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State Abbreviation only

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MEMORANDUM FOR Chief, National Guard Bureau, ATTN: NGB-ILE-EPR,  
Building E-4430, Aberdeen Proving Ground, MD 21010-5420

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Field Advance under 3<sup>rd</sup> letter

SUBJECT: Geohydrologic Study No. 38-EH-1625-99, Delaware Army National Guard, Dagsboro  
Armory/OMS 5, Dagsboro, Delaware, 19-23 April 1999.

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Tab

1. Four copies of draft report with Executive Summary are enclosed for your review.
2. This program will await consolidated Army National Guard comments from your office. Please submit these comments and any additional concerns to Ms. Mary Grez, Project Manager, at DSN 584-8549.

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FOR THE COMMANDER:

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Encl

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JOHN W. BAUER, P.G.  
Program Manager  
Ground Water and Solid Waste

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HQDA(DAIM-ED)  
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CDR, MEDCOM, ATTN: MCHO-CL-W  
CDR, FT JACKSON  
CDR, CERL, ATTN: CECER-ECA  
CDR, SOUTHEAST RMC  
CDR, DDEAMC, ATTN: PVNTMED SVC  
CDR, FT JACKSON, ATTN: PVNTMED SVC (2 cy)  
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GEOHYDROLOGIC STUDY NO. 38-EH-1625-99  
DELAWARE ARMY NATIONAL GUARD  
DAGSBORO ARMORY/OMS 5  
DAGSBORO, DELAWARE  
19-23 APRIL 1999

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EXECUTIVE SUMMARY  
GEOHYDROLOGIC STUDY NO. 38-EH-1625-99  
DELAWARE ARMY NATIONAL GUARD  
DAGSBORO ARMORY/OMS 5  
DAGSBORO DELAWARE  
19-23 APRIL 1999

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1. PURPOSE. The purpose of this study at the former Delaware Army National Guard Armory and OMS 5 at Dagsboro, Delaware was to determine if several potential source areas resulted in soil or ground-water contamination at levels that present a threat to human health or the environment. The potential source areas identified during a previous Site Assessment Survey (SAS) are briefly described in Table EXSUM and their locations are shown in Figure EXSUM.

TABLE EXSUM. POTENTIAL SOURCE AREAS, DAGSBORO ARMORY/OMS 5.

Potential Source Area	Potential Contaminant(s)	Environmental Media of Concern
A - Old Vehicle Wash Area Cesspool	Washwater and wastes containing petroleum, oil, and lubricants (POLs), solvents, antifreeze, or other materials	Potable ground water in the shallow unconfined aquifer
B - Old Septic Field	Used for disposal of wastes potentially containing POLs, solvents, antifreeze, or other materials	Potable ground water in the shallow unconfined aquifer
C - Stained and Bare Soils	Surface soils stained with POLs or solvents near the hazardous materials storage shed and the aluminum building, and bare soils denuded by over-use of herbicides along fencelines	Potable ground water in the shallow unconfined aquifer and surface soils that may come into human contact
D - Waste Battery Electrolyte Disposal Pit	Waste battery electrolyte disposed of into the pit	Potable ground water in the shallow unconfined aquifer and shallow soils that may come into human contact

2. CONCLUSIONS.

Tab

a. None of the potential source areas present a threat to human health or the environment via the surface water, air, or ground-water pathways.

Tab

b. Analytical results indicate that Potential Source Area D (PSA-D) does not present a threat to human health or the environment via the soil pathway.

c. Analytical results indicate that stained and bare soils near the aluminum shed do not present a threat to human health or the environment via the soil pathway.

d. Levels of the herbicide Dicamba present in surface soils along fencelines do not exceed U.S. Environmental Protection Agency Region III risk-based concentrations for industrial use. However, soil ingestion levels for residential use are exceeded in most of the samples. Three residences are within 200 feet of fencelines at the Dagsboro Armory/OMS 5.

