1.0 Free Product Policy

This guidance has been prepared to document Iowa DNR policy as it pertains to the cleanup of free product at sites enrolled in the Land Recycling Program (567 – IAC 137), and in particular to clarify sub-rule 137.9(6), which addresses this issue. Sub-rule 137.9(6) reads as follows**:**

> *"Free Product and gross contamination. The response action or strategy for an enrolled site shall take into account a stated policy of the Act to encourage environmental cleanup. To this end, the department requires that contaminants present as free product and gross contamination shall not be addressed through the implementation of institutional or technological controls. For purposes of this rule, gross contamination will be considered to be contamination present at concentrations in excess of a standard by an amount sufficient to reasonably expect that institutional or technological controls will not be adequately protective of human health or the environment.*
>
> *The department recognizes that treatment or removal of free product or gross contamination may not, in some cases, be feasible. In such cases the department may grant a variance to this portion of the rule. It will be the responsibility of the participant to make a sufficient case that such a variance is warranted."*

Free product is defined in 567 – IAC 137.2 as "…a hazardous substance that is present as a nonaqueous phase liquid (e.g., liquid not dissolved in water) or is present as a solid in its original form as a product or waste material".

Background

There are two types of liquid free product- light, non-aqueous phase liquids (LNAPLs) and dense, non-aqueous phase liquids (DNAPLs), and two phases of free product - a residual phase and a nonresidual phase.

LNAPL behavior in the subsurface is better understood and more predictable than DNAPL behavior, since LNAPLs do not typically migrate below the water table surface and can be readily identified during site assessment in shallow monitoring wells. DNAPL behavior is more complex due to a variety of factors, but mainly due to a higher density that allows gravitational forces to move the NAPL through the saturated zone. If a sufficient quantity of DNAPL is released, vertical flow can continue until a low permeability geologic unit (aquitard) is encountered. At that location, the DNAPL may pool on the upper surface of that unit or migrate horizontally along the aquitard.
It is generally understood that *residual phase NAPLs* are bound to the aquifer/soil matrix and are, for practical purposes, immobile under normal subsurface conditions (although they can act as a continuing source of dissolved phase contamination). The *nonresidual phase NAPLs* (sometimes referred to as "free phase") can migrate through the subsurface under the influence of gravity and capillary forces and are represented by LNAPLs that accumulate on the water table surface and by DNAPLs that pool on or migrate along a low permeability geologic units.

More substantive information and discussions of DNAPL behavior can be found at www.itrcweb.org/gd_DNAPLs.asp, as well as a variety of other sources.

Policy

It is the Department's policy to focus free product recovery efforts on the nonresidual (mobile) portion of non-aqueous phase liquids released to the environment. In its application of sub-rule 137.9(6), *the Department is requiring that all free product present in the nonresidual (mobile) phase be recovered or treated to the extent technically feasible*. Our reasons for this position are as follows:

a) The complexity of non-aqueous phase liquid migration, in particular DNAPLs, makes it difficult to predict NAPL plume fate and transport. Therefore, recovery of the potentially mobile NAPL fraction should be pursued to account for this uncertainty.
b) Once the mobile fraction is removed, conventional techniques to determine dissolved plume stability are more reliable.
c) Removal of source areas should enhance the effectiveness of natural attenuation processes on the overall groundwater contaminant plume.
d) Removal of the most concentrated contaminant sources should decrease the time frame over which aquifer restoration is achieved.
e) Removal of the mobile component of the NAPL should reduce the risk of exposure to contaminants in the future, should an institutional control fail, since it is assumed that the residual, immobile NAPL would be less available for uptake.

If only residual phase free product is confirmed at an enrolled site, or if free product recovery efforts have been performed to the point where only residual phase product remains, institutional controls in lieu of further recovery/treatment are likely acceptable. At a minimum, the institutional control would consist of an environmental easement that contains a description of type and nature of NAPL present, as well as a prohibition of the installation of water supply wells in the area where free product is expected to exist.

