REPORT OF THE

GOVERNOR'S LOWRY LANDFILL ASSESSMENT

TASK FORCE

NOVEMBER 24, 1980

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LOWRY LANDFILL ASSESSMENT TASK FORCE REPORT

On February 20, 1980, Governor Lamm issued an Executive Order to create the Lowry Landfill Assessment Task Force. This task force was charged with assessing the nature and magnitude of hazardous and toxic waste disposal activities and the existence of any threats to public health and safety or environmental quality and determining the available methods to reduce or control those threats found to exist.

Additionally, the Executive Order created a Scientific Assessment Subcommittee, principally from Task Force members, to evaluate the available scientific information relating to hazardous waste disposal at Lowry. This Scientific Assessment Subcommittee provided the Task Force with an assessment report (Appendix A) concerning the threats associated with hazardous and toxic waste disposal at Lowry.

During the course of its study, the Task Force held several meetings and considered a substantial amount of information and data concerning the activities at the Lowry Landfill - past, present and proposed future.

Issues

Based on the final report of the Scientific Assessment Subcommittee and other data presented to the Task Force, the following are issues related to the disposal of hazardous and toxic wastes at the Lowry Landfill:

1. Data from the Colorado Department of Health and the U.S. Environmental Protection Agency indicate the presence of certain contaminants in the monitoring samples taken from Section 6 of the Lowry site. The extent and significance of contamination are unclear.
2. Further processing, recycling and disposal of hazardous wastes at the Lowry Landfill should incorporate state-of-the-art technology and management practices.

3. The present site is not the best possible/practical site for burial of highly hazardous wastes. A new secure site is needed, as well as administrative guidelines for identifying those wastes which are unsuitable for processing or burial at the Lowry site.

4. Clearly the Lowry site is convenient to a large number of generators. The Task Force accepts the fact that Lowry is an existing disposal site and could continue to be used for processing, recycling and disposal activities.

5. The Task Force recognizes that inadequate state statutory authority exists for the regulation of hazardous waste.

6. The Task Force recognizes that sewage sludge disposal activities have been conducted at the site which have their own set of impacts on the site. The Task Force members felt that although these impacts complicate the resolution of issues, the evaluation of this problem is beyond the scope of the Executive Order which created the Task Force.

RECOMMENDATIONS

THE TASK FORCE, THEREFORE, MAKES THE FOLLOWING RECOMMENDATIONS:

1. That further groundwater analyses, geological and hydrological investigations be conducted by the City and County of Denver and/or the State of Colorado to confirm the source and impact of any contaminants found to be present. We further recommend if pollutants are found which threaten public health and safety, that appropriate mitigation measures be taken.

2. That state-of-the-art technology and management practices be implemented at the Lowry Landfill and monitored by the Colorado Department of Health and the U.S. Environmental Protection Agency to assure compliance with applicable laws and regulations.

3. That the Governor appoint a Task Force to work with the Colorado Department of Health to select, plan and implement a secure site for the disposal of highly hazardous wastes. The site should be on State-owned land which meets the criteria proposed by the Colorado Geological Survey under S.B. 336 of the 1979 session of the State Legislature. Criteria and administrative guidelines should be developed by the Colorado Department of Health to define highly hazardous wastes.

4A. That highly hazardous and other hazardous wastes continue to be received at the Lowry site for processing and recycling.

4B. That other hazardous wastes or treatment residues be buried at the Lowry site if it is possible to do so in a manner that is approved by the Colorado Department of Health and the U.S. Environmental Protection Agency.

5. That the Governor urge the legislature to pursue legislation to regulate hazardous waste.

DISCUSSION

In assessing the nature and magnitude of hazardous and toxic waste disposal activities at Lowry, the Task Force determined that past disposal activities were very difficult, if not impossible, to specifically identify. Records of quantities and types of waste disposed were not maintained at the site by the owner and operator. It has been estimated that approximately 10-15 million gallons of liquid wastes and an unknown quantity of solid hazardous wastes were received annually during the 14 year life of the landfill. Thus, it is impossible to assess the magnitude of the past chemical waste disposal activities with any degree of certainty.

This situation has improved greatly with the assumption of operations by Chemical Waste Management, Inc. (CWMI). Exact records are now being maintained of the volumes, types and sources of wastes received. These data may not be representative of past disposal types and quantities for several reasons. First, the new site is not receiving large quantities of specific types of wastes (i.e., sludges and liquids, with greater than 20% solids) in bulk because there are no present facilities to handle these items and second , the costs for disposal at the new site have increased 15 to 25 fold with a minimum disposal fee of $95.00. These significant cost increases appear to have markedly affected the volumes and types of waste received at the new facility. Additionally, CWMI requires all wastes to be manifested, all transportation firms heavily bonded for possible accidents and all drivers to have adequate training in handling spill situations and operating procedures. This has greatly reduced the number of transportation firms using the new chemical waste disposal facility.

For these reasons the quantities and types of hazardous and chemical wastes received at the new facility cannot be used for comparative purposes to infer what materials have been disposed at the old Lowry site.

The Task Force was requested to assess threats to public health, safety and environmental quality at Lowry. Monitoring of the groundwater at the Lowry site has been ongoing since initiation of the U.S. Geological Survey program on groundwater quality in 1972. A USGS report by Stanley Robson on Lowry was issued in 1975. Between 1972 and 1975, 41 observation wells were installed at depths ranging from 4 to 248 feet (Appendix B). Eleven of these observation wells have been monitored regularly since 1975 for inorganic contamination of the groundwater. Eight of these show significant contamination for certain inorganics.

On June 25-27, 1980, a sampling program was performed for organic contaminants in twenty of the observation wells. Four wells located proximate to the area of actual past disposal showed contamination for organic chemicals. Three of the four had shown inorganic contamination previously. The fourth well is located north of the old landfill activities in the alluvial drainage along the direction of groundwater flow. It is significant for this reason, and because it has not previously shown elevated levels of inorganic contamination.

This was a single analysis of the observation wells for organic contaminants and when combined with the existing doubts about the integrity of the observation wells, it was agreed that further groundwater analyses be performed by using new monitoring wells. Because the extent of the contamination is not well defined, the Task Force believes that assessing measures to mitigate any potential threats caused by the past activities involving hazardous waste disposal should be performed in conjunction with the study using new wells to evaluate existing contamination.

