Appendix A

Correspondence

Burl L Summers
02/08/99 07:42 AM

To: Shannon L Ansley/ANS/LMITCO/INEEL/US@INEL
cc:

Subject: Re: railroad set back for percolation ponds

I have not found any information relating to setbacks of railroads. I would suggest that toe-of-slope to toe-of-slope be a minimum of 50 feet. Burl

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October 16, 1997

Distribution

INEEL WELLHEAD PROTECTION PROGRAM - MEF-04-97

The Idaho Wellhead Protection Plan, published in February 1997 by the Idaho Division of Environmental Quality (IDEQ), describes a program (currently voluntary) which recommends the establishment of a "Wellhead Protection Program" to prevent the contamination of drinking water wells. This program is intended to protect drinking water supplies through the delineation of wellhead protection areas[a] followed by the implementation of management policies for these areas (and the potential contamination sources within them) relative to the levels of risk they pose. This Plan is soon to become regulation when adopted by EPA's Source Water Assessment program, but at the present time does not set implementation deadlines.

The Idaho National Engineering and Environmental Laboratory (INEEL) has chosen to begin implementation of a Wellhead Protection Program for all INEEL drinking water and production wells prior to regulatorily enforced implementation deadlines. It is the intent at the INEEL to minimize impact to existing and future operations while at the same time establishing a program which improves groundwater protection in cases where a significant risk to INEEL water sources now exists or may exist in the future. This can be accomplished by defining those areas in which contaminants (if released) could migrate to the drinking water and production wells, using the appropriate INEEL organizations to evaluate the potential risks within these areas and establish appropriate controls and policies, and making INEEL personnel more cognizant of the areas of potential impact to INEEL water sources. In brief, it is intended to establish a program which requires that groundwater and wellhead contamination risks be considered during INEEL operations and projects; it is not the intent to discontinue or prohibit common INEEL activities within the Wellhead Protection Areas.

Implementation of a Wellhead Protection Program can be expected to create additional financial and regulatory responsibilities at the INEEL. In order to establish an effective Wellhead Protection Program with minimal adverse impacts to INEEL operations, projects and budgets, it

[a] Wellhead protection areas are defined as those surface and subsurface areas surrounding a well through which contaminants are likely to move and contaminate the well over specified time periods.

is important that the appropriate people be involved during program development. Attachment A describes IDEQ's Wellhead Protection Plan requirements, discusses the INEEL activities conducted to date, and addresses future program implementation tasks, while Attachment B presents proposed wellhead protection area maps for the INEEL. Please review the Attachments (or pass them on to an appropriate responsible party) and provide comments back to me by November 15, 1997 regarding designated points of contact for further development of the INEEL's Wellhead Protection Program, specific interests or concerns you may have regarding this program, and the proposed wellhead protection area maps. I can be reached at 526-5522, Mailstop 4110, or OV address "FELDME".

Sincerely,

Mark Feldman

Mark Feldman
Environmental Monitoring

MEF:caq

Attachments

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Attachment A

The Idaho Wellhead Protection Plan has three general goals: to prevent the contamination of groundwater by appropriately managing potential contamination sources; to establish "response action areas" around a wellhead which provides sufficient time to respond to an event which could contaminate drinking water supplies; and to protect the area of contribution of a well by appropriately managing land use. The Plan attempts to accomplish these goals by requiring a number of actions, including delineating wellhead protection areas for each drinking water well, maintaining an inventory and management strategy for the potential contamination sources within these areas, and developing land-use policies which protect the areas of contribution to a well. It also requires that contingency plans be developed in the event a drinking water well becomes contaminated, and that sites for future wells be identified and protected.

The Plan recognizes that the "management" and "policy" components are the most important parts of the Plan, and provides much latitude to the water purveyor in the manner in which most requirements can be met. The exception to this is the delineation of the wellhead protection areas; boundaries must be established using the guidelines presented. The Plan requires that four distinct zones be identified for each well. These zones, presented in order of the stringency with which they should be managed, include:

(1) Zone 1A, which corresponds to a 50 foot sanitary setback radius from the well (presently required by state law),
(2) Zone 1B, which corresponds to the boundary for a 3-year time of travel for contaminants in the aquifer,
(3) Zone 2, which corresponds to the boundary for a 6-year time of travel for contaminants in the aquifer, and
(4) Zone 3, which corresponds to the boundary for a 10-year time of travel for contaminants in the aquifer.