3. RECOMMENDATION. Discontinue excessive herbicide application along fencelines at the Dagsboro Armory/OMS 5 to allow natural degradation of Dicamba to take place. After 6 months, collect surface soil samples for herbicides analysis to confirm that levels of Dicamba are below residential risk-based concentrations.

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DELAWARE ARMY NATIONAL GUARD  
DAGSBORO ARMORY/OMS 5  
DAGSBORO, DELAWARE  
19-23 APRIL 1999

1. REFERENCES.

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- a. Site Assessment Survey No. 38-EH-7892-98, Delaware Army National Guard, Dagsboro Armory/OMS 5, Dagsboro, Delaware, 6-10 April 1998.
- b. Sampling Plan, Geohydrologic Study No. 38-EH-1625-99, Delaware Army National Guard, Dagsboro Armory/OMS 5, Dagsboro, Delaware, 19-30 April 1999.

2. AUTHORITY. CHPPM Form 250-R, NGB, 25 January 1999.

3. PURPOSE. The purpose of this study at the former Delaware Army National Guard Armory and OMS 5 at Dagsboro, Delaware was to determine if several potential source areas resulted in soil or ground-water contamination at levels that present a threat to human health or the environment.

4. GENERAL.

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a. Personnel Contacted.

(1) MSG Waters, State Environmental Specialist, Facilities Management, Delaware Army National Guard.

(2) Mr. Baker, Dagsboro OMS 5, Delaware Army National Guard.

b. USACHPPM Personnel Conducting the Study.

(1) Ms. Mary Grez, Geohydrologist and Project Manager.

(2) Mr. Rocky Hoover, Engineering Technician and Drill Rig Operator.

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Geohydrologic Study No. 38-EH-1625-99, 19-23 Apr 99

(3) Mr. Alex Franckewitz, Engineering Technician and Drill Rig Operator's Assistant.

c. Investigative Background. Four potential source areas were identified during a Site Assessment Survey (SAS) conducted at the site by USACHPPM in 1998 (reference 1a). The SAS cited recommendations for further study at each potential source area. The Delaware Army National Guard requested that USACHPPM implement the SAS recommendations by conducting this geohydrologic study to detect potential contamination from past activities. This study was accomplished using the U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site Inspection Guidance Document.

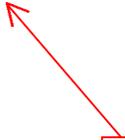
## 5. SITE DESCRIPTION AND OPERATIONAL HISTORY.

a. Location and Description. The Dagsboro Armory/OMS 5 is located southeast of the town of Dagsboro, in Sussex County, Delaware (Figure 1). The site, at the time of the original SAS and during this study, consisted of approximately 12.5 level acres with two permanent buildings and several outbuildings as shown in Figure 2. Surrounding areas are primarily farmland with low-density housing along main roads. The property to the north of the Armory/OMS 5 site has been used as a salvage yard. The three nearest houses, shown in Figure 1, are within 200 feet of the southeast and southwest property boundaries. Site drainage is generally toward the northeast and east, though during the SAS there were many puddles throughout the property where rainwater infiltrated directly to the subsurface instead of running off. An enclosed, swampy depression northeast of the property fence receives runoff from part of the site. Runoff toward the east flows into an indistinct low grassy area along the east-northeast site boundary. Surrounding topography does not allow overland flow of runoff away from the property; no distinct channels are present to direct runoff toward surface water features. The site is at least 3/4 mile away from any well-defined surface water feature, so it is evident that site runoff infiltrates into the ground surface.

b. History and Use. The property was privately owned and used as farmland prior to its sale to the State of Delaware in 1949. The vehicle maintenance shop portion of the Armory/OMS 5 building was constructed in 1949, and the Armory portion of the building was added in 1958. The OMS 5 used the original building from 1949 to 1989. The shop area in the building was used for unit storage from about 1989 to 1998. The original Armory/OMS 5 were used for weekend drill from 1950 to 1995; weekend drill for trainees formerly assigned to the Dagsboro Armory is now conducted at the Laurel Armory. The new OMS 5 was constructed in 1989. There are four full-time employees at the OMS 5 and up to 200 trainees during drill weekends. Demolition and removal of the old Armory/OMS 5 building was underway during this study. Plans included complete removal of outbuildings such as

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Figure 1.