The Task Force also reviewed the potential threats to public health, safety and environmental quality created by the new chemical waste disposal facility. It was agreed that the handling and disposal practices proposed by CWMI were a vast improvement over the previous operation and can represent state-of-the-art management for hazardous wastes if properly documented and followed. It was further stated that CWMI should continue to work closely with the Colorado Department of Health and the Environmental Protection Agency to assure compliance with applicable regulations and to insure that state-of-the-art disposal technologies are used at the Lowry site. The Task Force feels that it is of primary importance for CWMI, CDH, EPA and Tri-County Health Department to specifically define the types of hazardous wastes to be received at Lowry and of these wastes which should continue to be buried there.

Other concerns acknowledged by the Task Force were related to the location of the site and its proximity to populated areas, concerns were expressed about access routes to the site. At a minimum the question of spill or other incident response capability is one that should be addressed by CWMI and coordinated with state, local and regional emergency response authorities.

Submitted by the Lowry Landfill Assessment Task Force.

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APPENDIX A

F I N A L R E P O R T

SCIENTIFIC ASSESSMENT COMMITTEE

LOWRY LANDFILL ASSESSMENT TASK FORCE

F I N A L R E P O R T

SCIENTIFIC ASSESSMENT COMMITTEE

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EXECUTIVE SUMMARY

The report for which this is the executive summary is based in part upon the Scientific Assessment Committee's analysis of two sets of written materials. One was information gathered by the Colorado Department of Health regarding the past operation of the Lowry site, supplemented by evaluations of water samples taken periodically from monitoring wells at or near the site (Attachment 1 to the basic report). The other set of materials was the proposal submitted by Chemical Waste Management, Inc., (CWM) to the City and County of Denver for the future contract operation of the Lowry site by CWM (Attachment 2 to the basic report).

The Committee developed a number of questions regarding the future operation of the site as a result of reviewing the above mentioned materials (these questions appear as Attachment 3 to the basic report). The questions were submitted in writing to CWM. Subsequently the Committee met with CWM representatives and staff members of the Colorado Department of Health to discuss each point raised by the Committee.

The basic report is divided into three sections according to the time frame being examined. These divisions are--The Past; The Present- and Near-Term Future; and the Very Long-Term Future. This summary follows the same format.

I. The Past. The Scientific Assessment Committee is unanimous in its belief that the Lowry site should not be operated in the future as it has been in the past. What is of special concern to the Committee regarding

past management of the site is the indiscriminate acceptance and co-disposal of materials ranging from municipal garbage to highly toxic chemical wastes and low level radioactive wastes.

Organically contaminated samples of shallow groundwater have been collected at the site. Differences of opinion exist among Task Force members on the question of whether the contaminated well samples collected prior to, and during, the Task Force's work, are representative of the actual chemistry of the goundwater at the site. The differences of opinion regarding the proper inferences to be drawn from the analysis of the well samples center around three possible explanations.

1. The contaminants found in the samples may have been introduced by leachate and liquid flow through the surficial deposits in intimate contact with groundwater. This is the case which would occur naturally and predictably based upon the history and practice at the Lowry site for the past decade or more. In this situation the contamination in the samples may be reasonably taken to reflect the condition of the groundwater in the aquifer.

2. The contaminants found in the water samples might have been introduced by contaminated surface runoff being allowed to run down the well bore due to improper grouting of the casing or actual flow into the casing. In this case the level of contamination in proximity to the sample locations may be somewhat greater with respect to the entire aquifer but still representative of the types of contaminants involved. This is due to the extreme likelihood that portions of the contaminated surface water also percolated into the unconsolidated surficial deposits in addition to the amount of contamination introduced down the wells which would then diffuse into the surrounding aquifer.

3. The contaminants found in the samples collected at the site may have been introduced prior to collection by improper preparation of the sample containers or after sampling due to improper storage or handling prior to analysis. In this case some or all of the contaminants and/or their concentrations may not be representative of the groundwater at the site. This type of problem has occurred during previous sampling at the Lowry site and it is beyond the limits of the information available to the Scientific Assessment Committee to guarantee that this is not the case. However, one blank sample and one deep aquifer sample were run along with these tests and these two samples, presumably clean, showed only trace amounts of the contaminants. These trace amounts are most likely due to a sample shadow effect caused by procedural limitations in the laboratory process.

It is the Scientific Assessment Committee's feeling, based upon a subjective determination of the likelihood of the above explanations and the long history of inorganic contamination of the shallow groundwater on the site, that processes 1 and 2 are probably both operating to some degree and that the results of the sampling and analysis for organic contamination are fairly representative of the water quality at the site. It is further assumed, until contradictory evidence is presented, that this organic contamination is the result of previous landfill practices at the site.

II. <u>The Present- and Near-Term Future</u>. Because CWM will operate the Lowry site for the City and County of Denver, the Committee concentrated much of its efforts on evaluating the procedures and technology proposed by CWM for the management of the Lowry site. What CWM proposed may be characterized as the professional management of the site in terms of:

(1)--a sanitary landfill for municipal garbage; (2)--a permanent disposal site for certain hazardous wastes which have been converted into solids (the term hazardous wastes does not include radioactive materials); (3)--a chemical recycling facility where wastes can be reclaimed, treated, or neutralized; and (4)--a temporary storage site for wastes which are not to be handled at the facility, but collected and shipped elsewhere for treatment and final disposition. The "treat or ship" decision is based upon plant capability, not site suitability.

The CWM plan includes the following proposed operations:

Hazardous chemical liquid wastes which will be permanently disposed on-site will be placed into evaporation ponds lined with compacted clay in two layers of five-foot thickness, separated by a one-foot leachate collection system.

Evidence exists that organic solvents may interact with the material in the clay liners of evaporation ponds in a way which has the potential of breaking down the impermeable quality of the clay, thus permitting the escape of liquids from the ponds. CWM has indicated recognition of this problem by stating that every effort will be made to assure that such solvents will be excluded from the Lowry evaporation ponds. CWM has not yet made it clear how the organic solvents will be handled.