The Plan also identifies 5 methods for delineation, dependent upon the amount of information available, and cautions that any assumptions made on behalf of information uncertainties should be made such that the delineation analyses yield the largest (most protective) wellhead protection area.

The INEEL decided 2-3 years ago to begin implementation of the requirements of IDEQ's Wellhead Protection Plan as a "best management practice" for all drinking water and production wells because the Plan represented a sensible approach to groundwater protection. The ensuing activities in 1995 resulted in the preparation of "capture zone" maps for all the INEEL wells, but little else in the form of implementation. More recently, IDEQ submitted the updated Plan (published in February 1997) as a proposal to meet EPA's Source Water Assessment program requirements and, based on initial feedback from EPA expects approval of the Plan in its current form. This action is expected to make the requirements mandatory within the next 2 years, and has sparked renewed interest in the program. As an initial step, proposed wellhead protection area maps have been prepared for each of the INEEL facilities in which these wells are located. These maps were created by modifying the previously prepared capture zone maps to meet the current requirements of the IDEQ Plan, and include the four designated protection area zones.

During preparation of the maps, efforts were made to balance the total area impacted against the need to identify all areas which may be in the zone of contribution for a wellhead. The result is a series of maps which represent conservative boundaries for wellhead protection areas based on conditions which have been documented over time at the INEEL. The boundaries for these wellhead protection areas do not imply that all areas encompassed actually contribute to the wellhead, but more accurately they suggest that contribution to the wellhead is possible within these areas. This is consistent with the intended use of the maps, which is to indicate those regions in which (1) added care should be given to those existing sites which represent potential groundwater contamination sources and (2) special consideration should be given to future construction which may represent a groundwater risk. (The maps cannot be used to definitively state that a site, specifically one in close proximity to a protection area boundary, is or is not in the catchment zone for a wellhead.) Attachment B provides a detailed discussion of the delineation process for the INEEL's wellhead protection areas, and presents the maps and tabular information on the protection zones.

Future INEEL Wellhead Protection Program activities include finalizing the wellhead protection area maps and completing the inventory of potential contamination sources, determining programmatic responsibilities and implementation avenues, and developing appropriate policies for managing potential contamination sources and land use within the protection zone boundaries. The wellhead protection area maps can be finalized after incorporation of any feedback on the proposed delineations in Attachment B, and the initial inventory of potential contamination sources (which has already begun) can be based upon information already documented in the INEEL's GIS library and other readily available resources. Concurrent with this, discussions regarding the appropriate organizations for ownership of responsibilities should be initiated, with the intent to use those organizations and programs already performing similar tasks. (Examples include possible use of the Environmental Restoration organization to evaluate the relative risk of existing and future potential contamination sources within the wellhead protection areas; the INEEL Groundwater Protection Program Plan and the INEEL Land Use Planning Document to publicize the wellhead protection area maps and provide easy access for their use across the INEEL; and the National Environmental Policy Act project review checklist for early identification of INEEL operations and projects which fall within the protection areas.) Policy development efforts for the INEEL Wellhead Protection Program should begin soon thereafter. Based on recommendations of the INEEL Groundwater Committee, the focus of these policies should be to identify (and minimize where feasible) existing risks to INEEL water sources while at the same time protecting these water sources from future INEEL activities through informed siting and controls. Emphasis should be placed on a "common sense" approach which avoids the practice of summarily prohibiting activities and projects within wellhead protection areas.

Attachment B

The Idaho Wellhead Protection Plan identifies five techniques for the delineation of wellhead protection areas; three of these techniques (the Basic I, Basic II, and Refined Methods) can be applied at the INEEL. The Basic I and II Methods are both conservative techniques which establish four large, concentric, fixed-radius circles around each wellhead as boundaries for the four protection area zones, while the Refined Method allows the water purveyor to use knowledge of the aquifer properties to establish the protection area zones and boundaries. (The Refined Method estimates a capture zone boundary for a wellhead using various modelling codes and requires access to data such as transmissivity, hydraulic gradient, flow angle, and pump rate.) Given sufficient information, the Refined Method provides a better estimation of the actual catchment area for a wellhead, as well as a smaller protection area which must be managed.

