FACT SHEET ATTACHMENT A
2005 Remediation General Permit Fact Sheet Excerpts

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Please note, the Table of Contents has been created to help readers identify and navigate this Appendix; it was not part of the 2005 Remediation General Permit Fact Sheet.

Selection of Parameters and Limits

a. General Approach

EPA-NE has determined that the various types of discharges can be broadly grouped into categories of similar activities and, that within these activity groups, common pollutants are typically found (see Tables I and III in sections I.A and B above). The potential exists for any one or groups of chemicals listed as toxic or hazardous pollutants under various EPA and state water (e.g., CWA Priority Pollutants) and remediation programs (Superfund, RCRA Corrective Action, Leaking Underground Storage Tanks) to be present at a contamination site. Based on available literature, reviews of other existing permits, as well as operational information from site remediation projects, EPA-NE has determined that it would be both impractical and unnecessary to attempt to document and limit every contaminant which could be present in a discharge under this permit. For example, one of the most common categories of discharge which may be covered by this permit is cleanup of gasoline releases from underground storage tanks (USTs). There may be more than 50 chemical constituents in refined gasoline and another 30 - 40 chemical additives used for various purposes in the final product delivered to a retailer.

Of the many individual chemicals potentially encountered in discharges covered by this permit, the physical/chemical characteristics of individual chemicals or compounds often make them useful as “indicator” pollutants for establishing technology-based (BAT) effluent limitations. Rather, than limiting all the possible pollutants in a common group, it is often more protective and efficient to regulate an indicator contaminant. Different pollutants or classes of compounds may have varying susceptibilities to treatment by pollution control technologies. Certain pollutants or classes of pollutants may be more toxic than others but the removal of an indicator chemical can insure that other chemicals with similar characteristics will also be removed. For example, benzene is often used as an indicator compound in the control of the volatile organic compounds (e.g., toluene, ethylbenzene, and xylenes) in gasoline and other gasoline constituents (see EPA's model permit for cleanup of gasoline releases - 1989) due to its chemical characteristics and behavior when available control methods are used.

Based on the information available, including discharge monitoring reports from more than 2,000 historical sites, EPA-NE has selected a limited number of pollutants for specific effluent limitations in the permit (see Appendix III of the RGP). In general, these pollutants represent those which are most commonly reported from the types of activities being covered by this permit. Additional parameters were evaluated for inclusion in the general permit, but were not listed for a number of reasons including: i) non-relevance; ii) uniqueness - may need an individual permit; iii) rarely found in discharges; iv) common pollutants which are known to be removed along with indicator pollutants; or v) other factors. EPA-NE has decided that some parameters (for example, pesticide compounds) are infrequently encountered in discharges covered by this permit and if an owner/operator determines that a compound(s) is a significant contaminant in the water, an individual NPDES permit may be required or another means of handling the wastewater may be necessary.

b. Examples - Selection of Permit Parameters

An evaluation of the type of discharge is required for the Notice of Intent (NOI) application form. From reviews of available literature, other EPA and state issued NPDES permits, and the review and issuance of over 2,000 approved site remediation projects in MA and NH, the following example scenarios provide additional background on how parameters were selected for this RGP.

Example #1: A cleanup at a former leaking underground gasoline tank (UST) at a service station requires a short-term dewatering for tank replacements or long-term ground water pump & treat.

Site Characterization: Gasoline is the only known source of contamination.

Pollutants/Indicators: Total Petroleum Hydrocarbons (TPH), Benzene,
BTEX -Benzene, Toluene, Ethylbenzene, Xylenes, Naphthalene, Total Lead (If any indication of "older" gasoline containing tetra- ethyl/methyl lead)
Methyl tert-Butyl Ether (MtBE), tert-Butyl Alcohol (TBA) or other additives/oxygenates , Total Iron (If high iron content groundwater, potential iron fouling).

Example #2: A fuel oil (#2 heating oil or other) release cleanup requires soil removal with dewatering.

Site Characterization: Fuel Oil(s) are the only contaminants.

Pollutants/Indicators: Total Suspended Solids (TSS), TPH, Benzene + BTEX, Naphthalene + Polycyclic Aromatic, Hydrocarbons (PAHs), and Total Iron.

Example #3: Remediation of a former electronics facility release of solvents/degreasers with dewatering

Site Characterization: Site screening identifies chemicals of concern.

Pollutants/Indicators: Chlorinated Volatile Organic Compounds (VOCs)
(e.g. trichloroethylene, tetrachloroethylene, dichlorobenzenes, vinyl chloride, etc.)
pH (standard units), Metals (copper, zinc, lead, iron, etc).

Example #4: Construction excavation in an older "urban fill" area requires dewatering.

Site Characterization: Typically soil borings/test pits reveal contaminated soils needing to be classified for disposal. Some low level groundwater contamination will be exacerbated by excavation.

Pollutants/Indicators: TPH, pH, TSS, PAHs, Metals

Discussion of Specific Parameters and Associated Effluent Limitations in RGP

The pollutant limits in Appendix III of the RGP represent a mix of technology- based effluent limitations (e.g., for the volatiles and semi-volatiles) and water quality-based effluent limitations (e.g., for the metals and chlorine). In establishing the effluent limits, EPA-NE evaluated concentrations achievable using currently available pollution control technology, as well as the current aquatic and health based standards established for each compound. Since there are no national effluent limitation guidelines for the categories of discharges covered by this general permit, EPA has used Best Professional Judgment to establish the effluent limits.

Over the past decade, EPA has set limits for, and received discharge and treatment system performance data from more than 2,000 remediation activities in MA and NH. In developing this permit, EPA-NE has continued the practice of setting a maximum value effluent limitation for each parameter. In some cases, the limits have been set at different assumed average hardness values for the receiving waters in each State. The limits have been based on the nature of treatment systems typically used (e.g. physical and/or chemical treatment) which are amenable to frequent start-up and shut-down and the once per month grab sample monitoring requirements. Both the selection of parameters and the determination of the limits were based on the demonstrated performance of similar systems in-the-field.