Periodically the concentrated waste residues will be dredged from the ponds and mixed with other materials to produce a relatively non-leachable solid. How this will be accomplished is not evident at this time because the exact composition of the sludges which will accumulate in the evaporation ponds cannot be pre-determined with accuracy. Furthermore, the technology for such "fixing" is not well advanced. Similarly, the degree of toxicity of the sludges is unknown. The immobilized waste residue from the evaporation ponds will be permanently buried in clay lined trenches excavated into relatively

unweathered bedrock, and will be sealed from precipitation by covering the trenches with an impermeable clay cap. The area will be graded, re-vegetated, and marked. The disposal trenches for the sludges must meet the permeability requirements of the Federal Resource Conservation and Recovery Act (RCRA).

It should be noted that 55 gallon drums of liquid wastes will be buried at Lowry only until the RCRA standards prohibiting such disposal become effective in November of 1981.

The site will be monitored for the migration of methane gas, and for the migration of chemical wastes by a system of trenches, wells and sampling pipes.

Using contemporary standards for judging the quality of hazardous waste disposal sites, the Scientific Assessment Committee is unanimous in its belief that the CWM proposal represents current state-of-the-art technology and management practices. The operation of the Lowry site by CWM will represent a substantial improvement over the past operation of the site.

As of November 19, 1980, the U.S. Environmental Protection Agency will have the legal responsibility to monitor the operation of the treatment, storage, and disposal facilities for hazardous wastes permitted under authority of the Resource Conservation and Recovery Act (RCRA). Of course the Scientific Assessment Committee cannot guarantee that CWM will in fact live up to its proposal or to the verbal assurances its representatives gave to the Committee in responding to the written questions mentioned on page 1 of this summary. In this context the Committee believes the State of Colorado might do well to study the issue of surety bonding for companies which operate waste disposal sites such as Lowry, and the related matter of perpetual care of such sites after they are closed. Attachment 4

to the basic report is a briefing on these subjects as they have been treated in the State of New York.

Independent of the fact that the Lowry site will be operated in the future by CHM is the problem that environmental contamination exists as a consequence of past disposal practices. Regarding this matter the Scientific Assessment Committee believes that the Colorado Department of Health should (a)--continue its efforts to define the extent of surface and groundwater contamination at the site; and (b)--should ascertain the environmental significance of such contamination. If it is determined that the current contamination represents a significant environmental or public health hazard, then a mechanism must be established to correct the situation and prevent future problems from arising as a result of the past operation of the site.

III. The Very Long-Term Future. As one of the Scientific Assessment Committee members observed, the best possible chemical waste disposal and storage site is always somewhere else. Generally that means it is downstream, in someone else's political district. This comment highlights the the distinction which must be made by those responsible for day-to-day policy between "best possible site," and "best practical site." The term "best possible site" suggests the seeking of absolute safety forever, regardless of economic costs. The term "best practical site" suggests seeking acceptable safety for the foreseeable future, in the context of striking a balance with such other factors as convenience, economic costs, and political realities.

Using the definitions set forth above, the Scientific Assessment Committee believes the Lowry site is not the "best possible site," and a majority of the Committee believe it may well not be the "best practical

site" for highly toxic wastes. However, it should be possible to permanently dispose of some hazardous wastes at the Lowry site. The determination as to which wastes will be disposed at Lowry will need to be made on a waste-by-waste basis by CWM in accord with an agreement to be developed by CWM and concerned state and local governmental entities, and considering any relevant state and federal standards. It should be noted that CWM, in the oral presentation cited on page 1, stated the intention of categorizing wastes received at Lowry into a "Category A" and a "Category B." The distinction between the two categories is based on whether the waste will be treated or disposed at Lowry, or transported elsewhere for ultimate disposition. Residues from treatment processes may fall into either "Category A" or "Category B."

Taking the long view, well beyond the end of this century, the "best possible site" would be one in which the geology present would promise very substantial protection against the eventual failure of human efforts to contain the migration of hazardous wastes. What this means is that when, not if, stored materials eventually migrate out from their burial trenches, there would be natural geologic impediments to further migration toward sources of potable water and toward population centers.

A geologic region having the characteristics of a "best possible site", in association with reasonable economic parameters, is located in eastern Colorado. It is the belt of the Pierre Shale outcrop and shallow sub-crop zone which appears as the darkest area on the map which is attachment 5 to the basic report, a copy of which is appended to this summary. In this region the nearly impermeable Pierre Shale is as much as 5,000 to 6,000 feet thick. Furthermore, the underlying aquifers contain non-potable water. The region contains few streams, water impoundments are unlikely, and the present population is sparse and probably will

remain so. An interstate highway and railroad bisect the region. From a purely technical/geologic perspective the Pierre Shale Formation may represent one of the "best possible sites" in the continental United States, and could logically serve as a multi-state repository for hazardous wastes.

It is likely this fact will be noted by a research group which the Scientific Assessment Committee understands will be formed later this year by the National Academy of Sciences, upon request of the Environmental Protection Agency, to study the possible location of hazardous waste disposal sites nationwide. The EPA office heading up the study appears aware of the interest by states in the proposed study and seemingly wishes to be cooperative. The Committee suggests that the Colorado Department of Health establish contact on this matter with Dr. Stephen Plehn, Washington office of the EPA.

In comparison with the region of the Pierre Shale to the east, the Lowry site has several physical limitations which place into question the ultimate suitability of the site as a location for the permanent disposal of hazardous wastes. One such limitation is that the burial medium is the Denver-Dawson Formation. This formation is characterized by the nearly random presence of sandstone lenses which can act as transport pathways for ground water or other fluids. These lenses represent localized minor aquifers, some of which provide the principal domestic irrigation and stock water supply for the immediate area and for some residents of the area. When containment of wastes fails at some point in the future, the sandstone lenses may provide a potential path for the migration of contaminants into these potable water supplies.

In the relatively short-time frame, the presence of monitoring and collection systems and clay caps over burial trenches should reveal and

retard the scope and migration of toxic substances due to hydraulic gradient. The problem lies in the future interval of several hundreds and thousands of years after operation and post closure activity. After closure of the Lowry site, normal geological and physiographic processes will continue on the site. Containment of toxic and poisonous materials will be only as good as the ability of the natural physical characteristics of the site to resist the ravages of time, climate, and long-term geo-chemical processes.