The wellhead protection areas delineated for the INEEL drinking water and production wells are based upon the Refined Method. In 1995, the RESSQC Module of EPA's WHPA modelling code was selected for use from the list of modelling codes and simple "capture zone" maps were generated for 2 and 5-year times of travel for each of the wells. In 1997, when work on the INEEL's Wellhead Protection Program was reinitiated, the previous capture zone maps were compared to IDEQ's current Wellhead Protection Plan requirements. Changes and details highlighted in the Plan (basing protection area zones on 3, 6, and 10-year times of travel, requiring the use of the most conservative assumptions when faced with data uncertainties or ranges of values, and noting that the WHPA code assumes no lateral migration of contaminants through the vadose zone) implied that the capture zone maps prepared in 1995 no longer satisfy Plan requirements. Faced with three options (1) adopt much larger protection areas via the use of one of the Basic Methods, (2) embark on an expensive mission to remodel the capture zones using a more complex code, or (3) modify the existing capture zone maps, the latter was chosen.

Based on the recommendations and assistance from the INEEL Groundwater Committee, the capture zone maps were modified in a number of ways. First, the protection areas were lengthened by linearly extrapolating the 2 and 5-year time of travel capture zones to 3, 6, and 10-year times of travel. Second, the protection areas were widened by adopting flow angle "ranges", rather than the single, dominant flow angle used in the original capture zone maps. Based on information in the 1993 "INEL Groundwater Monitoring Plan" (GMP) all INEEL facilities exhibit variation or uncertainty in aquifer flow angle ranging from 20 degrees to 90 degrees. (Identified and documented in the GMP for the purpose of siting monitoring wells at INEEL facilities, these ranges are believed to represent conservative values.) Adopting these flow angle ranges as bounding guidelines in establishing the lateral boundaries of the protection areas, the resultant protection areas resemble a pie-shaped wedge.

Third, the protection areas were augmented with a circular zone surrounding the wellhead to account for uncertainties associated with a heterogeneous aquifer, a thick vadose zone, and lateral migration of contaminants prior to their entry to the aquifer. The GMP, in the Monitoring Network sections for each facility, recognizes that ample opportunity exists for lateral migration of contaminants through the vadose zone due to its thickness and fractured basalt structure. As a

result, it defines the distance the "line of compliance" monitoring wells should be located from the potential contamination sources in order to capture any lateral migration. In effect, these distances provide a site-specific estimate of the potential for lateral movement of the contaminants through the vadose zone. Ranging from 500 to 4000 feet, these values represent the best facility-specific information available, and were adopted as the radii for the circular management zones around the wellheads.

Finally, as recommended by IDEQ's plan, in situations where the mapped protection areas of multiple wells intersect, the protection areas are combined and the wells are treated as a single wellfield. This has resulted in a single wellhead protection area for each of the INEEL facilities within which drinking water or production wells are located. Table 1 provides a listing of the wells by facility and summarizes the final specifications used in delineating the protection areas at each of the INEEL's facilities, and figures 1-18 present the maps showing the protection area zones and boundaries. As can be expected and is seen in the figures, most of the INEEL's wellhead protection areas are common in shape and orientation, though some abnormalities exist. Those figures which demonstrate abnormal characteristics are discussed below.

The INEEL and all of its wellhead protection areas are shown in Figure 1, providing an indication of the total areas covered. As expected, this figure shows variation in protection area size when comparing one facility to another. This is largely the result of the variation in transmissivity values (which dictates protection area length) and groundwater flow angle range values (which dictates protection area width) across the site. Close observation of this figure also points out an apparent discrepancy; NRF and ICPP portray similar wellhead protection area characteristics, but TRA has a protection area which differs significantly in size and orientation, even though it overlaps that of ICPP. This is probably caused by facility-specific data being extrapolated to a larger region. (Local hydrologic conditions vary greatly in fractured basalt; when these localized conditions are projected over a larger area, subtle differences in the data become magnified.) These differences do not necessarily indicate an error in the development of the protection area for TRA, but more likely reflect the degree of uncertainty associated with establishing the protection areas for NRF and ICPP. As a result, no effort to change the protection area maps to reflect "consistency" have been made.