Generally, for the majority of compounds, the technology-based limits achieve concentrations that are coincidentally at or below human health based water quality criteria. However, for a number of contaminants, including: **Benzene; Carbon Tetrachloride; 1,2 Dichloroethane; Tetrachloroethylene; 1,1,2 Trichloroethane; Trichloroethylene; Vinyl Chloride; Bis (2-Ethylhexyl) Phthalate; Arsenic; and Iron,** the limits are higher than the human health criteria. Thus, in certain low flow or zero dilution receiving waters where the effluent essentially constitutes the flow, the effluent limitations for these compounds could potentially exceed the human health based standards.

Based on this potential, EPA-NE has evaluated the need for human health-based effluent limitation for these contaminants. One option would be to prohibit the discharge to very low flow or zero flow receiving waters such as wetlands or intermittent streams to insure a dilution factor would be available and adequate to maintain human health criteria values. However, EPA-NE has determined that except in rare circumstances, the prohibition of discharge is not necessary for a number of reasons.

First, human health-based standards are typically developed to achieve certain risk-based concentrations based on long-term (e.g., 70 year or lifetime) exposure to the toxic material (e.g., less than a one in a million additional cases of cancer drinking water ingested over a lifetime). Yet, the majority of discharges anticipated to be covered by the RGP are short duration (e.g., from a few days to 1-2 years). The longest discharges observed by EPA-NE in the site remediation projects were a few instances of groundwater remediation systems that have pumped and treated water for approximately 10 years. Second, the discharges covered by this permit are typically small volume discharges, designed with flow rates of a few gallons per minute up to about 30 gallons per minute (approximately 40,000 gpd). Therefore, EPA does not anticipate any discharges covered by the permit to expose individuals at concentrations of concern for a lifetime.

Third, because a general permit is designed for a variety of potential situations, the effluent limitations (other than for metals) have been set conservatively at zero dilution. But, low flow or zero flow waters are not typically used as sources of drinking water, although they may be in recharge areas or tributary to waters used as water supplies. Furthermore, discharges to public drinking water supply (Class A waters) are essentially excluded from coverage under the permit. Additionally, in many instances, there will be some flow or dilution available in the actual receiving water. Although dilution is only being considered in setting the limits for discharges of metals, EPA believes that human health risks will be effectively mitigated by the combination of the technology based limits and dilution found in typical receiving waters.

Finally, when EPA and the States review the notice of intent (NOI) for discharges under this permit and determine that there are unusual circumstances where human health criteria based limits are needed for these compounds, EPA will issue an individual permit.

As discussed above, for discharges containing metals, dilution is being considered in setting the effluent limits in the permit. For the majority of situations, the treatment systems are expected to remove contaminants down to very low levels that should be capable of achieving water quality standards for zero dilution situations. However, for metals, EPA has decided to apply a dilution factor for two reasons. First, the aquatic life water quality standards for several metals are lower than can be typically achieved with standard treatment. And second, a number of metals are naturally occurring or secondary to more voluminous and toxic compounds found in the discharge (e.g., hydrocarbons).

For example, for a mixed effluent of pollutants that includes petroleum hydrocarbons and/or industrial solvents (volatile organic compounds or VOCs), there may also be low levels of one or more metals present in the groundwater. The primary concern of the groundwater remediation is removing the BTEX, PAHs, and VOCs using standard treatment such as carbon adsorption. The low levels of metals in the groundwater would be a secondary concern and to further reduce them at zero dilution could require significant additional expense and complexity of the treatment system. If the receiving water has available dilution, simple changes could be made to components of the standard treatment train, such as enhancing the filtration step for fine solids (assuming that the metals are bound to the fines), before the carbon treatment to remove enough metals to meet the metals limit with dilution.

In the case of chlorine (TRC), typically, dilution would be based on the low flow of the receiving water and factored into the effluent limit for TRC for individual NPDES permits. In the RGP, however, EPA is establishing a single effluent limit for TRC that anticipates de-chlorination or chlorine control and therefore does <u>not</u> provide for calculation of TRC limits based on available dilution.

The following is a discussion of the individual pollutants/indicator parameters, the proposed limitations, and the rationale for the limits imposed. The section numbers correspond to the parameter numbers listed in Appendix III of the RGP. Unless otherwise indicated, the averaging times associated with the limits are as follows. Where the limit is based on chronic water quality criteria, the averaging time is a monthly average. Otherwise, if the limit is based on acute water quality criteria, human health criteria, or available technology, the averaging time is daily maximum.

1. Total Suspended Solids (TSS)

a. General Limit - The limit for TSS may be both a BAT/BCT and a WQBEL based limitation. Solids are considered a "conventional pollutant" (as opposed to toxic). Suspended materials in water can cause turbidity, discoloration, interruption of light passage for aquatic growth, coating of fish gills, and sedimentation on stream bottoms interfering with egg laying and feeding. They can also act as carriers (through adsorption) of toxic materials and cause interference with proper operation and maintenance of the typical treatment systems used for the pollutant control in this permit (e.g. air stripping, carbon adsorption, ion exchange, etc.). Groundwater, such as from extraction wells used in ground water pump & treat systems, is typically low in TSS. TSS is more of a problem in construction operations where soils and organic materials are being disturbed and mixed with ground waters or storm waters.

EPA-NE has determined that control of TSS in the waste streams from a large number of the dischargers covered by this RGP should be required, especially discharges from any sites involving construction or disruption of soils or sediments. A TSS limit is particularly important to maintaining good operation of subsequent treatment units in the system such as carbon adsorption (e.g clogging of pores in the carbon granules) and to aid in the removal of contaminants which are adsorbed to soil particles.