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the aluminum shed and hazardous waste shed, demolition of the existing Armory/OMS 5 building, removal of the existing paved surfaces surrounding the building, re-grading and paving of most of the compound, and construction of the new building.

c. Physiography and Vegetation. The State of Delaware is mostly situated within the Coastal Plain physiographic province, which is a generally flat, seaward-sloping lowland . The Dagsboro Armory/OMS 5 topography is flat to gently rolling, with no distinct direction of slope. No native vegetation is present in the vicinity of the site; the property itself is primarily covered with grass turf, gravel, or paved parking areas, and surrounding areas are primarily farmland. A small wooded area stands along the northeast fenceline of the property. The elevation at the site is about 25 feet above mean sea level. The average temperature ranges from 37° F in January to 77° F in July, and the average annual precipitation is about 42 inches, with an average of about 12 inches of snowfall per year.

d. Soils. The Evesboro loamy sand, which comprises soils over the entire property, is a very deep, excessively drained, sandy soil that forms on uplands. Soil borings conducted at the site prior to this study indicated that the top 1 foot of soil is a brown sandy loam grading to a yellow-brown fine to coarse sand with some silt and coarsening with depth. From 6.0 to 8.0 feet, the soil was a white medium sand with traces of silt.

e. Geology. The near-surface geology of the Dagsboro area is summarized in Table 1. Swamp, alluvial, bog, and marsh deposits of recent and Pleistocene age are present in some areas, but the primary surficial deposits are of the Omar Formation.

f. Hydrogeology. A detailed description of the hydrogeology of the Dagsboro vicinity is provided in the SAS report (reference 1a). The unconfined Columbia aquifer is expected to be about 115 feet thick near Dagsboro. The aquifer is recharged by precipitation and discharges locally to streams and wells. Shallow ground water in the vicinity of the Armory/OMS 5 may discharge to Pepper Creek, north of the site. The unconfined aquifer yields most of the fresh water used in the area and is highly susceptible to contamination by surface and near-surface sources. The unconfined water level is expected to be between 1-20 feet below the ground surface, with annual fluctuations of up to 10 feet.