It is expected that all unacceptable risks associated with residual phase free product will be addressed through the risk evaluation/response action rules in 567 - IAC 137.9.

With regard to LNAPLs, existing free product recovery rules exist for petroleum sites and are listed in 567 - IAC 135.7(5). Those rules are generally incorporated into this policy document for sites enrolled in the Land Recycling Program and are consistent with the policy listed above, which focuses recovery efforts on the mobile portion of the LNAPL plume. These rules will also apply to non-petroleum LNAPL sites. In those situations where specific citations in 567 - IAC 135.7(5) conflict with the LRP rules, it will be necessary that the IDNR project manager and the LRP site enrollee work together to establish an appropriate response generally consistent with 567 - IAC 135.7(5) while compliant with 567 - IAC 137.9(6).

With regard to DNAPLs, the Department of Natural Resources does not have any existing rules or guidance. While there are passive recovery techniques that have been deployed successfully for a sufficient length of time to make the technology generally accepted in the industry as viable (e.g., sump collection of pooled coal tars), it is recognized that current DNAPL recovery techniques can be more demanding than the standard LNAPL recovery techniques. In recognition of these differences between the current states of technology, the Department recognizes that nonresidual (mobile) phase free product recovery/treatment may not be feasible in some situations.

The following chapter contains a description of the information needed by the Department before a variance can be considered to forgo the requirement to recover/treat nonresidual free product in accordance with sub-rule 137.9(6).

2.0 Variance

As stated in the previous section, the Department's policy with regard to sub-rule 137.9(6) is that free product (DNAPL and LNAPL) present in the nonresidual (mobile) phase should be recovered or treated to the extent technically feasible. For those situations where only residual phase free product is present, recovery or treatment is unnecessary, provided no unacceptable risks exist and an institutional control is in place as described in section 1.0.

However, it is recognized that situations may exist where nonresidual free product is present but site-specific factors make recovery infeasible. In those cases, the Department may consider a variance to sub-rule 137.9(6) provided sufficient supporting information is submitted as described in the following paragraphs.

Components Required for a Variance Request

In order to consider a free product variance request, the following information must be supplied: free product plume definition, estimated volume, and a 'best available technology' demonstration. An incomplete variance request will be returned to the enrollee.

- **Free Product Plume Definition**. A sufficient number of samples must have been collected during the site assessment to clearly define the nature and extent (vertical and horizontal) of each free product plume present.

- **Estimated Volume**. The total volume of nonresidual and residual free product present at each enrolled site must be estimated and the rationale and associated calculations presented in the variance request.

- **Best Available Technology Demonstration**. The applicant must present to the Department the results of a field demonstration of the best available free product recovery/treatment technology applied at the subject site. Information must be presented to the Department that supports the position that the technology utilized was the most appropriate for the particular situation. All information gained from the field demonstration must be included in the variance request, including the expected and actual free product recovery rates.

The Department will process the complete variance request using a listing of weighted criteria explained in Section 3.0.

3.0 Criteria

The Department will use the criteria described below to evaluate a variance request. The Primary Criteria are criteria in which a variance may be granted or denied based solely upon one individual criterion. Secondary criteria would only be taken into consideration if review of the primary criteria yielded inconclusive results and could not be used alone to grant or deny a variance.

Primary Criteria

Effectiveness of Technology. It is the Department's Policy if passive recovery methods are effective at recovering DNAPL, recovery will be considered feasible. That would include hand bailing, french drains, sumps, or other instances where free product will flow readily by gravity to, or otherwise accumulate in a well or drain where it may be recovered, and would include pumping systems. Variances may be granted where passive recovery is ineffective.

The Department may also grant a variance where the action of recovering free product unacceptably increases risk, such as mobilizing DNAPL that might otherwise be expected to be immobile unless induced to move by a recovery method.

Structures with free product. The Department will require free product present in structures be recovered. Types of structures may include, but not limited to, above ground and underground tanks, waste disposal pits/trenches, gas holders, pipe runs, and tar wells. The rationale for this is that the material is generally accessible, and a possible future release caused by degradation or damage to the structure can be prevented. In addition, the structures may contain hazardous substances in undiluted form, which could pose an acute exposure concern if accidentally encountered.