Treatment technology is well understood and a properly designed sedimentation and/or filtration system can readily remove TSS to low concentrations. Examples of established effluent limitations for TSS in other permits include: i) the conventional technology treatment standards promulgated by EPA at 30 milligrams per liter (mg/l) monthly average, and 45 mg/l weekly average for sewage treatment plants, ii) EPA-NE's General Permit for Construction Dewatering at uncontaminated sites includes limits for TSS at 50 mg/l average and 100 mg/l maximum (assumes simple sedimentation treatment); iii) EPA's promulgated effluent guidelines, Part 436 for Mineral Mining, Industrial Sand category, sets TSS limitations of 25 mg/l average and 45 mg/l maximum; iv) EPA's proposed effluent guidelines, Part 440 for Ore Mining categories, sets TSS limitations of 20 mg/l average and 30 mg/l maximum. Considering all of these limits and technical factors, this general permit sets a technology based TSS limit of 30 mg/L.

b. TSS limit for hydrostatic testing - After installation or certain types of repair, tanks and pipelines must be tested with water, i.e., hydrostatic testing. Typically, the tanks or pipes are sealed, filled with water, and pressurized to check on the structural integrity of the vessel. Following the test, the water is removed from the vessel. These discharges are often large volume, short term discharges of one or two days.

Although this RGP is primarily intended for management of ground water and incidental storm waters, EPA-NE is establishing a separate TSS effluent limit for hydrostatic testing discharges from gas and oil tanks and pipelines due to the unique nature of these activities. In the site remediation projects, EPA-NE has typically required these projects to include “best management practices” (BMPs), e.g., pre-cleaning the vessels before filling with water, as well as numerical limits for specific parameters, e.g., TSS, BTEX, TPH, etc.

In researching available limits for this permit, EPA-NE also found a number of examples of numerical permit limits across the country, particularly in the southwestern U.S. where there are many oil and gas pipelines and storage facilities. Several States have proposed or issued general permits for hydrostatic discharges from gas pipelines that contained TSS limitations. For example, the TSS maximum limit for gas pipelines in Oklahoma and Arkansas is 45 mg/l. In Missouri, the TSS maximum limit is 100 mg/l and the average is 50 mg/l. In California, TSS limits are 75 mg/l maximum and 50 mg/l average. Similarly, the TSS limit that EPA-NE uses for construction dewatering in the general permit for uncontaminated water (“clean water”) is set at 50 mg/l.

Most often, these limits have been met successfully through the use of pre-cleaning only as a treatment and EPA-NE is setting the limit in this permit based on this widely used technology. EPA-NE recognizes that some older vessels may not be thoroughly pre-cleaned prior to typical hydrostatic testing. In those cases, the limits in this general permit may not be achievable without additional treatment of the effluent prior to discharge. Alternatively, such facilities may decide to apply for an individual NPDES permit prior to conducting hydrostatic testing.

Considering the state and EPA general permit limits, this permit sets a technology based limit for TSS from hydrostatic testing waters for new and existing gas and oil tanks and pipelines at 50 mg/L.

> **<u>Proposed Effluent Limitation for TSS (except for hydrostatic testing)</u>:**
> **Maximum Value = 30 mg/l**
> **<u>Proposed Effluent Limitation for TSS only for hydrostatic testing of gas and oil tanks and pipelines:</u>**
> **Maximum Value = 50 mg/l**

<u>2. Total Residual Chlorine (TRC)</u> - Chlorine is not a pollutant typically found at sites or other activities subject to this RGP, although many toxic organic compounds contain chlorine molecules in their chemical makeup. However, chlorine compounds are sometimes introduced to control bacterial growth in the treatment systems or in pipelines and tanks which are being hydrostatically tested. Similarly, in certain situations such as at construction sites, incidental domestic sewage may be encountered in which case disinfection may be required prior to discharge. As discussed previously, the TRC limit in this permit does not allow the consideration of dilution at a particular site. Therefore, if chlorine has been added to the wastewater, the operator will need to de-chlorinate prior to discharge in order to meet the limits.

The EPA National Recommended Water Quality Criteria (the "Criteria", FR Notice Dec 10, 1998 updated in EPA publication #822-R-02-047, Nov 2002) sets recommended freshwater and saltwater standards for chlorine for both acute and chronic toxicity which guide the development of TRC effluent limits in NPDES permits. Typically, the dilution, based on the low flow of the receiving water, would be factored into the effluent limit for TRC for individual NPDES permits. In the RGP, however, EPA-NE is establishing a single effluent limit for TRC and not providing for calculation of TRC limits based on available dilution.

Addition of chlorine compounds for activities covered by the RGP can be tightly controlled for specific purposes. Permittees covered by the RGP who submit information in an NOI or an NOC under this permit which indicates that chlorine compounds are used in the activity or treatment system must dechlorinate and monitor for the TRC in the effluent. In order to protect water quality, this permit sets effluent limits based on the EPA recommended water quality criteria which are 11 ug/L for freshwater (chronic) and 7.5 ug/L for saltwater (chronic). In all cases, the concentration of the total residual chlorine (TRC) in the effluent shall not exceed a compliance limit of 0.02 milligrams per liter (mg/l) or parts per million (ppm) based on the current minimum reporting level (ML) for chlorine residual.

Proposed Effluent Limitation for TRC :
Maximum Value for Freshwater = 11 ug/L
Maximum Value for Saltwater = 7.5 ug/L
Compliance Limit = 0.02 milligrams per liter (mg/L)

3. Total Petroleum Hydrocarbons (TPH) - EPA-NE has been incorporating TPH as a parameter at all petroleum related site remediation projects. Historically, "Oil & Grease" was the primary petroleum related parameter used in many of EPA-NE's individual NPDES permits and is a common parameter in many of EPA's promulgated industrial effluent guidelines. The "hydrocarbon" fraction of the oil and grease parameter, or TPH, is the most appropriate parameter for inclusion in this permit. A total oil and grease analysis would include other non-petroleum fats and greases in the result which would not be relevant to the activities covered by the RGP.
Similarly, due to the shear number of chemicals contained in refined petroleum products, measurement of all of the component chemicals is not practical, cost effective or needed for adequate attainment of water quality standards. An aggregate measurement of the hydrocarbon compounds serves as an indicator of overall relative pollutant concentration

and as an indicator for assessing water quality impacts. Individual analytes of TPH, such as benzene, toluene, etc., which are also parameters in this permit, provide additional chemical specific controls on the discharge. Additionally, the hydrocarbon makeup in the environment changes after the product has been released through leaks, spills, or other releases due to volatilization, biodegradation, sorption, etc. which occurs over a period of many years in the groundwater. This is sometimes referred to as "weathering" of the release in the soil, ground water, etc.

