029001

Date Out EAB: June 16, 1987

To: R. Forrest
Product Manager 21
Registration Division (TS-767)

From: Matthew N. Lorber, Acting Program Manager ML
Ground-Water Program
Exposure Assessment Branch
Hazard Evaluation Division (TS-769)

Attached please find the environmental fate review of:

Reg./File No.: ______

Chemical: 1,3-D

______

Type Product: ______

Product Name: Telone II

Company Name: DOW Chemical Co.

Submission Purpose: Small-scale retrospective groundwater monitoring study protocol

ACTION CODE: 352

Date In: 5/01/87

EAB # 70575

Date Completed: JUN 16 1987

TAIS (level II)	Days
	3.00

Deferrals To:

______ Ecological Effects Branch

______ Residue Chemistry Branch

______ Toxicology Branch

Monitoring study requested by EAB: /X/

Monitoring study voluntarily conducted by registrant: / /

REGISTRATION DIVISION DATA REVIEW RECORD

Confidential Business Information — Does Not Contain National Security Information (E.O. 12065)

1. CHEMICAL NAME: Telone

2. IDENTIFYING NUMBER	3. ACTION CODE	4. ACCESSION NUMBER	TO BE COMPLETED BY PM
464-511	352	—	5. RECORD NUMBER 195534
			6. REFERENCE NUMBER 2
			7. DATE RECEIVED (EPA) 5-1-87
			8. STATUTORY DUE DATE
			9. PRODUCT MANAGER (PM) FORREST
			10. PM TEAM NUMBER 21 - 557-7900 3783

14. CHECK IF APPLICABLE

- ☐ Public Health/Quarantine
- ☐ Minor Use
- ☐ Substitute Chemical
- ☐ Part of IPM
- ☐ Seasonal Concern
- ☐ Review Requires Less Than 4 Hours

TO BE COMPLETED BY PCB

11. DATE SENT TO HED/TSS

12. PRIORITY NUMBER

13. PROJECTED RETURN DATE

15. INSTRUCTIONS TO REVIEWER

A. HED
- ☐ Total Assessment - 3(c)(5)
- ☐ Incremental Risk Assessment - 3(c)(7) and/or E.L. Johnson memo of May 12, 1977.

C. ☐ BFSD
D. ☐ TSS/RD
E. ☐ Other

B. SPRD (Send Copy of Form to SPRD PM)
- ☐ Chemical Undergoing Active RPAR Review
- ☐ Chemical Undergoing Active Registration Standards Review

F. INSTRUCTIONS

Protocol for Groundwater Study

Catherine

16. RELATED ACTIONS

Data Delivered

17. 3(c)(1)(D)
- ☐ Use Any or All Available Information
- ☐ Use Only Attached Data
- ☐ Use Only the Attached Data for Formulation and Any or All Available Information on the Technical or Manufacturing Chemical.

18. REVIEWS SENT TO
- ☐ TB
- ☐ EEB
- ☐ EF
- ☐ PL
- ☐ RCB
- ☒ EFB
- ☐ CH
- ☐ BFSD

19.	To	TYPE OF REVIEW	Registration	Petition	EUP	SLN	Sec. 18	Inert	MNR. USE	Other
			NUMBER OF ACTIONS							
HED		TOXICOLOGY								
		ECOLOGICAL EFFECTS								
		RESIDUE CHEMISTRY								
	X	ENVIRONMENTAL DATE								1
RD/TSS		CHEMISTRY								
		EFFICACY								
		PRECAUTIONARY LABELING								
BFSD		ECONOMIC ANALYSIS								

20. ☐ Label Submitted with Application Attached

21. ☐ Confidential Statement of Formula

22. ☐ Representative Labels Showing Accepted Uses Attached

23. Date Returned to RD (to be completed by HED)

24. Include an Original and 4 (four) Copies of This Completed Form for Each Branch Checked for Review.

5/11/87
36171/HEL

REGISTRATION DIVISION DATA REVIEW RECORD

Confidential Business Information — Does Not Contain National Security Information (E.O. 12065)