As a disposal site, Lowry is far better geologically speaking than sites available to most other states in the midwestern, southern and eastern United States. However, taking the "geologic" perspective, i.e., the very long-term view, the majority of the Scientific Assessment Committee believes that the Lowry location should not be a permanent burial site for highly hazardous chemical wastes or highly hazardous waste treatment residues. It should be emphasized that the Scientific Assessment Committee is not aware of any nationally accepted criteria for the determination of which wastes or residues should be classified as highly hazardous. The State of Colorado, in cooperation with CWM and relevant local government entities, should address the classification problem, taking into account site specific parameters. However, under the management of CWM, this site should be capable of being safely operated indefinitely as a sanitary landfill, as a site for the processing and recycling of hazardous chemical wastes, and as a temporary storage facility for wastes to be permanently disposed elsewhere. These functions should be accompanied by increased monitoring of the site to ensure that migration of contaminants from the past operation are observed and, if possible, contained.

The Scientific Assessment Committee is aware that responsible officials must temper purely scientific opinion, which typically takes

the very long run perspective, with political reality, which typically is concerned with the present. In the case of the Lowry site this means the feelings of the Committee need to be balanced off against the fact the site exists, that it will be substantially better managed under CWM's program than previously; and that a "best possible site" may not be speedily opened.

However, in reference to the last point it should be noted opinion exists that the Colorado Land Board could designate land it owns for hazardous waste disposal even if such designation runs counter to the zoning criteria established by the county in which the Colorado Land Board land is found.

In conclusion, the Scientific Assessment Committee wishes the public record to show that the majority of the Committee members believe state leaders should plan for the eventual switch of the hazardous chemical waste burial function from Lowry to a "best possible site," though the processing of highly hazardous wastes at the Lowry site can continue indefinitely. This statement should not be construed as a criticism of CWM, nor of the current state-of-the-art in the management of hazardous chemical wastes. It reflects the truism that in the long-run all engineering fails, that natural physical and chemical processes will eventually be reestablished, and that other sites in eastern Colorado do offer a nearly ideal set of circumstances for the permanent disposal of hazardous wastes.

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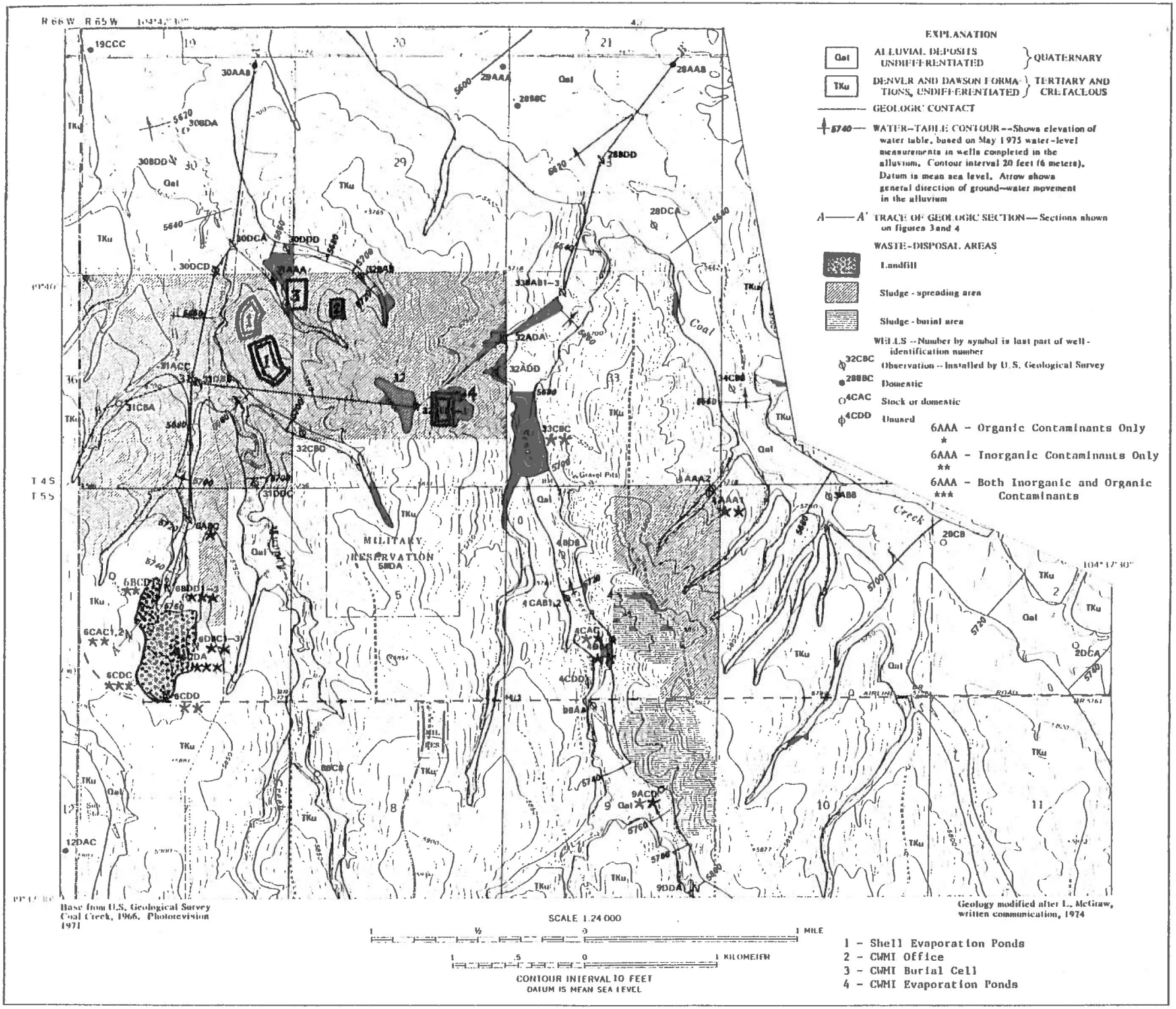
APPENDIX B

Lowry Site Map

and

Inorganic and Organic Data Summaries



MAP SHOWING GEOLOGY, LOCATION OF WELLS AND GEOLOGIC SECTIONS, AND WATER-LEVEL CONTOURS IN ALLUVIUM FOR MAY 1975

COLORADO DEPARTMENT OF HEALTH

Richard D. Lamm
Governor

Frank A. Traylor, M.D.
Executive Director

September 23, 1980

TO: Members of the Lowry Landfill Assessment Task Force

FROM: Christopher Sutton, Radiation and Hazardous Wastes Control Division

SUBJECT: Inorganic sampling data on the monitoring wells at Lowry Landfill

The attached data is a summary of the sample results for 13 parameters on eleven monitoring wells at Lowry Landfill. The wells are located in section 6 on or near the active landfill. The monitoring was performed jointly by the U.S. Geological Survey (USGS) and the Colorado Department of Health.