There is some variability to the quantification of TPH. There are several EPA approved methods (and modifications allowed) currently being widely used. EPA methods 418.1 (recently replaced by Method 1664 to eliminate the use of Freon) and Modified Method 8100 are both "extraction" procedures which may eliminate certain gasoline range (C_5 to C_9) volatile organic (GRO) compounds. It is also important to note that MA DEP uses an alternative methodology for analysis known as the Volatile Petroleum Hydrocarbon and Extractable Petroleum Hydrocarbon, or VPH/EPH, method. This method is required to be used for measuring petroleum hydrocarbons at sites being cleaned up under the MA Contingency Plan (MCP, Chapter 21E). The VPH/EPH method reports results in terms of concentrations of ranges of Aliphatic and Aromatic hydrocarbons (e.g., C_5 to C_{36}).

It is important to differentiate between the EPA TPH methods and the MassDEP's methods due to the large percentage of discharges eligible for coverage under this permit which are a result of cleanup actions under the MCP. EPA often receives data on applications and monitoring reports from MA dischargers containing VPH/EPH results along with "target" analyte data such as benzene, MtBE, etc. Using the EPH portion of the test results approximates the equivalent TPH value in the EPA approved extraction procedure methods. The MA DEP has also established certain risk based limits in the MCP groundwater and soil cleanup standards for the various hydrocarbon fractions. However, EPA does not currently have a means to evaluate carbon range data supplied under the MCP methods or to "translate" the data to evaluate compliance with NPDES permits which contain chemical specific numerical limits for toxics which are related to specific water quality criteria developed for specific pollutants. The State of NH does not utilize alternative protocols for TPH. Therefore, EPA-NE has not incorporated VPH/EPH requirements in this permit for discharges in MA.

In establishing the proposed effluent limit for TPH, EPA-NE reviewed a number of sources, including the substantial monitoring data being submitted pursuant to approved site remediation projects, reviewed a number of other EPA and state issued general permits and related effluent guidelines developed by EPA. Site remediation projects in MA and NH have consistently required an effluent limit maximum value for TPH of 5.0 parts per million (ppm) or milligrams per liter (mg/l). Review of monitoring information indicates that this limit is readily attainable with standard treatment technology and rarely exceeds 1.0 mg/l in the effluents reported. Typically, the results are "less than" the laboratory reporting levels (0.2 - 0.5 mg/l).

Regarding monitoring of TPH, EPA recognizes that arguments can be made to not require TPH monitoring at gasoline only sites. However, given the variability of cleanup sites, the historic operations of typical gasoline stations which included general repairs, oil changes, supply of diesel fuel, and other considerations, EPA proposes to retain the limitation and monitoring of TPH for all discharges. Operators may submit a "notice of change" (NOC) form based on operating data to request changes to TPH monitoring in certain circumstances.

EPA-NE has carefully evaluated the available information to establish a limitation for TPH in this general permit. Monitoring data from the many treated discharges in MA and NH authorized by EPA indicated that discharges can consistently meet limitations of less than 5.0 mg/l. EPA-NE is proposing to maintain the technology based TPH limitation of 5.0 mg/l as a maximum value for discharges in MA and NH.

Proposed Effluent Limitation for TPH:
Maximum Value = 5.0 mg/l (5,000 ug/L)

4. Cyanide - Compounds containing the cyanide group (CN) are used and readily formed in many industrial processes and can be found in a variety of effluents, such as those from steel, petroleum, plastics, synthetic fibers, metal plating, and chemical industries. Cyanide occurs in water in many forms, including: hydrocyanic acid (HCN), the cyanide ion (CN^-), simple cyanides, metallocyanide complexes, and as organic compounds. "Free cyanide" is defined as the sum of the cyanide present as HCN and CN^-. The relative concentrations of these forms depend mainly on pH and temperature.

Both HCN and CN^- are toxic to aquatic life. However, the vast majority of free cyanide usually exists as the more toxic HCN. And, since CN^- readily converts to HCN at pH values that commonly exist in surface waters, EPA's cyanide criteria are stated in terms of free cyanide expressed as CN^-. Free cyanide is a more reliable index of toxicity to aquatic life than total cyanide because total cyanides can include nitriles (organic cyanides) and relatively stable metallocyanide complexes.

EPA-NE has set the cyanide limits in this general permit considering a number of factors, including: water quality criteria, the MCL, and the existing limits in MA and NH (see Appendix A of this Fact Sheet). EPA's national water quality criteria for cyanide are 5.2 ug/L (chronic) and 22 ug/L (acute) for freshwater, and 1.0 ug/L (acute or chronic) for saltwater. EPA-NE has carefully evaluated a number of sources of information to establish a limitation for cyanide in this general permit. In order to be most protective, limits are based on the chronic water quality criteria for cyanide at 5.2 ug/L for freshwater and 1.0 ug/L for saltwater.

<u>Proposed Effluent Limitation for Cyanide</u>:
Maximum Value = 5.2 ug/L for freshwater
Maximum Value = 1.0 ug/L for saltwater

<u>5. - 9. Benzene, Toluene, Ethylbenzene, Xylenes (BTEX)</u>

<u>a. Limiting BTEX and Benzene</u> - EPA-NE estimates that greater than 50 percent of the discharges eligible for coverage by this permit contain petroleum related compounds in the contaminated water. These discharges are the result of managing contaminated groundwater's resulting from gasoline or other fuels or oil releases which contain compounds which are soluble in water at various concentrations.