1. CHEMICAL NAME: Telone

2. IDENTIFYING NUMBER	3. ACTION CODE	4. ACCESSION NUMBER	TO BE COMPLETED BY PM
464-511	352	—	5. RECORD NUMBER: 195534
			6. REFERENCE NUMBER: 2
			7. DATE RECEIVED (EPA): 5-1-87
			8. STATUTORY DUE DATE
			9. PRODUCT MANAGER (PM): FORREST
			10. PM TEAM NUMBER: 21 - 557-1900

14. CHECK IF APPLICABLE

☐ Public Health/Quarantine ☐ Minor Use

☐ Substitute Chemical ☐ Part of IPM

☐ Seasonal Concern ☐ Review Requires Less Than 4 Hours

AH

TO BE COMPLETED BY PCB

11. DATE SENT TO HED/TSS: 5-8-87

12. PRIORITY NUMBER: 43

13. PROJECTED RETURN DATE: 6-8-87

15. INSTRUCTIONS TO REVIEWER

A. HED ☐ Total Assessment - 3(c)(5)

☐ Incremental Risk Assessment - 3(c)(7) and/or E.L. Johnson memo of May 12, 1977.

B. SPRD (Send Copy of Form to SPRD PM)

☐ Chemical Undergoing Active RPAR Review

☐ Chemical Undergoing Active Registration Standards Review

C. ☐ BFSD

D. ☐ TSS/RD

E. ☐ Other

F. INSTRUCTIONS

Protocol for Groundwater Study

Delivered to Catherine 5/8/87

16. RELATED ACTIONS

Data Delivered

17. 3(c)(1)(D)

☐ Use Any or All Available Information ☐ Use Only Attached Data

☐ Use Only the Attached Data for Formulation and Any or All Available Information on the Technical or Manufacturing Chemical.

18. REVIEWS SENT TO

☐ TB ☐ EEB ☐ EF ☐ PL

☐ RCB ☒ EFB ☐ CH ☐ BFSD

19.	To	TYPE OF REVIEW	Registration	Petition	EUP	SLN	Sec. 18	Inert	MNR. USE	Other
			NUMBER OF ACTIONS							
HED		TOXICOLOGY								
HED		ECOLOGICAL EFFECTS								
HED		RESIDUE CHEMISTRY								
HED	X	ENVIRONMENTAL DATE								1
RD/TSS		CHEMISTRY								
RD/TSS		EFFICACY								
RD/TSS		PRECAUTIONARY LABELING								
BFSD		ECONOMIC ANALYSIS								

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3

EPA Form 8570-13 (Rev. 11-81) PREVIOUS EDITIONS ARE OBSOLETE.

1. CHEMICAL:

Common name: 1,3-D, Telone II
Chemical name: 1,3-dichloropropene

Structure:

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H2C—C═CH
 |  |  |
Cl  H  Cl
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2. TEST MATERIAL:

Not applicable.

3. STUDY/ACTION TYPE:

This is a protocol submitted by DOW Chemical Company for the small-scale retrospective ground-water monitoring study. The study will include monitoring for 1,3-dichloropropene and 1,2-dichloropropane (1,2-D) an impurity in the Telone II formulation.

4. STUDY IDENTIFICATION:

Preliminary Description of the Planned Retrospective Ground Water Monitoring Study for Telone II* Soil Fumigant.

April 3, 1987, DOW Chemical Company, Accession number: N/A
Identifying number: 464-511, Record number: 195534

5. REVIEWED BY:

Catherine Eiden
Ground-Water Program Chemist
and
George DeBuchananne
Ground-Water Program Consulting Hdrogeologist
Exposure Assessment Branch

Catherine Eiden
June 16, 1987

George D. DeBuchananne

6. APPROVED BY:

Matthew Lorber
Acting Ground-Water Program Manager
Exposure Assessment Branch

Matthew Lorber 6/16/87

7. CONCLUSIONS:

The protocol has been reviewed; the conclusions will address specific headings in the protocol.