Each table shows a chronological sequence of sampling results for a single well and gives the National Primary Drinking Water Standards (NPDWS) for comparison. The results indicate:

- No single well has passed all the NPDW Standards listed, although, well #6BDD 1 and 2 fall just above the standards for total dissolved solids, sulfates and ammonia;

- The remainder of the monitoring wells sampled show significant contamination for certain inorganics. The well depths ranged from 37 feet to 244 feet. This would indicate inorganic contamination throughout the alluvial and upper bedrock strata.

There exists some question concerning the installation and integrity of these wells for a comprehensive groundwater monitoring program. The majority of the wells were installed by USGS for alluvial monitoring in 1974. There is no data available on the depths at which the wells are perforated, if grouting was done properly and if any surface disturbances have allowed infiltration of contaminants down the well casings. For these reasons it is difficult to determine the extent of contamination in the upper bedrock since contamination in the alluvium or at the surface may be affecting the sampling results in the deeper wells.

CS:ew

Enclosure

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Lowry Landfill Samples

Well: SC5656BDD1
Depth: 130'

	Drinking Water Standard	3-20-78	8-7-78	1-30-79	6-13-79	11-30-79	CDH* 3-25-80	5-14-80
Ph	> 7.0	7.8	8.1	7.0	8.2	7.9	7.8	7.8
Sp.Cond.		1250	1140	1320 (H)	1400 (H)	1400 (H)	1300	1410
Diss.Solids	<250 mg/L	940	970	940	940	930	950	960
SO_4	<250 mg/L	455	490 (H)	485	460 (H)	470	460	460
Cl	<240 mg.L	110 (H)	120	120 (H)	120	120	120	110
C.O.D.		16	37	14	30	58	0	45
NH_3	<.02 mg/l	0.59	1.04	0.73	0.35	0.3	0.31	0.42
Fe	<.30 mg/L			<0.1	<0.1	<0.1	0.33	K0.1
Mn	< .50 mg/L	0.03.	0.16	.20	0.21	0.21	0.22	0.20
TKN.N		<1.0			<1.0 (H)	<1.0	<1.0	K1.0
NO_2.N	<10.mg/L		0.003	0.008			< .05	
NO_3.N	<10 mg/L			<0.05		<0.05	140	0.05
Na						150		170

single well sampled on that date

Lowry Landfill Sample

Well: SCS656BDD2
Depth: 175'

	Drinking Water STANDARD	3-20-78	8-7-78	1-30-79	6-13-79	11-30-79	5-14-80
Ph	>7.0	7.4	8.2	7.1	8.3	8.1	7.8
Sp. Cond.		1440	365	430	480	500 (H)	460
Diss.Solids	<250 mg/L	1140	280	270	260	250	260
SO_4	<250 mg/L	662	17	20	20(H)	15	20
Cl^4	<250 mg/L	34	60	55	55	57	56
C.O.D.		9	10	36	<30	<30	K30
NH_3.N	<0.02 mg/l	0	0.49	.55	0.20	0.22	0.25
Fe	<0.30 mg/L	1.5	0	0.1	<0.1	<0.1	K0.1
Mn	<0.50 mg/L	2.8	1.8	0.22	0.19	0.19	0.16
TKN.N		1.0	___	___	<1.0	<1.0	K1.0
NO_2.N	<10 mg/L	___	.008	.008	___	___	___
NO_3.N	<10 mg/L	___	___	0.05	___	<0.05	K0.05
Na		___	___	___	___	82	69

Lowry Landfill Samples

Well: SCS656BDD3
Depth: 37'

	Drinking Water Standard	3-20-78	8-7-78	1-30-79	6-13-79	11-30-79	5-14-80
Ph	> 7.0	____	7.4	7.7	7.8	7.4	7.2
Sp; Cond.	____	____	1390	1690 (H)	1800 (H)	1700(H)	1820
Diss.Solids	< 250 mg/L	____	1290	1240	1260	1230	1350
SO_4	< 250 mg/L	____	635(H)	590	630 (H)	610	590
Cl	< 250 mg/L	____	34	35	41	46	48
C.O.D	____	____	____	____	36	50	91
NH3:N	0.02 mg/L	____	2.8	1.6	0.26	0.18	0.41
Fe	0.30 mg/L	____	1.1	0.2	<0.1	0.59	1.9
Mn	<0.50 mg/L	____	3.5	2.6	3.0	3.10	3.0
TKN.N	____	____	____	____	1.0	<1.0	1.2
NO_2.N	< 10 mg/L	____	0.027	____	____	____	____
NO_3.N	< 10 mg/L	____	____	____	____	<0.05	0.05
Na		____	____	____	____	180	220

Lowry Landfill Samples

Well: SC5656BCD1
Depth:

	Drinking Water Standard	3-20-78	8-7-78	1-30-79	6-13-79	11-30-79	5-14-80
Ph	> 7.0	____	7.8	7.8	8.0	7.8	7.5
Sp.Cond.		____	990	1610 (H)	1300 (H)	1200 (H)	1300
Diss.Solids	< 250 mg/L	____	____	1230	830	820	890
SO_4	< 250 mg/l	____	415	750	400 (H)	430	430
Cl	< 250 mg/L	____	80	110 (H)	71	71	75
C.O.D.		____	19	14	< 30	< 30	39
NH_3N	< 0.02 mg/L	____	0.63	0.63	0.35	0.40	0.44
Fe	< 0.30 mg/L	____	____	< 0.1	< 1.0	0.23	K0.1
Mn	< 0.50 mg/L	____	0.33	< 0.05	0.21	0.67	0.60
TKN.N		____	____		< 1.0	< 1.0	K1.0
$NO_2.N$	< 10 mg/L	____	0.003	0.005	____		____
$NO_3.N$	< 10 mg/L	____	0.005	< 0.05	____	< 0.05	0.05
Na		____	____	____	____	150	160

Lowry Landfill Samples

Well: SC5656BCD2
Depth:

	Drinking Water Standard	3-20-78	8-7-78	1-30-79	6-13-79	11-30-79	5-14-80
h	> 7.0	____	10.3	7.6	8.8	8.0	7.3
p.Cond.	____	____	1210	____	2000 (H)	2200 (H)	3400
iss. Solids	< 250 mg/L	____	1110	810	1530	1680	2970
O_4	< 250 mg/L	____	50 (H)	390	840 (H)	1000	1590
l	< 250 mg/L	____	85	71 (H)	130	140	230
.O.D.	____	____	32	20	35	64	45
H_3.N	< 002 mg/L	____	0.69	1.9	0.21	0.25	0.16
e	< 0.30 mg/L	____	____	0.1	<0.1	<0.1	K0.1
n	< 0.50 mg/L	____	____	0.62	0.71	0.52	0.28
KN.N	____	____	____		<1.0(H)	<1.0	K1.0
O_2.N	< 10 mg/L	____	0.50	0.007	____	____	____
O_3.N	< 10 mg/L	____	0.36	<0.05	____	<0.05	0.66
a	____	____	____		____	200	320

Lowry Landfill Samples

Well: SCS656CDA
Depth: 63'

	Drinking Water Standard	3-20-78	8-7-78	1-30-79	6-13-79	11-30-79	5-14-80
ph	>7.0	7.0	6.8	6.1	7.2	6.7	6.6
Sp. Cond.	--	11400	12020	18500(H)	17000(H)	13800 (H)	18800
Diss.Solids	<250 mg/l	8040		12100	9,750	9120	12560
SO_4	<250 mg/L	207	210	235	350 (H)	370	300
Cl	< 250 mg/L	4400 (H)	4810	8300 (H)	5300	5400	6900
C.O.D.							Interferences
NH_3N	<0.002 mg/L		3.2	19	5.4	4.3	5.9
Fe	<0.30 mg/L	27	41	85	16	15	21
Mn	<0.50 mg/L	12	15	22	16	12	19
TKN.N		1.0			6.6 (H)	5.6	6.9
NO_2.N	< 10 mg/L		0.008	0.030			
NO_3.N	< 10 mg/L			0.10		0.10	5.9
Na						2250	3100

Lowry Landfill Samples

Well: SC5656CDC
Depth: 150'

	Drinking Water Standard	3-20-78	8-7-78	1-30-79	6-13-79	11-30-79	5-14-80
pH	> 7.0	7.3	7.0	7.5	7.4	7.1	7.0
Sp.Cond.		2390	3080	1830	3600 (H)	4000 (H)	4360
Diss.Solids	<250 mg/L	1980	___	1450	2890	3380	3560
SO_4	<250 mg/L	976	1410	750	1340 (H)	1680	1690
Cl	<250 mg/L	160 (H)	410	80	420	100	450
C.O.D.		7	15	5	39	58	K30
NH_3.N	<0.02 mg/L	___	___	0.44	0.20	0.28	0.12
Fe	<0.30 mg/L	___	___	0.1	<0.1	0.03	K0.1
Mn	<0.50 mg/L	0.07	0.14	0.38	0.21	<0.05	0.11
TKN.N		<1.0	___	___	1.8	<1.0	K1.0
NO_2.N	<10 mg/L	___	0.007	0.005	___	___	___
NO_3.N	<10 mg/L	___	3.2	0.80	___	8.1	7.2
Na		___	___	___	___	260	330

Lowry Landfill Samples

Well: SC5656CDD
Depth: 53'

	Drinking Water Standard	3-20-78	8-7-78	1-30-79	6-13-79	11-30-79	5-14-80
Ph	> 7.0	6.9	6.8	7.6	7.3		6.8
Sp.Cond.		2800	2070	2770	3500(H)	2200 (H)	2870
Diss.Solids	< 250 mg/L	2650		2240	3010	1810	2260
SO_4	< 250 mg/L	1410	1025	1250	1330 (H)	1050	1130
Cl	< 250 mg/L	200	133	110	290	93	140
C.O.D.		8	35	19	52	< 30	56
NH_3.N	< 0.02 mg/L	0.25	1.1	1.0	0.19	< 0.1	0.11
Fe	< 0.30 mg/L			0.1	< 0.1	< 0.1	K0.1
Mn	< 0.50 mg/L	1.1	1.4	1.5	1.3	0.48	1.2
TKN.N		1.0			1.2 (H)	< 1.0	K1.0
NO_2.N	< 10 mg/L		0.38	.079			
NO_3.N	< 10 mg/L		9.6	11.0		< 0.05	15.0
Na							210

Lowry Landfill

Well: SC5656DBC1
Depth: 80'

	Drinking Water Standard	3-20-78	8-7-78	1-30-78	6-13-79	11-30-79	5-14-80
Ph	>7.0	8.0	8.2	7.5	8.0		7.8
Sp. Cond.		2220	2080	2320	2500	2400 (H)	2700
Diss.Solids	<250 mg/L	1910		1850	1920	1910	2030
SO_4	<250 mg/L	1080	990	1095	1090	1065	1130
Cl	<250 mg/L	110	145	110	97	180	130
C.O.D.		11	8	5	<30	180	64
NH_3.N	<0.02 mg/L	0.69	0.59	0.62	0.45	0.22	0.44
Fe	<0.30 mg/L	0.13	0.19	0.3	0.2	0.18	K0.1
Mn	<0.50 mg/L	0.23	0.28	0.33	0.35	0.33	0.29
TKN.N		<1.0			<1.0	<1.0	K1.0
NO_2.N	<10 mg/L	---	0.004	0.015	---	---	---
NO_3.N	<10 mg/L	---	0.005	0.22	---	0.9	0.41
Na			---	---	---	350	350

Lowry Landfill

Well: SC56560BC2
Depth: 177'

	Drinking Water Standard	3-20-78	8-7-78	1-30-79	6-13-79	11-30-79	5-14-80
Ph	> 7.0	11.3	10.8	7.7	10.3		10.3
Sp.Cond.		2430	1970	2210	2400	2200 (H)	2540
Diss.Solids	< 250 mg/L	2040		1800	1890	1810	1900
SO_4	< 250 mg/L	1170	1160	1165	1140(H)	1050	1140
Cl	< 250 mg/L	110	90	91	92	95	93
C.O.D.		11	12	30	33	<30	50
NH_3.N	< 0.02 mg/L		0.38	0.83	0.26	0.28	0.39
Fe	< 0.30 mg/L			0.1	<0.1	<0.1	K0.1
Mn	< 0.50 mg/L			0.05	<0.05	<0.05	K0.05
TKN.N		1.0			<1.0H	<1.0	K1.0
NO_2.N	< 10 mg/L		0.002	0.004			
NO_3.N	< 10 mg/L		0.034	0.05		<0.05	K0.05
Na						325	310