1) Background - The four Alkyl Benzene volatile organic compounds (benzene, toluene, ethylbenzene, and the ortho, para, and meta xylenes) are common constituents of petroleum fuels. For example, in gasoline, these compounds may contain approximately 2% Ethylbenzene, 5% Benzene, and 11-12% Toluene and Xylenes depending on the formulation. The term BTEX, representing the sum of the concentrations of these four compounds, is commonly used by the petroleum industry in measuring the quality of fuels. This parameter has been adapted for use by EPA and state agencies to serve as a measure of effluent quality of these contaminants in water and to serve as an "indicator" parameter representing the wide variety of compounds found in petroleum products (see "Model NPDES Permit for Discharges Resulting From The Cleanup of Gasoline Released From Underground Storage Tanks;" June 1989).

In evaluating technology-based effluent limits, the BTEX compounds have similar physical/chemical characteristics which can be used to assess the treatability of the contaminated water. Several important characteristics include the "Henry's Law" constant, the octanol/water partitition coefficient or $K_{ow,}$ the organic carbon partition coefficient or $K_{oc,}$ and the chemical's solubility in water (see definitions for additional information). Table V provides comparison values for these physical/chemical characteristics for the BTEX compounds and many of the other parameters contained in this permit.

Since air stripping and carbon adsorption are the most widely used treatment technologies for control of volatile, semi-volatile, or non-volatile organic compounds in water, the evaluation of the chemical characteristics will allow an evaluation of the potential ease of removal of contaminants by these treatment methods. In general, the more soluble a substance is in water the more difficult it is to remove by air stripping and carbon treatment. Additionally, the lower the Henry's law constant, the harder the compound is to remove by air stripping alone. Potential for carbon treatment (or natural soil attenuation) can be evaluated by using the partition coefficients (Kow and Koc) which provide an indication of the tendency of organic compounds to “sorb” onto soil or carbon particles (e.g. carbon adsorption). Lower Kow and Koc values (e.g., less than 100) indicate less efficient sorption.

Table V: Chemical Coefficients for Selected Permit Parameters

PARAMETER	SOLUBILITY (mg/l)	Henry’s Law atm-m^3/mole	Koc	Kow
Benzene	1750	0.0056	83	132
Ethylbenzene	152	0.0064	1100	1410
Toluene	535	0.0064	300	537
Mixed Xylenes	198	0.0070	240	1830
m-Xylene	130	0.0107	982	1820
o-Xylene	175	0.0051	830	891
p-Xylene	198	0.0071	870	1410
Naphthalene	32	0.0012	1300	2760
Ethylene Dibromide	4300	0.00067	14-160	58
Methyl-tert-Butyl Ether	54,000	0.00059	og Koc 0.55-.9	og Kow 0.94-1
tert-Butyl Alcohol	Miscible	0.000012	log Koc 1.57	Log Kow 0.35
tert-Amyl Methyl Ether		0.002		
Tetrachloro-ethylene	150	0.026	364	398
1,1,1-Trichloro-ethane	1500	0.014	152	316
1,1,2-Trichloro-ethane	4500	0.0012	56	295
Trichloro-ethylene	1280	0.0099	126	240
Vinyl Chloride	2670	0.082	57	24
Acetone	Miscible	0.000019		log Kow -0.24

1,4 -Dioxane	Miscible			
Phenols	93,000	0.0000028	14.2	28.8
Penta-chlorophenol	14	0.00000045	53,000	100,000
Bis -2-Ethylhexyl Phthalate	0.3	0.00000036	5900	9500

Rather than attempt to establish effluent limits for every compound found in a petroleum release, selection of those compounds which would be most difficult to remove to low levels, coupled with an evaluation of the degree of toxicity of the compound, will provide an adequate indicator of removal of the other compounds in the contaminated water being treated with the standard technologies. Benzene has commonly been selected as a primary indicator of effluent quality for these reasons. In fact, EPA's Model NPDES Permit for Cleanup of Gasoline (June 1989) discusses the rationale for selection of Benzene and BTEX as appropriate parameters for discharge permits.

2) Setting the Limit for BTEX - Virtually all EPA and state issued permits for petroleum remediation discharges reviewed in the research for this permit limit BTEX as a secondary parameter. All of the BTEX compounds have closely related chemical characteristics to Benzene. However, the composition of gasoline is highly variable and for some gasoline products, any one of the four BTEX compounds could be the dominant constituent. Therefore, regulating the total of the four, rather than individually, provides a useful secondary indicator for control of water discharges containing volatile petroleum contaminants (see discussion of oxygenates below).

EPA's "Model NPDES Permit for Discharges Resulting From The Cleanup of Gasoline Released From Underground Storage Tanks;" (June 1989), recommends a BTEX limit of 100 ug/L. This limit is based on the typical removal efficiency of 99.5% or better for BTEX using a commercially available air stripper unit. Based on EPA's model permit and the observed performance of control equipment at historical or existing cleanup sites in New England, EPA-NE is setting a technology based limit for BTEX at 100 ug/L.

3) Setting the General Limit for Benzene - Of the compounds in gasoline, Benzene has one of the highest solubilities in water and one of the lowest Henry's law constants. Thus when using air stripping, Benzene will be more difficult to remove. Benzene also has a low Koc value. Thus, it will be the most likely to "break through" when using carbon treatment and appear in the effluent when the carbon's adsorptive capacity is becoming exhausted and needs replacement. Since Benzene is an indicator compound, Benzene breakthrough would also indicate that other hydrocarbons are no longer being sorbed as well. Benzene is also one of the most toxic constituents (listed as a carcinogen in EPA's

drinking water standards). Therefore, an effluent limitation on Benzene is needed and will insure adequate control of the majority of the many other volatile gasoline constituents.