Surface condition/accessibility. The Department understands that surface conditions may make mobile free product recovery less feasible, such as free product under buildings, roadways, and water bodies. The Department may issue a conditional No Further Action Certificate where mobile free product recovery is suspended until the structure is removed, at which time free product recovery would be required.

The Department may also grant a variance where free product recovery methods may adversely affect sensitive environments or species.

Volume of Free Product. The Department has determined that free product volumes less than 50 gallons (including immobile residual product) are generally not feasible to clean up. The department will consider proposals to terminate free product recovery when the amount of product collected from a monitoring well is equal to or less than 0.1 gallon each month for a year unless another plan is approved by the Department. When recovery activities have been terminated, owners/operators must inspect the monitoring wells monthly for at least a year. The Department must be notified and recovery activities reinitiated if during the monthly well inspections it is determined the product

thickness in a monitoring well exceeds 0.02 foot. The monthly well inspection records must be kept available for review by the Department.

Secondary Criteria

Cost of Recovery. The Department considers passive recovery a cost-effective recovery method. This criterion will only be considered for sites where the Department determines that significant efforts have been made to recover mobile free product and recovery operations have been correctly and adequately implemented and, where it has been demonstrated, site conditions are such to make recovery efforts prohibitively expensive.

Extent of free product. The Department will consider this factor if the extent of free product is very limited and contained to the enrolled property.

Geology/hydrogeology. The Department will consider variances where geology/hydrogeology may make it unfeasible to recover mobile free product. For example, it is generally easier to recover mobile free product in course grained sediments than in fractured bedrock.

Impact to off-site property owner. The Department will not grant variances where free product is on an off-site property unless the off-site property owner agrees to a waiver (and the associated environmental easement described in Section 1.0) and/or actions of recovering free product may cause unacceptably increased risk, such as mobilizing otherwise immobile DNAPL free product. The granting of a waiver by an off-site property owner does not guarantee, however, that the Department will grant a variance.

Importance/value of an aquifer. Variances to free product recovery will not be granted to sites that are impacting locally used aquifers. Protected groundwater sources downgradient from mobile free product will also be given high importance, and the lack of a use of an aquifer will not be grounds to grant a variance.

Timeframe for clean up. This factor may be considered when a recovery timeframe is unacceptable to a LRP applicant. The Department will only utilize this criterion in those situations where (1) passive recovery efforts have been performed for a sufficient length of time to make a judgement on the capability of passive recovery efforts to recover a significant portion of the nonresidual free product plume, and (2) a demonstration that more aggressive recovery is infeasible. The LRP applicant always has the option to move to an aggressive cleanup method if timeliness is a priority.

Type of Free Product. The Department understands that feasible recovery of NAPLs will depend somewhat on the contaminants' chemistry and mobility. For example, free phase chlorinated solvents may be difficult to recover in the subsurface due to their high specific gravity and low viscosity. On the other hand, due to their high viscosity, coal tars are relatively easier to recover.