Lowry Landfill Samples

Well: SC5656DBC3
Depth: 244'

	Drinking Water Standard	3-20-78	8-7-78	1-30-79	6-13-79	11-30-79	5-14-80
Ph	> 7.0	7.9	8.0	6.7	8.0		7.7
Sp.Cond.		2130	1830	2210	2400 (H)	2200 (H)	2590
Diss.Solids	< 250 mg/L	1980		1740	1840	1810	1850
SO_4	< 250 mg/L	1180	1060	1085	1060	1050	1050
Cl	< 250 mg/L	100	90	93	90	93	93
C.O.D.		7	5	10	30	<30	K30
NH_3.N	< 0.02 mg/L	0.25	0.64	0.56	0.47	0.33	0.36
Fe^3	< 0.30 mg/L			0.01	<0.1	<0.1	K0.1
Mn	< 0.50 mg/L		0.42	0.08	0.51	0.48	0.47
TKN.N		1.0			<1.0 (H)	<1.0	K1.0
NO_2.N	<10 mg/L		0.002	0.011			
NO_3.N	<10 mg/L		0.097	0.05		<0.05	K0.05
Na^3						300	310

COLORADO DEPARTMENT OF HEALTH
Division or Section of Radiation and Hazardous Wastes Control

INTER-OFFICE COMMUNICATION

TO : Al Hazle, Jim Martin

DATE : September 2, 1980

FROM: Chris Sutton

SUBJECT: Monitoring Well Data rom Lowry Landfill Samples taker 6/25-27/8[illegible]

Wells showing contamination with organic chemicals; comparing EPA and CDH data (See attached map for well locations)

Well #	Compound	CDH result(ug/l)	EPA result(ug
6CDA (HO133) Depth of well 63 ft.	methylene chloride	20	24
	trichloroethylene	15	13
	1,2-dichloroethane	ND*	14
	1,1-dichloroethane	ND	32
	chloroethane	ND	11
	benzene	ND	40
6CDC (HO136) Depth of well 150 ft.	methylene chloride	15	<10
	trichloroethane	1720	941
	trichloroethylene	238	117
	tetrachloroethylene	1280	571
	benzene	21	50
	toluene	NQ**	ND
	dichlorodifluoromethane	NQ	38
	trichlorofluoromethane	NQ	<10
	1,2-dichloroethane	Q	41
	1,1-dichloroethane	NQ	11
	1,1-dichloroethylene	NQ	44
6ABC (HO137) Depth of well 25 ft.	methylene chloride	ND	<10
	trichloroethane	266	313
	trichloroethylene	9	<10
	tetrachloroethylene	24	22
	benzene	7	<10
	1,1-dichloroethane	NQ	26
	1,1-dichloroethylene	NQ	13
	1,2-dichloropropane	ND	50
	pentachlorophenol	ND	14
6BDD3 (HO131) Depth of well 37 ft.	methylene chloride	ND	51
	dis(2-ethylhexyl) phthalate	ND	45
	benzene	ND	<10
	1,2-dichloroethane	ND	68

* ND None detected (less than 5 ug/l)
** NQ detected by 6 CMS but not quantitated

7

Signature

AD BUS-29 (10-29-100)

The remainder of the well samples taken show no detectable quantities of organic compounds.

The EPA results were obtained from two separate laboratories, West Coast Technical Service, Inc. (WCTS) and California Analytical Laboratories, Inc. (CAL).

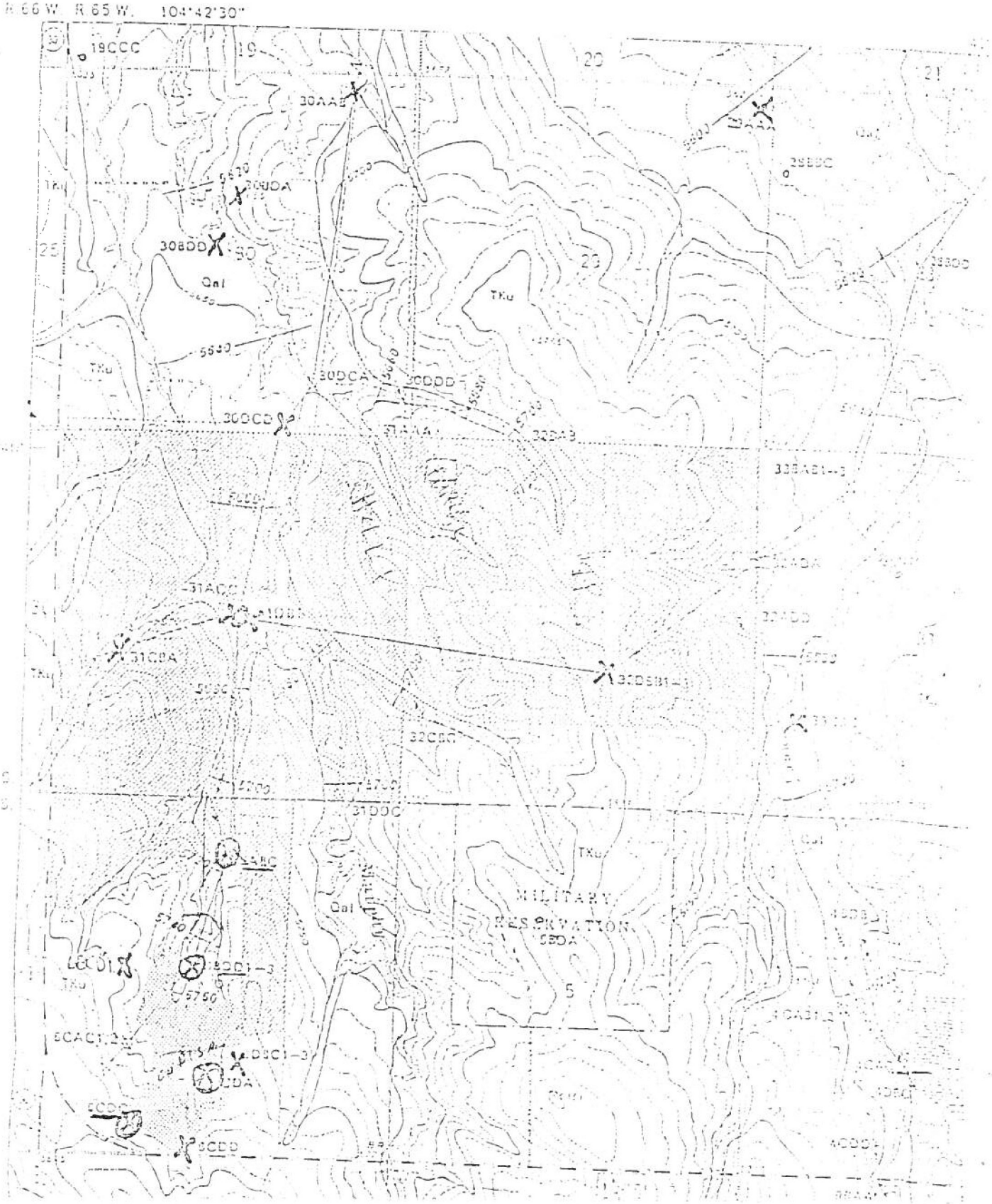
The results from WCTS all show low to trace concentrations of methylene chloride and Bis (2-ethylhexyl) phthalate. Many of the results from CAL also show methylene chloride and Bis (2-ethylhexyl) phthalate, along with several other compounds in trace amounts.