Specific Characteristics of the Site

Usage Data: The protocol includes the pounds of Telone II used per county. This data would be more useful as pounds of Telone II used per county per crop. If data on the pounds of Telone II used per crop are not available, then that crop, which gets the greatest percentage of Telone II use per county should be specified. Also, is this yearly usage, monthly, total?

We need to be able to relate the pounds of Telone II used on a crop type to verify that sites chosen reflect major crop uses. Are we to assume, given the protocol, that potatoes, crucifers, pineapples, tobacco and sugar beets constitute the five major uses of Telone II?

No data are given on the rate of application, depth of injection of Telone II on the crops chosen for study. Because rates of fumigant use relate directly to leaching problems, this information is necessary. At what rate is Telone II applied to the five crop choices? How does this compare to other crop types?

Vulnerability data: Inadequate data were supplied to assess the vulnerability of the sites to leaching. However, neither were specific sites chosen. The sites chosen should include those parameters listed under the heading, Specific Characteristics of the Site. It is indicated that sites will be chosen with "higher potential". We conclude this to mean sites that where several candidate sites exist, the site with the highest leaching potential will be selected. For example, there may be similar or dissimilar sites as to soil type, climate, and irrigation practices. Therefore choose sites that could be considered worst-case, having a high leaching potential versus a low leaching potential. The field chosen should be characterized as 1) typical for the cropping pattern chosen, 2) aquifer materials should be unconsolidated, and 3) depth to the water table aquifer should be shallow, e.g., 0-30 feet.

The hydrogeology of the field must be characterized. In many cases, only semiquantitative analyses are necessary. Some points to consider are:

- soil types in the field above the water table;
- types, depths, and extent of layers of reduced permeability such as clay pans and silt-clay lenses (if any);
- water-table depth below the surface as a function of time; the water table may fluctuate seasonally with rainfall/runoff events and snowmelt;
- type of aquifer (confined, unconfined, artesian);
- geologic materials comprising the aquifer (sand and gravel, glacial till, carbonates, etc.);
- permeability of soil;
- whether the aquifer has recharging or discharging characteristics;
- any man-made activities that may affect the water level of the aquifer such as ground-water pumpage or tile drainage.

Climatological information for the site will be necessary. Precipitation data, air temperature and pan evaporation data, and any use of irrigation water must be carefully recorded. Irrigation and natural recharge is a critical aspect of pesticide leaching.

Frequently Soil Conservation Service Soil Surveys contain this kind of information on a county basis. Another source is the local cooperative agricultural extension agent.

The actual field site selected for all study sites may be at least 4-5 up to 10 acres in size. However, the field site should not be isolated. The field site should be located within a major use area. For example, typically, this would be a 5-10 acre tobacco plot located within or adjacent to a much larger tobacco growing area. Therefore, the site chosen should be a part of a larger area cropped to the specfic crop under study. Isolated research type situations are not a part of the small-scale retrospective study design.

Specific Site Choices

Five regions have been selected as site choices; one crop type has been selected for each region.

Each of the regions selected will be discussed individually.

In California a site will be selected in the San Joaquin/Sacramento Valley grown to crucifers. Nine counties are shown to be high use (> 1000000 pounds Telone II) in the region. One study site in this large of an high use area is not enough. If there are major crop uses other than crucifers in these high use areas they should be included. For example, a use site for a different crop with a different irrigation practice (flood) or a different application rate of Telone II should be included.

In North or South Carolina there are many counties with Telone II usage at 550-500,000 pounds. Again, one site among all these counties is not enough. Tobacco is a major crop in these areas and for Telone II use. A second tobacco site should be selected. The site(s) chosen would reflect different soil conditions, agricultural practices or climate. Flood irrigation practices, if used, should be included.

Is the site in Nebraska to be in the high use county? This would be expected to be a low vulnerability setting. Site information will be necessary at the time of a specific site selection as outlined under the vulnerability heading.

In Oregon, a site for potatoes will be selected. Is this site to be in the high use county? Site information will be necessary at the time of specific site selection as outlined under the vulnerability heading.

In Hawaii, a site will be selected for pineapples. Site information will be necessary at the time of a specific site selection as outlined under the vulnerabiltiy heading.