In establishing a technology-based effluent limit for Benzene, EPA-NE evaluated the current aquatic and health based standards established for this compound. The goal of this permit is to provide conservative protection for the receiving waters since the location of "new" discharges and the receiving water quality is not known for purposes of developing this permit. For many organic compounds, the health-based standards are most conservative. Health-based standards are typically developed to achieve certain risk-based levels based on long-term (lifetime) exposure to the toxic material. For example, a certain concentration in water ingested over a lifetime may cause a one in a million additional cases of cancer.

Discharges covered by this permit will not typically be discharged directly to a drinking water supply, however since the limitations in this permit are not being developed on an individual or site-specific basis, the permit must be protective of all potential uses or exposure scenarios. Since the technologies used to treat Benzene, BTEX, and many of the other pollutants covered by this permit, can typically achieve minimum laboratory detection or reporting level concentrations, the lowest established human health or aquatic criteria are usually acceptable for establishing effluent limitations, however, there are a number of caveats which have to be considered on a chemical by chemical basis.

The most commonly used technology-based effluent limit for Benzene is 5.0 ug/L which is also the current Maximum Contaminant Level (MCL) for Benzene in drinking water. The most recent EPA published (November 2002) recommended water quality criteria value for human health for Benzene is 2.2 ug/L (consumption of water + organisms) and 51 ug/L (consumption of organism only). Thus in certain low flow or zero dilution receiving waters where the effluent essentially constitutes the flow, an effluent limitation of 5.0 ug/L could exceed the human health based water quality standard for consumption of water and organisms.

Based on this potential, EPA-NE has evaluated the need for a water quality-based effluent limitation for Benzene. One option would be to prohibit the discharge to very low flow or zero flow receiving waters such as wetlands or intermittent streams to insure a dilution factor (DF) would be adequate to maintain the criteria value. However, EPA-NE has determined that except in rare circumstances, the prohibition of discharge approach is not necessary for a number of reasons.

First, low flow or zero flow waters are not typically used as sources of drinking water although they may be in recharge areas or tributary to waters used as water supplies. Second, the human health criteria values are based on a "lifetime" exposure scenario or continuous consumption of certain amounts of water at the concentration levels of concern. The majority of discharges anticipated to be covered by the RGP are short duration (e.g., from a few days to 1-2 years). These pump and treat systems are typically small discharges, designed with flow rates of a few gallons per minute up to about 30 gallons per minute (approximately 40,000 gpd). Also, EPA-NE believes that the proposed limit will not be problematic because typical treatment systems, if operating properly, will produce an effluent quality at lower concentration than the currently accepted laboratory quantification levels for Benzene, which are 0.5 - 2.0 ug/L or lower than the most conservative standard. Finally, if the NOI for discharge under this permit indicates some unusual circumstances where the effluent limitation for Benzene or the BTEX compounds may be problematic or human health criteria based limits are needed, EPA-NE will issue an individual permit.

b. Benzene limit for hydrostatic testing - After installation or certain types of repair, tanks and pipelines must be tested with water, i.e., hydrostatic testing. Typically, the tanks or pipes are sealed, filled with water, and pressurized to check on the structural integrity of the vessel. Following the test, the water is removed from the vessel. These discharges are often large volume, short term discharges of one or two days.

Although this RGP is primarily intended for management of ground water and incidental storm waters, EPA-NE is establishing a separate benzene effluent limit for hydrostatic testing discharges from gas and oil tanks and pipelines due to the unique nature of these activities. Historically, EPA-NE has typically required these dischargers to implement “best management practices” (BMPs), e.g., pre-cleaning the vessels before filling with water, as well as numerical limits for specific parameters, e.g., TSS, BTEX, TPH, etc.

EPA-NE considered a number of resources in setting the benzene limit for hydrostatic testing. First, EPA-NE reviewed the natural gas pipeline industry study of hydrostatic test water discharges from existing natural gas pipelines ("Environmental Aspects of Hydrostatic Test Water Discharges: Operations, Characterization, Treatment and Disposal," Tallon, Myerski and Fillo, prepared for the Gas Research Institute, April, 1996). The Gas Research Institute (GRI) study gathered data on benzene in hydrostatic test water both before and after treatment. The results of the information in the GRI study indicate pre-scouring (or “pigging” as its known in the industry) to be the most effective way of lowering benzene levels in the test water discharges. The study showed that 50 ug/l benzene was achievable in the grab sample with the highest benzene level. Based on the results of the GRI study, EPA Region 6 and Louisiana proposed or issued permits contain the benzene limit of 50 ug/L for hydrostatic test water.

EPA-NE recognizes that some existing vessels may not be thoroughly pre-cleaned prior to typical hydrostatic testing. In those cases, the limits in this general permit may not be achievable without additional treatment of the effluent prior to discharge. Alternatively, such facilities may decide to apply for an individual NPDES permit prior to conducting hydrostatic testing.

Based on the GRI study and the existing limits in other states, EPA-NE has set a technology based maximum level for Benzene from hydrostatic testing discharges at 50 ug/L.

Proposed Effluent Limitation for Benzene:
Maximum Value (except hydrostatic testing dischargers) = 5.0 ug/L
Maximum Value for hydrostatic testing dischargers = 50.0 ug/L

Proposed Effluent Limitation for BTEX (sum of Benzene, Toluene, Ethylbenzene, and m,p,o-Xylenes): Maximum Value = 100 ug/L

10. Ethylene Dibromide (EDB) - (also 1,2-Dibromomethane) - EDB is included as a parameter in this permit due to the historic use of this compound as a plant fumigant (pesticide) and as an additive in leaded gasoline (as a lead scavenger, especially in aviation fuels) although due to its toxicity, most uses of EDB have been eliminated since the mid 1980s. Direct application of EDB and releases of gasoline to the environment have contaminated groundwaters in New England. EDB has been identified at a small number of sites where discharges exist which are expected to be covered under this permit. Additional sites may also require coverage for this pollutant for future discharges.