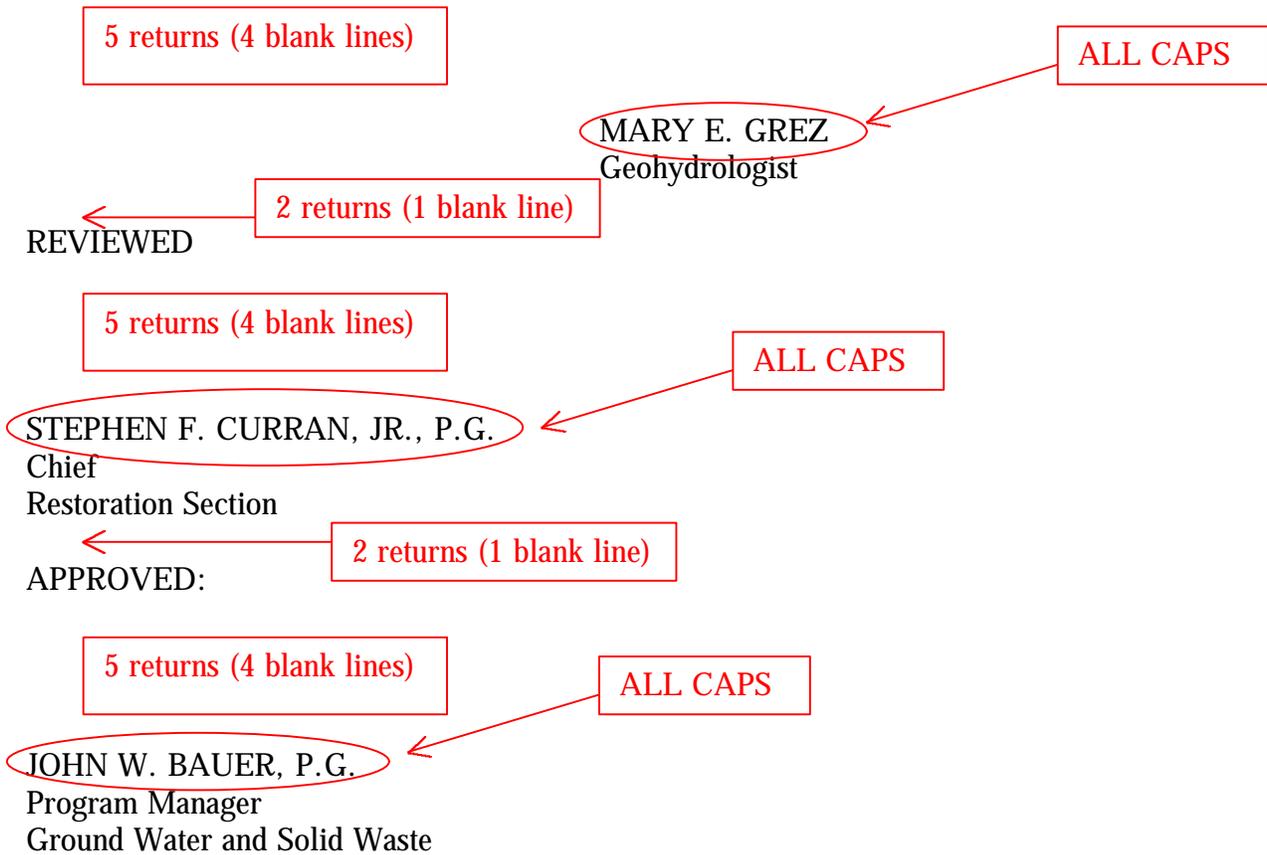
6. **POTENTIAL SOURCE AREAS.** The investigation focused on four potential source areas (PSA) identified in the SAS (reference 1a). All of the PSA, with the exception of portions of PSA-C (bare soils along fencelines) are located within the south-southwest half of the installation. The potential source areas are described in the following paragraphs, and their locations are shown in Figure 3.

TABLE 1. GEOLOGY IN THE VICINITY OF THE DAGSBORO ARMORY/OMS 5, DELAWARE (From reference 1a).

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Age	Group	Unit	Description	Hydrology
Pleistocene	Columbia	Omar Formation	fine to coarse white to brown sands locally containing layers of silt, clay, and gravel	unconfined aquifer
		Beaverdam Formation		
Miocene	Chesapeake	Bethany Formation	gray to white fine to coarse sand with some fine gravel and local silt and clay layers and a maximum thickness of 90 feet (Pocomoke aquifer); fine to coarse light-gray sand with occasional fine gravel with a maximum thickness of 120 feet (Ocean City aquifer)	Pocomoke/Ocean City aquifers
		Manokin Formation	up to 150 feet thick; fine and medium gray sand with occasional layers of coarse sand to fine gravel, layers of gray clay increasing in number and thickness with depth	Manokin aquifer/basal confining unit
		St Mary's Formation	up to 180 feet of clay with minor layers of silt	confining unit
		Choptank Formation	generally not penetrated in coastal Sussex County	Choptank aquifer

10. RECOMMENDATION. Discontinue excessive herbicide application along fencelines at the Dagsboro Armory/OMS 5 to allow natural degradation of Dicamba to take place. After 6 months, collect surface soil samples for herbicides analysis to confirm that levels of Dicamba are below residential risk-based concentrations.



APPENDIX A

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FIELD METHODS

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1. DRILLING EQUIPMENT AND METHODS. Each borehole was drilled to completion using a 6-inch outside diameter, hollow-stem auger. Each borehole was completed at about 19 feet below the ground surface, approximately 8 to 10 feet below the first encounter of ground water within the shallow sand aquifer. No fluids were introduced during drilling. Boreholes were logged by inspecting the return cuttings, and the project geohydrologist recorded relevant information on well-logging forms during drilling. Borehole logging forms are provided in Appendix B.