No sites are listed for Florida or New York. To date these are the two states in which 1,3-D has been found.

The Florida State Department of Epidimeology has reported finding 1,3-D and 1,2-D in an area North of Orange County. This area is noted as having Telone II use at 551-550,000 pounds. Two sites in Florida should be included taken from the following counties: Lake, Hamilton, Seminole, and Jackson. These counties contain some muck soils; these soils should be avoided. Tobacco and peanut farming, are practiced in Jackson and Hamilton counties, respectively. The counties contain some sandy areas, and possibly karstified topography.

A site on potatoes should be selected in New York. Researchers in New York found 1,3-D and 1,2-D downgradient from potatoe fields in Suffolk County. Maps of New York state provided with this protocol do not indicate Telone II use in Suffolk County. Another county should be chosen, perhaps Orange County.

In general five sites, one per five crops chosen are inadequate given the large areas treated with Telone II in several states. For a major crop use like potatoes or tobacco or peanuts more than one site should be included if soils, climates and agricultural practices differ among different growing regions. To reiterate, the following sites will be the minimum required for the small-scale retrospective ground-water monitoring study on Telone II:

Two sites in Florida, one on peanuts in Jackson Co. and one on tobacco in Hamilton Co. are preferred.

Site in New York on potatoes.

Two sites in California on crucifers or a different crop.

Two sites in North and South Carolina for tobacco.

Site in Hawaii on pineapples.

Site in Oregon on potatoes.

Site in Nebraska on sugar beets.

Study Design

The following are points to be considered in study design. They follow from the unpublished guidelines for conducting ground-water monitoring studies.

General Information Regarding Well Placement, Construction and Sampling

Well Siting for Ground-Water Flow Measurement:

The direction of local ground-water flow must be known to properly site and then construct monitoring wells, as previously mentioned. The points discussed here are applicable to the small-scale retrospective and prospective study types.

If the direction of ground-water flow in the water-table aquifer can be determined from existing hydrogeological information on the study site, then the design and placement of the monitoring wells can proceed. If there are no preexisting data for the study area regarding direction of ground-water flow and no preexisting wells, the following approach may be used.

Initially, the surface topography of the field(s) selected should be noted, and the elevations of the four corners of the field(s) established. Shallow ground-water flow can be visualized on a rough, first-cut basis as a subdued replica of the land surface topography. The shallow ground-water flow will generally be from an area of the highest land surface elevation towards an area of lower land surface elevation. This generalization about the slope of the water table can be used to plan the location of a minimum of three monitoring wells that will be used to define more accurately the horizontal direction of shallow ground-water flow.

It is recommended that the initial well (well #1) be located in the upgradient part of the test area as indicated by the rough detrermination of shallow ground-water flow direction, i.e., at the point in the field with the highest land surface elevation. After this first well is drilled, a second and then a third well should be drilled down gradient from it (the first) in such a position as to form an equilateral triangle with sides 100 feet or more in length.

After these wells are developed water level measurements, using the wetted tape method, can be used to establish the direction of ground-water flow more accurately. If a fourth or fifth well is necessary to identify the direction and travel time of a solute plume, this more accurate analysis of horizontal flow can be used to determine the location for such wells. These additional wells should also be located using the equilateral triangle pattern to refine the definition of the direction of flow.

The wells, once established, can be used for monitoring the water-table aquifer. At each well location, a minimum of two wells shouuld be constructed. The first well should be a skimming well with its screen placed so that it intercepts the top 5 feet of the zone of saturation. This places the screen so as to allow for some seasonal fluctuations in the water-table aquifer. The importance of a skimming well is that it intercepts the zone of saturation at the water table. Pesticides are hydrocarbons and are expected to float at or near the water-table surface. It is, therefore, important to set the screen so as to intercept the water table. A second well, at this same location, should be drilled and its screen placed so that it intercepts that portion of the zone of saturation approximately 5 feet below the bottom of the first well screen. This second well will act as a precaution to drastic changes in fluctuations of the water table. Measurements of water from this deeper well may also be used to verify any vertical gradient of a solute in the aquifer. Because a water-table aquifer is unconfined and only gravity forces are acting on the fluids in the formation, movement of the ground water is expected to be downward.