These compounds were shown in the method blanks and in the background sample, Well #12 DAC. Therefore, the data should be discounted as due to either sampling or analytical contamination.

(5) - Monitoring wells sampled showing some organic compound contamination.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Prepared in cooperation wi
METROPOLITAN DENVER SEWAGE DI
AND THE COLORADO GEOLOGIC



LABORATORY REPORT

Hazardous Materials Laboratory
Division of Laboratories
COLORADO DEPARTMENT OF HEALTH

July 24, 1980

To: Ron Marty

From: C. E. Lott, Jr.

SUBJECT: Priority Pollutant Analysis of Lowry Samples

On June 27, 1980, a series of 22 water samples were received for priority pollutant analysis. As a result of the apparent high interest in the analytical results, I have prepared the attached initial report. The analytical work is not yet complete but the results thus far obtained indicate at least one serious difference with the results obtained by the EPA samples collected in March, 1980. The EPA reports significant levels of methylene chloride in all their samples. As you will note, I found methylene chloride at levels greater than 1 ppb in only two samples. Further, 1,1,1-trichloroethane, trichloroethylene, and tetrachloroethylene were found to be, at this stage of the work, the primary contaminants when contaminants are found. Additional unknown volatile compounds were noted in a number of the samples. Identification attempts will be made on these unknowns.

The analytical technique utilized in this study is the GC/MS coupled with the purge and trap concentration approach. Identification of the extractable organics will continue. A final report is anticipated for completion on August 5, 1980.

C. E. Lott, Jr.

Volatile Organics (µg/l)

Sample #	Methylene Chloride	Chloroform	Trichloro ethane	Trichloro ethylene	Tetrachloro ethylene
121 31D8B	N.D.*	N.D.*	N.D.*	N.D.*	N.D.*
122 31ACC	"	"	"	"	"
123 30DCD	"	"	"	"	"
124 30D8B	"	"	"	"	"
125 30BDA	"	"	"	"	"
126 31AAA	"	"	"	"	"
130 6BDD2	"	"	"	"	"
131 6BDD3	"	"	"	"	"
132 12DAC	"	"	"	"	"
133 6CDA	20	"	"	15	"
134 6D8C	N.D.*	"	"	N.D.*	"
135 6CDD1	"	"	"	"	"
136 6CDC	15	"	1720	238	[illegible]
137 6A8C	N.D.*	"	266	9	24
138 6BCD1	"	"	N.D.*	N.D.*	N.D.*
139 31CBA	"	"	"	"	"
140 30AAB	"	"	"	"	"
141 29AAA	"	"	"	"	"
142 33CBC	"	"	"	"	"
143 32D8B	"	"	"	"	"
6 CDC **			1440	137	[illegible]
6 CDA **				8	

* All values less than 5 ppb indicated by (N.D.) None Detected. All samples analyzed.

** These samples submitted on a later date.

COLORADO DEPARTMENT OF HEALTH

Richard D. Lamm
Governor

Frank A. Traylor, M.D.
Executive Director

LABORATORY REPORT

Hazardous Materials Laboratory
Division of Laboratories
COLORADO DEPARTMENT OF HEALTH
August 22, 1980

To: Ron Marty

From: C. E. Lott, Jr.

Subject: Priority Pollutant Analysis of Lowry Samples

On July 24, 1980, I reported to you the initial analytical results obtained on the levels of several organic compounds in a series of 22 water samples from Lowry. As you are aware the analytical work has continued since that date in spite of instrument difficulties and repeated power failures.

Additional quantitative determinations were made on the samples for several volatile organic compounds including benzene. Benzene levels, the only compound matching the standards, is reported in Table 1 for those samples in which it was found.

TABLE 1

Benzene Levels (ug/l)

Sample	Benzene
136	31
137	7
6CDC	63
6CDA	None Detected

A series of the samples were examined by GC/MS for the presence "EPA-(Base/Neutrals)." These compounds were not quantitated due to both a lack of standards and a time construction. Sample 136 was found to contain the following list of compounds in addition to those already reported:

- Dichlorodifluoromethane
- Trichlorofluoromethane
- Dichloroethylene (two isomers)
- Dichloroethane (two isomers)
- Phthalate Esters (7 cmpds)
- Toluene
- Naphthalene
- Dimethyl Naphthalenes
- C_2 substituted benzenes
- Methyl Styrene
- C_3 substituted benzenes
- C_4 substituted benzenes

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A total of 37 compounds were separated which I am sure is not complete. Many of the compounds remain to be identified. Samples 6CDC, 6CDA and 137 show similar profiles at widely varying levels relative to 136. Samples 134 and and 135 did not show the presence of these compounds.

C. E. Lott, Jr.

APPENDIX C

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