EDB has not been included as a priority pollutant for development of national water quality criteria, however Maximum Contaminant Levels (MCLs) have been established under EPA's drinking water program. The current MCL is 0.05 ug/L or 50 parts per trillion. The groundwater standard in New Hampshire is also 0.05 ug/L while the proposed GW-1 groundwater standard in Massachusetts is 0.02 ug/L.

EDB is typically found at very low concentrations in contaminated groundwaters. It is typically being treated with granular activated carbon (GAC) treatment systems, although it is somewhat more difficult to remove from water than Benzene (see Benzene discussion and Table V). Review of monitoring data indicates that an effluent limitation established at 0.05 ug/L can be achieved by current technology. Therefore, EPA-NE is setting a technology based effluent limit of 0.05 ug/L for EDB.

Proposed Effluent Limitation for Ethylene Dibromide (EDB) :
Maximum Value = 0.05 ug/L

11. - 13. Oxygenate Compounds: Methyl-tert-Butyl Ether (MtBE), tert-Butyl

Alcohol(TBA), tert-Amyl Methyl Ether (TAME) - Many chemical compounds have been added to petroleum fuels to enhance their performance. Due to the phase-out of leaded gasoline, in the early 1980's, several alcohols and ethers began to replace tetraethyl lead as an anti-knock and octane boosting additive. Since 1992, higher concentrations of gasoline "oxygenates" (which improve the combustion of fuel) such as MtBE have been used in certain air pollution "non-attainment" areas of the country including the Northeastern US (all of Massachusetts and the southern counties of New Hampshire).

a. Background on gasoline oxygenates - As a replacement for lead containing compounds, MtBE was used in concentrations of 2-4% and as high as 8% in gasoline. When the 1990 Clean Air Act requirements for cleaner burning fuels took effect (which required additional oxygen content), MtBE concentrations increased to 11-15% by volume. As a result, MtBE and several of the other oxygenate compounds have been detected in significant concentrations in groundwater due to tank leaks or other releases of petroleum fuels.

As recently as April 2003, the New England Interstate Water Pollution Control Commission (NEIWPCC), under an agreement with EPA, has conducted surveys of all 50 States to collect information on state requirements for oxygenate contamination at leaking underground storage tank (LUST) sites. Most States, including MA and NH have established groundwater standards of varying types for MtBE and to a lesser degree, other oxygenate compounds such as TBA and TAME. A number of other oxygenates including; Ethyl Tertiary-Butyl Ether (ETBE), Disopropyl Ether (DIPE), and Ethanol (EtOH)(ethyl alcohol) have limited standards developed and are also not significant in New England. In the near future changes may occur due to various state bans being enacted on the use of MtBE due to groundwater contamination. It can be assumed that even with stringent controls on underground storage tanks, leaks and spills of fuels will occur.

Due to the significant numbers of MtBE contaminated groundwater sites being cleaned up and the resulting surface water discharges in MA and NH, EPA-NE has for some time included MtBE as a parameter in remediation projects using the available state drinking water standards (currently 13 ug/L in NH and 70 ug/L in MA) as effluent limits on an interim basis. In 2002, EPA-NE became aware of some sites where high levels of TBA contamination were also at issue. The NH DES established an interim cleanup guideline for TBA of 1,000 ug/L which is currently used for discharge limitations in that State. An Action Level of 1,000 ug/L for TBA is in place in MA although EPA does not currently limit TBA in MA discharges.

b. Consideration of gasoline oxygenates for permit limits - In preparation of this permit, EPA-NE conducted additional research on the various gasoline oxygenates to better understand the existing and potential contamination caused by the oxygenate compounds and to determine appropriate permit requirements. EPA's UST program office has encouraged States to recognize and monitor additional oxygenate compounds beyond MtBE at UST release sites nationally (memorandum S. Ng, Jan. 18, 2000). Recent articles have also suggested that MtBE is not the only issue in dealing with groundwater contamination by fuel oxygenates and more monitoring and standards setting needs to be done. According to the NEIWPCC survey, many States are reevaluating existing standards and developing new standards for other oxygenate compounds.

In evaluating the information available regarding the most likely contaminants to be of concern in MA and NH for this permit, EPA-NE reviewed survey data from EPA's Air Program Offices on the composition of reformulated gasoline fuels (RfG) sold in various metropolitan areas of the country. Survey data for several locations in New England including the Boston-Worcester metropolitan area, Springfield, MA, and Manchester NH for the years 1995-2002 provides the following information.

Table VI: Oxygenate Content in RFG in Selected Metropolitan Areas*

AREA	MTBE (wt %)	TBA (wt %)	TAME (wt %)
BOSTON-WORCESTER	10.2	0.03	1.6
SPRINGFIELD	10.2	0.02	1.8
MANCHESTER	11.0	0.03	0.9

* Summertime Average Values for 1995-2002, Other oxygenates are negligible.

The solubility, Henry's law, and Koc values for the oxygenates indicate potential treatment effectiveness issues for gasoline oxygenates (see Table V above). For example, MtBE is about 30 times more soluble than Benzene and is about 10 times less volatile than Benzene when moving from dissolved phase in water to a vapor phase (e.g. air stripping) due to the lower Henry's law constant. MtBE is also much less likely to sorb to organic carbon due to a lower Koc than benzene (see OUST Fact Sheet #2 and Table V for selected chemical constants). In using air stripper technology, significantly more air capacity is required to strip MtBE from water. Using carbon treatment, additional carbon capacity is necessary and more frequent carbon change-outs are required. Both of these factors increase the cost of operation and maintenance. Therefore, the parameters which make Benzene attractive as an indicator of treatment efficiency for the majority of the other constituents in fuels, do not necessarily apply to the oxygenates.