Deeper wells may be considered necessary as the study and sampling continue. If pesticides are found in the water-table aquifer, it will become necessary to drill deeper wells to define the extent of their movement downward to the deeper water sources.

Well Construction:

There are many drilling techniques available for well construction: hollowstem; flight auger; direct circulation rotary drilling; cable tool drilling; reverse circulation rotary drilling; and air rotary drilling. Barcelona, Gibb and Miller (1983) provide a more detailed discussion of each (19).

For the purposes of monitoring the shallow water-table aquifer in a a small-scale retrospective or prospective study, the hollow stem, continuous-flight auger is recommended. The hollow-stem auger is mobile and inexpensive to operate. If necessary, it is capable of drilling up to 150 feet into unconsolidated material. (Practical experience indicates that 100 feet may be successfully drilled.) The rig is equipped with a removable plug that helps in the drilling process, but is inserted inside the hollow stem of the auger and is, therefore, easily removable.

The auger drilling procedure uses no drilling fluids, thereby minimizing contamination problems between the borehole materials and the drilling process (20). Soil core samples can also be obtained during the drilling process by inserting a Shelby Tube or a split spoon (split barrel) sampler inside the hollow stem, lowering the assembly to the bottom of the hole and driving the sampling tube into the undisturbed profile (21). These core samples can be used in the lithologic description of the geologic materials encountered in the well. Once the borehole has been drilled to the desired depth, the plug is removed from inside the hollow-stem and a small-diameter well casing, 1 1/4"-2", (3-5 cm) can be inserted inside the hollow stem. The hollow-stem auger can then be pulled out of the borehole leaving the well casing in place, which can then be easily grouted in.

Cross-contamination of drilled materials and soil samples collected for lithologic identification can be minimized during hollow-stem auger drilling by installing temporary casing as the drilling proceeds, and reversing the drill spin in place. After the first well has been drilled from the soil surface to the desired depth, usually the water table and below, the soil cores from this site may be used for lithologic identification, as mentioned. For any other wells drilled on the same plot, in which a Shelby Tube or split spoon sampler are not used, the first 18" of earth can be removed with a shovel reducing the possibility of soil from these upper zones from contaminating the lower drilling depths. This is desirable for retrospective studies as the first 18" of soil often contains the higher concentrations of pesticides.

In most cases the hollow-stem auger will produce a sufficiently deep borehole for a small-scale ground-water study designed to detect the leaching of pesticides from normal agricultural use. Where deeper wells are needed or where consolidated formations are encountered other drilling techniques may be researched for their applicability.

Once a screened casing has been lowered into the borehole to the depth of interest, quartz sands, frac sand or pea gravel should be filled in around the screen to several inches above the screened interval. Barcelona et al. suggest a 1 foot layer of fine Ottawa or silica sand be placed above the pea gravel pack that is placed around the screened interval (1). Then a layer of bentonite pellets above the gravel pack around the screen several feet thick. The bentonite pellets upon expansion in situ should provide a seal to downward migration of bentonite slurry and neat cement seals. This may be followed by bentonite powder up to within 2-3 feet of ground surface. A final cement grouting should be used for a cap placed to a depth of the probable deepest frost (2). This protects the well from frost heaving.

It is important to keep any use of cement away from the screened interval as grout in contact with well water may cause pH changes in the well water and thereby affect the pesticide persistency in that well water.

Using backfill material removed from the well bore-hole during drilling to fill up the annulus is not recommended for the small-scale retrospective study type.

The effects of the materials used to fill in the annuluar space between well casing and well bore may be expected to be more important than well casing material, because of the relatively greater surface area contact of solutes with aquifer solids than with well casing materials (3).