2. EQUIPMENT CLEANING METHODS. Auger flights and cutting heads were cleaned with a high pressure hose using potable water from the installation prior to use at each borehole. Non-dedicated sampling equipment was cleaned in a solution of distilled water and Alconox® and rinsed with distilled water prior to use at each borehole.

3. INVESTIGATIVE DERIVED WASTES. Soil cuttings were disposed of at each borehole site, as no odors, staining, or other physical evidence of contamination was present during drilling. Equipment wash water was disposed of at the oil/water separator, and purge water was disposed of on-site.

4. SOIL SAMPLE COLLECTION. At selected boreholes, a split spoon sampler was pushed in advance of the auger to collect soil samples for chemical analysis. Surface and shallow (< 2 foot) soil samples were collected using dedicated EnCore sampling system vials for VOC analysis, and stainless steel scoops and a cleaned, rinsed shovel was used to collect soil samples for other analyses. Sampling personnel used clean, disposable, latex gloves that were changed after each sample was collected. Samples were placed in clean containers provided by the USACHPPM laboratory and preserved as specified in Table A.

5. GROUND-WATER SAMPLING. Permanent ground-water monitoring wells were not installed as part of this project. Ground-water samples were collected using temporary monitoring wells as described in the following paragraphs. Temporary wells were abandoned in accordance with State of Delaware requirements after development, purging, sampling, and collection of samples and field data.

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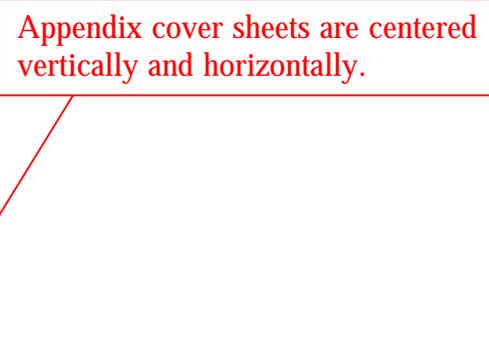
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APPENDIX E

GROUND-WATER MONITORING WELL SUMMARY

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U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE  
GROUND-WATER MONITORING WELL SUMMARY

<b>WELL NUMBER</b>	<b>DA-1</b>	<b>DA-2</b>	<b>DA-3</b>	<b>DA-4</b>	<b>DA-5</b>	<b>DA-6</b>
Height of well casing above ground level	3	3.2	3	3.3	3.2	3.2
Total depth of well below ground level	17	16.8	17	16.7	16.8	16.8
Depth to top of well screen below ground level	7	6.8	7	6.7	6.7	6.8
Well screen length	10	10	10	10	10	10
Well screen slot size	0.010"	0.010"	0.010"	0.010"	0.010"	0.010"
Well diameter	2"	2"	2"	2"	2"	2"
Monitoring well casing material	PVC	PVC	PVC	PVC	PVC	PVC
Monitoring well screen material	PVC	PVC	PVC	PVC	PVC	PVC
Grout thickness below ground level	3.8	2.8	1.4	3.7	2.0	3.4
Depth to top of bentonite seal below ground level	3.8	2.8	1.4	3.7	2.0	3.4
Bentonite seal thickness	1.6	1.5	3.2	1	2.8	1.4
Depth to top of sand pack from ground surface	5.4	4.3	4.6	4.7	4.8	4.8
Elevation – top of well casing	28.82	21.37	25.49	21.44	27.82	22.60
Elevation at ground level	25.82	18.17	22.49	18.14	24.62	19.40
Depth to static water level:						
Date measured	04/22/99	04/22/99	04/22/99	04/22/99	04/22/99	04/22/99
From top of well casing	14.00	12.34	11.55	12.01	13.45	13.10
From ground level	11.00	9.14	8.55	8.71	10.25	9.90
Ground-water elevation	14.82	9.03	13.94	9.43	14.37	9.50
Comments:	All measurements are in feet unless otherwise stated					