The EBR-I and RWMC wellhead protection areas, shown in figures 6 and 13 respectively, each have circular protection areas rather than the characteristic wedge-shaped protection areas. This is due to the low transmissivity values measured at each facility, resulting in relatively short distances modelled for 10-year times of travel (296 feet for EBR-I and 1800 feet for RWMC). In both cases, the distance associated with the "potential for lateral movement of contaminants through the vadose zone" exceeds the linear distance for the 10-year time of travel. As a result, the circular zone placed around the wellhead to account for lateral contaminant movement in the vadose zone is the dominant feature, and has been designated the protection area boundary for both maps. (Consistent with this boundary designation, the lines marking Zones 1B and 2 were adjusted accordingly.) This technique is supported at RWMC by the fact that contaminants believed to have originated in the Subsurface Disposal Area (which is not within the flow angle range measured at the RWMC) have been detected at the wellhead.

The ICPP wellhead protection area, shown in figures 8 and 9, is notable simply for its size. Covering approximately 40 square miles and enveloping the NRF facility, this protection area is influenced by the high transmissivity values measured at ICPP and a wide aquifer flow angle range which is probably due to the influence of the Big Lost River. This protection area also has the largest circular zone surrounding the wellheads, owing to a history of significant contaminant movement along the perched water zones below ICPP. (Contaminants, believed to have originated south of the wells and well outside the groundwater flow angle range for ICPP, have been detected in the ICPP Production Wells 04 & 05.) As noted previously, the boundaries for this wellhead protection area are based on the information specific to the localized conditions at ICPP. Projection of these conditions over a larger area to establish boundaries for the ICPP wellhead protection area has likely resulted in a very conservatively sized protection area, but is also reflective of the lack of information available on the area between ICPP and NRF.

The rest of the wellhead protection areas, as shown in the remainder of the figures, are very similar in nature and exhibit no notable abnormalities.

Table 1 -- INEEL Wellhead Protection Area Delineation Specifications

FACILITY; Well ID	Zone 1A[a] Radius (ft)	Circular Zone[b] Radius (ft)	Boundary Angles [c] (degrees)	Zone 1B[d] Length (ft)	Zone 2[e] Length (ft)	Zone 3[f] Length (ft)
ANL-W ; EBR-II #1&2	50	500[g]	20 degree span from 45 - 65 degrees	6200	12400	20000
CFA; CFA #1&2	50	1000	35 degree span from 0 - 35 degrees	2833	5667	9000
EBR-I; EBR-I	50	500	360 degree span from 0 - 360 degrees	150	300	500
Gun Range; Rifle Range Well	50	500[g]	80 degree span from 0 - 80 degrees	3767	7533	12600
ICPP; CPP #01, 02, 04 & 05	50	4000	90 degree span from 325 - 55 degrees	11533	23067	38000
NRF; NRF #1, 2, & 3	50	500[g]	60 degree span from 330 - 30 degrees	6700	13400	22400
PBF; SPERT #1 & 2	50	500	30 degree span from 25 - 55 degrees	1087	2173	3600
RWMC; Production Well	50	2000	360 degree span from 0 - 360 degrees	600	1200	2000
TRA; TRA #01, 03, & 04	50	1000	30 degree span from 30 - 60 degrees	3067	6133	9200
TAN-CTF; FET #1 & 2	50	500	55 degree span from 355 - 50 degrees	500	800	1200
TAN-TSF; ANP #01 & 02	50	500	90 degree span from 315 - 25 degrees	667	1333	2000
TAN-WRRTF; ANP #08	50	500	75 degree span from 310 - 25 degrees	500	1033	1700

[a] Sanitary setback distance defined by the State of Idaho for drinking water wells.

[b] Circular protection zone for the lateral migration of contaminants within the vadose zone, based on information in the "INEL Groundwater Monitoring Plan".

[c] Lateral protection area boundaries measured clockwise from due North.

[d] Estimated distance for a 3-year time of travel in the aquifer.

[e] Estimated distance for a 6-year time of travel in the aquifer.

[f] Estimated distance for a 10-year time of travel in the aquifer.

[g] The "INEL Groundwater Monitoring Plan" does not identify a distance for these facilities -- 500' was selected as the minimum default value.