"The recommended well diammeter is 2 inches (5 cm)". A 2 inch well diammeter will accommodate most sampling devices. There are several casing material choices. "The following materials were ranked by the U.S. Geological Survey (USGS) as to their inertness and suitability as casing materials: glass, Teflon, stain PVC, black pipe, fiberglass. From the aforementioned USGS memorandum a combination of materials for well casing is recommended, specifically, "a Teflon or stainless steel screen and casing in the water bearing zone and PVC casing for the remainder of the hole." This procedure is recommended for both volatile and non-volatile pesticides of expected low concentration levels in a non-corrosive environment, i.e., pH greater than 5, no iron precipitation, and low concentrations of organic solvents. Whenever PVC is used, no organic-based solvents or sealers should be used because of the possibility of contamination. Joints of casing should be threaded and screwed together, not glued together.

Well Screen Placement:

The wells should be screened in the water table aquifer for determination of shallow ground-water flow. Once these wells are drilled and screened, they may also be used for ground-water sampling as part of the monitoring well network.

To properly define the movement of pollutants vertically and horizontally, "it is essential to collect depth-discrete water level data "(1). The water table aquifer or uppermost aquifer provides the starting point for determining the vertical movement of a pesticide.

It is recommended that "well clusters" be constructed. A "well cluster" can be defined as a group of 2-3 wells, located very near each other, which penetrate three depths of the aquifer, i.e., each well is screened at a different depth to obtain three dimensional sampling of the aquifer at each well cluster. Each well in the cluster should be individually cased. This construction procedure is recommended over the contruction of well nests or multiple-completion wells, because the integrity of the individual seals for multiple-completion wells may be suspect. Individually sealed holes for vertically nested wells are advised and expected.

For a water table aquifer of adequate depth, each well in a well cluster should be screened at a different depth in the aquifer, i.e., a skimming well at 5 feet, a second screened 5 feet below this, and if necessary a third well screened at 5' below the second well of the well site. Resulting in three closely spaced, individually-cased wells at 5, 10, and 15 feet per well site. If the water table aquifer is not expansive enough to accommodate such a well placement scheme, then 2 wells per wells site would suffice. The point is to cover the water table aquifer three dimensionally with up to 3 wells/well cluster. For most water-table aquifers composed of unconsolidated aquifer materials 2-3 wells/ well cluster is appropriate.

The number of well clusters/study type field is discussed in detail in the individual study type sections.

Once the wells are in place, ground-water samples can be taken for water quality measurements. Assuming the field has had several years of seasonal pesticide use, pesticides may be detected in well samples at any time of the year. However, the two optimal times for sampling beneath and just down-gradient

of the field are not long following application in late spring and early summer, and during the winter-spring snowmelt period (ca. March). Experience has shown that leaching pesticides typically contaminate shallow ground water beneath the field with the first major period of recharge following application; i.e., with spring recharge following application in the spring for pesticides in the Northeast, or with summer rain for spring applied pesticides in the Southeast. Because of the temporal changes in ground-water quality (15-17), wells should be sampled beginning at the onset of the sampling program and continuing through the winter and into the next season. Because of the uncertainty in developing individual sampling schemes for different chemicals and types of studies, the sampling frequency will be bi-weekly to monthly.

Well Development:

Once a new well is in place it needs to be developed. Well development refers to the procedure used to clear the wellscreen of fine silts and clays produced during drilling. Pumping the well until sediment free-flow is established or by using a surge block to loosen clogged material are recommended (21).

The following points should be included in the well bore diagram: (1).

Date/time of construction	Gravel pack/type size	(depths from__to__)
Drilling method	Sand pack	(depths from__to__)
Well location	Bentonite pellets	(depths from__to__)
Bore hole diammeter	Backfill	(depths from__to__)
Well depth	Bentonite slurry	(depths from__to__)
Casing material	Cement/grout	(depths from__to__)
Screen material	Ground surface elevation	
Screen slot size/length	Well cap elevation	
	Depth ground water encountered	

Well Sampling

These procedures are recommended for small-scale retrospective ground-water monitoring studies.