4.0 Review Process

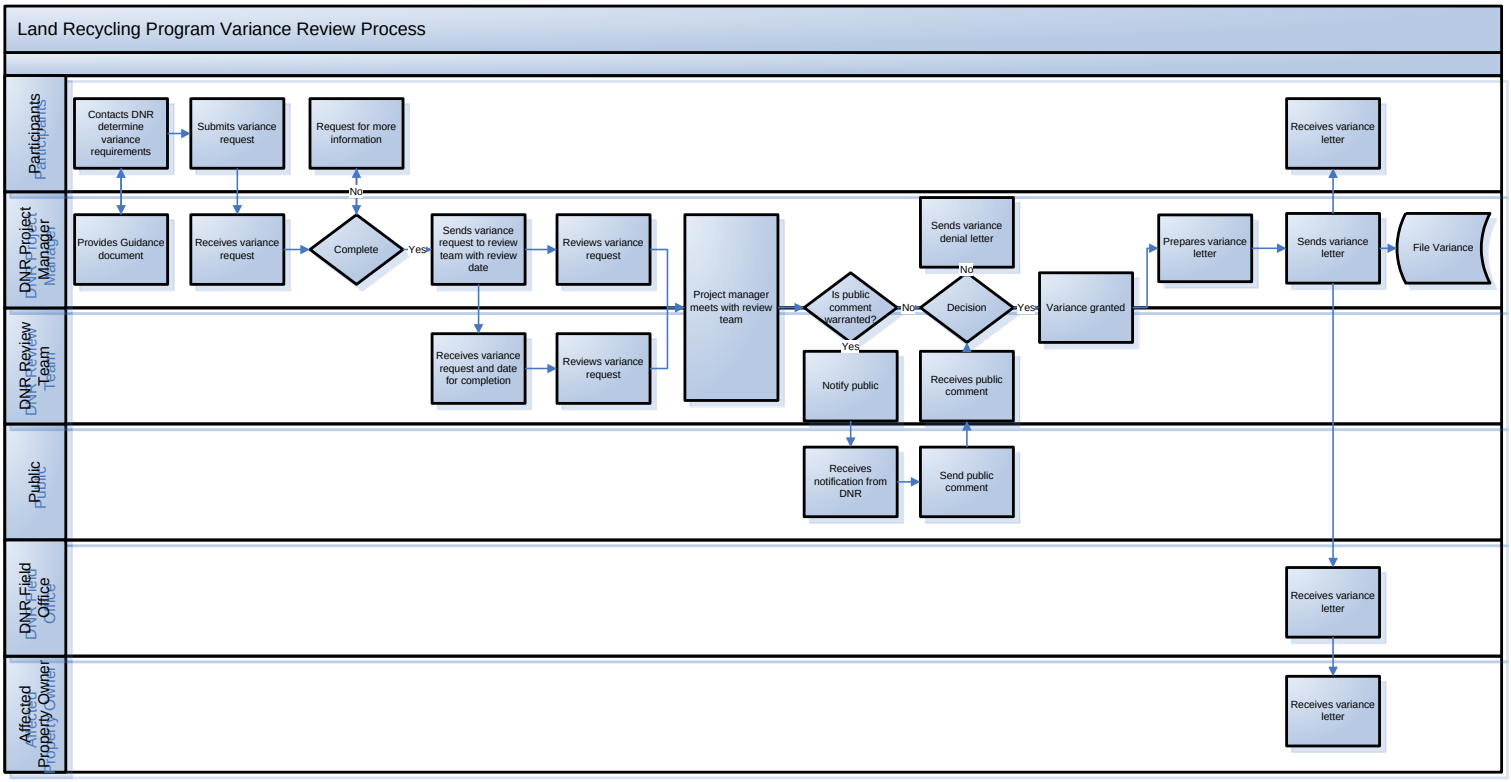

Figure 1

When a variance request is received, the Department's Project Manager will review it for completeness and then form a review team consisting of the Project Manager and two other Contaminated Sites technical staff members. The Department's review process is illustrated in Figure 1.

The Department will issue a separate Public Notice in accordance with subrules 137.7(4) and 137.8(6) specific to this variance request before granting any variances

The review team will use the criteria as stated in Section 3 along with public comments and grant or deny the variance as follows:

- If evaluation of the Primary Criteria by the review team results in the determination of infeasibility for just one of those criteria, a free product recovery variance is justified and the Department will issue a Public Notice of intent to grant the variance.

- If free product recovery infeasibility has not been determined for any of the Primary Criteria, the variance will be denied.

- If evaluation of any one of the Primary Criteria yields inconclusive results, the review team will evaluate the Secondary Criteria and make its determination based upon the Primary and Secondary Criteria.

If the Department determines that a variance is justified, a Public Notice of the intent to grant a variance will be issued; if a variance is not justified, a specific Public Notice will not be necessary at this time. After consideration of public comments, the Department will grant or deny the variance request. It is anticipated that the Department will make its final determination within 60 days of receiving the completed request.