27	2.566	3.64	-19.21%
log Magnesium	25	4.4	0.53	2.292	274.45	15	4.3	0.67	2.566	411.26	49.85%
log Calcium	25	4.9	0.51	2.292	432.21	15	4.9	0.65	2.566	711.87	64.70%
log Sodium	25	4.2	0.47	2.292	195.83	15	4.2	0.59	2.566	303.06	54.76%
log Potassium	25	3.5	0.2	2.292	52.37	15	3.5	0.24	2.566	61.30	17.05%
GENERAL PARAMETERS											
Ammonia	70	95.2	101.61	2.006	299.03	54	103	104	2.03	314.12	5.05%
Chloride	92	35632.6	23497.16	2.006	82767.90	54	39392.6	26991.4	2.03	94185.14	13.79%
pH	38	7.2	0.27	2.141	7.78	11	7.1	0.4	2.815	8.23	5.76%
Dis. Phosphorus	68	77	94.99	2.006	267.55	52	52.8	87.3	2.047	231.50	-13.47%
Sulfate	91	71841.8	25608.07	2.006	123211.59	53	75464.2	30215.8	2.05	137406.59	11.52%
Tot. Phosphorus	19	861.1	2292.46	2.423	6415.73	19	861.1	2292.5	2.423	6415.83	0.00%
Fluoride	47	0.4	0.36	2.08	1.15	23	0.6	0.5	2.329	1.76	53.60%
TKN	10	30.2	94.8	2.911	306.16	10	30.2	94.8	2.911	306.16	0.00%
Nitrates	61	1.8	3.07	2.006	7.96	23	1.8	3.8	2.329	10.65	33.82%
TOC	40	5837.5	9269.74	2.125	25535.70	4	2125	1652	5.145	10624.54	-58.39%
Alkalinity	28	262107.1	56782.45	2.249	389810.83	1	NA	NA	NA	NA	NA
Specific Conductivity	27	651.3	136.55	2.263	960.31	0	NA	NA	NA	NA	NA
TDS	55	435327.3	97822.79	2.035	634396.68	28	449571.4	117740.9	2.249	714370.68	12.61%
Surfactant	29	179.3	137.27	2.234	485.96	29	179.3	137.3	2.234	486.03	0.01%
log Ammonia	70	1.8	0.4	2.006	13.50	54	1.9	0.3	2.03	12.29	-8.92%
log Chloride	92	4.5	0.25	2.006	148.64	54	4.5	0.3	2.03	165.50	11.35%
log Dis. Phosphorus	68	1.6	0.52	2.006	14.06	52	1.4	0.5	2.047	11.29	-19.72%

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Background Groundwater Sensitivity Analyses

	WITH DOE DATA					WITHOUT DOE DATA					
Constituent	n	Mean	S.D.	T	UTL (ug/l)	n	Mean	S.D.	T	UTL (ug/l)	% Diff. (+)
log Sulfate	91	4.8	0.17	2.006	170.89	53	4.8	0.2	2.05	183.09	7.14%
log Tot. Phosphorus	19	2.2	0.75	2.423	55.55	19	2.2	0.7	2.043	37.72	-32.10%
log Fluoride	47	-0.5	0.36	2.08	1.28	23	-0.4	0.4	2.329	1.70	32.68%
log TKN	10	-0.5	1.12	2.911	15.80	10	-0.5	1.1	2.911	14.91	-5.66%
log Nitrates	61	-0.6	1.05	2.006	4.51	23	-0.4	0.8	2.329	4.32	-4.22%
log Phenols	38	-2.1	0.48	2.141	0.34	27	-2	0.5	2.263	0.42	22.61%
log TOC	40	3.5	0.48	2.125	91.84	4	3.2	0.4	5.145	192.10	109.17%
log Alkalinity	28	5.4	0.09	2.249	271.08	1	NA	NA	NA	NA	NA
log Spec. Cond.	27	2.8	0.09	2.263	20.16	0	NA	NA	NA	NA	NA
log TDS	55	5.6	0.15	2.035	368.98	28	5.6	0.2	2.249	424.03	15.55%
log Surfactants	29	2.2	0.27	2.234	16.50	29	2.2	0.3	2.234	17.64	6.93%
RADIOLOGIC PARAMETE											
Uranium (Tot)	55	29.98824	51.1687	2.035	134.12	27	17.26393	21.1025	2.263	65.02	-51.52%
Gross Beta	46	55.74304	98.1688	2.088	260.72	27	65.47778	124.6768	2.263	347.62	33.33%
Gross Alpha	46	55.07511	109.0808	2.088	282.84	27	61.44074	136.3836	2.263	370.08	30.85%
Potassium-40	27	58.14815	42.5203	2.263	154.37	27	58.14815	42.5203	2.263	154.37	0.00%
log Uranium	55	0.70111	1.0369	2.035	16.63	27	0.65315	0.9461	2.263	16.35	-1.69%
log Beta	46	1.38352	0.5637	2.088	12.94	27	1.34939	0.6324	2.263	16.13	24.61%
log Alpha	46	1.23329	0.7323	2.088	15.84	27	1.20109	0.7438	2.263	17.89	12.97%
log Potassium-40	27	1.69322	0.2285	2.263	9.12	27	1.69322	0.2285	2.263	9.12	0.00%