Sampling Pump Choice:

The choice of pump used to evacuate a well and collect a sample may vary. The same pump may be used for both evacuation and sample collection or different pumps may be used. The following table outlines recommended pump choices for sampling and evacuation for small diammeter shallow wells. The sampling pump selected should be constructed so that only materials of stainless steel, Teflon, Viton (non-reactive chemicals, relatively) contact the ground-water sample. The following pump types are not recommended for ground-water sampling: syringe type pump, and the gas lift or suction lift type pumps.

Although a suction-lift pump should not be used for sample collection, a type of vacuum pump, the peristaltic pump, can be used for evacuation. It is advised to evacuate the small, shallow wells slowly. The peristaltic pump has a pumping rate of 0.2-1 gpm, which can be adjusted to a slow enough flow rate so as not to pump the well to dryness during evacuation.

The New Jersey District Office of the US Geological Survey (USGS) compared the relative ability of 7 different samplers to recover purgeable organic compounds (POCs) from ground water (1). The results of their study conducted with each of the 7 samplers at 3 different sites indicated the peristaltic (suction-lift) pump and the syringe pumps to be the least effective samplers at collecting POCs from ground water.

The point-source bailer, Teflon or stainless, bladder pumps, helical rotor submersible pump and gear submersible pump are all constructed to allow the ground water sample to contact surfaces of stainless steel, Teflon, Viton-type materials only.

A combination of pumps may be used, one for evacuation, one for sampling. A larger well may be evacuated with a suction lift pump, but sampled with another type of pump. If the Teflon bladder type of pump is used, it is important that there is enough water to completely cover the pump in order to prevent the introduction of air into the water sample. Sampling devices should be selected that minimize the introduction of air and gas bubbles into the sample (28, 29). For wells without enough water to cover the bladder, a Teflon or stainless steel bailer resembling a long, narrow bucket may be used (27). All sampling devices should be flushed with at least 1 liter of representative well water before a sample is taken.

Well Purging:

Before a well is sampled, it must be purged of its standing water or storage water until the well yields representative aquifer water upon pumping. Storage water is water that "does not come into contact with the flowing ground water" (25, 26). It is necessary to purge the well, because water standing in the casing has the opportunity to interact with the well casing material and exchange with atmospheric gases.

In the past, the most common method used to obtain a representative aquifer sample was to flush the well-bore by pumping a specified number of well-bore volumes of water. This procedure is considered outdated, and is not advised. The following excerpt is a compilation of the information compiled by Gibbs and others outlining recommendations for the collection of ground-water samples (25):

1) When a well has been drilled and developed, a two or three hour pumping test should be conducted on each monitoring well to be sampled. Analysis of the pump test data and other hydrologic information should be used to determine the frequency at which samples will be collected and the rate and period of time each well should be pumped prior to collecting the sample. If pumping tests cannot be conducted, slug tests may be substituted to provide the needed hydrologic information.

These small 2" wells should not be overpumped to the point of dryness. A pumping rate slow enough to allow the well to recharge or recover is recommended. Overpumping can cause excessive silt and clay fines to be drawn into the well (27) and dewatering of the gravel pack may cause water chemistry changes through aeration (1).

The U.S. Geological Survey requires that at each time a well is sampled the specific conductance and temperature of the water be allowed to stabilize before taking a sample that is considered representative of the aquifer; this is the OPP/EPA policy, as well. The pH of the sample should be recorded to ± 0.1. There are no set number of well casing volumes to be pumped.

Measurement of chemical parameters is best accomplished with an in-line closed measurement cell (25). When the values of the indicator parameters are observed to vary less than ± 10% over three consecutive well-bore storage volumes, the well may be presumed to have been adequately flushed for representative sampling. When in-line measurement cells are not practical, standard pH and conductivity meters and thermometers are used. All containers used for measurements must be rinsed 3 times with representative well water.

8. RECOMMENDATIONS:

The points made in the conclusion section should be followed as closely as possible.

9. BACKGROUND:

Telone II is a fumigant used in the eradication of nematodes.

10. DISCUSSION OF INDIVIDUAL TESTS OR STUDIES:

The protocol was previously discussed under the conclusions section. A copy of the protocol is attached.

11. COMPLETION OF ONE LINER:

Not applicable.

12. CBI:

CBI was included in this package.