For this permit, EPA-NE has determined that MtBE, TBA, and TAME should be considered chemicals of concern and listed as permit parameters. Additional information including the potential change from reliance on MtBE as an additive, may re-direct future versions of this permit. This general permit is being issued for a 5 year period. During the effective life of this permit or upon re-issuance, EPA may modify or revise this permit to include additional oxygenate parameters and/or revise effluent limitations as additional information warrants.

c. Establishing limits for gasoline oxygenates - To establish appropriate effluent limitations for MtBE, TBA, and TAME, EPA evaluated both technology-based and water quality-based requirements. EPA has gained considerable experience from the treatment of MtBE contaminated waters since limitations for this parameter have been in place for a number of years in MA and NH and in other States around the country. Additionally, EPA-NE has issued several hundred NPDES discharge authorizations in NH and MA including MtBE as a parameter with the associated state standards as effluent limits. Less information is available for treatment of TBA and TAME in wastewaters.

1) MtBE - For the site remediation projects in Massachusetts and New Hampshire, EPA has required monitoring of both influent and effluent samples. Many of the data reports submitted from these sites include technical discussions of treatment efficiency, operational problems, and other information. These reports also indicate that MtBE contamination is common at most gasoline related cleanup sites and is found at other sites where known releases of gasoline may not be readily apparent. The reports show that concentrations of MtBE in water have been treated effectively from a few tens or hundreds of parts per billion (ug/L) to many thousands of parts per billion. In the majority of discharges, permittees have been able to meet the effluent limitations (13 ug/L in NH and 70 ug/L in MA) using air stripping and/or carbon adsorption, although challenges in treatment to low concentration have been noted in some instances. This is also borne out in the literature reviewed (EPA-OUST Fact Sheet #2, Jan 98, and others).

In determining water quality-based effluent limitations for the oxygenates of concern, these compounds are currently not listed as priority pollutants by EPA and as such have not had either aquatic or human health standards developed under EPA's water quality programs. The majority of work regarding oxygenates has been through the underground storage tank and drinking water programs where the primary concern has been impacts on ground waters and health impacts from drinking water obtained from wells. EPA's drinking water program has not yet established Maximum Contaminant Levels (MCLs). However, EPA has issued lifetime health advisories for MtBE in drinking water based primarily on taste and odor thresholds and the advisory concentrations are also considered protective of human health. An advisory from 1996 established a MtBE concentration level of 70 parts per billion as being protective. The current advisory establishes a concentration of 20 - 40 parts per billion (ug/L) of MtBE in drinking water as a threshold value for taste and odor.

At the state level, the NEIWPCC state survey results for oxygenates at LUST sites indicates a fairly wide range of the type of standard established as well as numeric values where they exist. The States were asked if they had established Action Levels, Cleanup Levels, and/or primary, secondary or advisory type drinking water standards (EPA advisory or other State advisory) for the various oxygenates. Forty-two States responded that they have a level or standard in place for MtBE. The lowest action level reported is 12 ug/L (WI) and the lowest cleanup level reported is 10 ug/L (NY). The lowest primary drinking water standard reported is 10 ug/L (DE) with the next lowest being 13 ug/L (NH and CA). The lowest secondary drinking water standard is 5 ug/L (CA). As discussed previously, the State of NH has established a primary drinking water standard of 13 ug/L, a secondary standard of13ug/L and an ambient groundwater standard of 70 ug/L. MA has established action and cleanup levels at 70 ug/L and a drinking water advisory at 70 ug/L as well. Currently, MA is considering lowering these levels.

In summary, EPA-NE has determined that MtBE is the primary contaminant of concern for control under this permit and that it is appropriate to establish effluent limitations. Given the national trend to lowering of human health standards for fuel oxygenates in water, and based on the wide variability of discharge scenarios (e.g. receiving water classes, low flows, etc.), EPA-NE is proposing that a conservative limitation be adopted in this permit.

In NH, which has one of the lowest state standards in the country (13 ug/L), the effluent limitation will continue to be set at that level as is currently the case for site remediation activities in NH. In MA, EPA has previously required an effluent limit of 70 ug/L from discharges from site remediation projects based on the current state cleanup standard (GW-1 under the state MCP). However, monitoring reports from gasoline remediation sites pursuant to approved site remediation projects demonstrate that using best available treatment (e.g. air stripping and/or carbon) a limit of 20 ug/L is feasible. Therefore, EPA is setting a technology based limit for MtBE of 20 ug/L (the lower EPA advisory threshold for taste and odor effects and for the assurance of protection of human health).

2) TBA and TAME - Less information is currently available for TBA and TAME than is for MtBE. However, we do know that TBA, which can be present as both a fuel additive and as a breakdown product of MtBE in the environment, is essentially miscible in water, has a much lower Henry's law constant (10^{-5}) and also a low Koc value. Thus, TBA is expected to be even more difficult than MtBE to control to low concentrations.

Currently, ten States have developed or proposed levels or standards for TBA and 5 States for TAME. The lowest action levels for TBA are 12 ug/L (CA) and "any amount" (NY). The State of NJ has established a cleanup level for TBA of 100 ug/L. Of three States with primary drinking water standards, the lowest is 15 ug/L (CO). The State of NH has established an advisory level in drinking water for TBA of 1,000 ug/L. For

TAME, of two States with cleanup levels, the lowest is 190 ug/L (MI) and the lowest primary drinking water standard is 50 ug/L (NY).

In NH and MA, TBA has been reported at several cleanup sites and is suspected to be present at others and may exist at high concentrations. TAME is reported to be present in significant concentrations in gasoline products sold in NH and MA and would likely be present in groundwater releases. EPA-NE has determined that additional monitoring for these two parameters should be required at all fuel release cleanup sites covered under this permit. This is supported by the national trend to require monitoring for oxygenates in addition to MtBE and to establish standards for them.

Insufficient data exists at this time to establish appropriate technology-based or water quality-based effluent limitations for TAME. Therefore, this permit requires only monitoring for TAME. Although little data is available for TBA, EPA-NE is setting a technology-based limit of 1,000 ug/L, NH's current advisory level.

Proposed Effluent Limitations for Methyl-tert-Butyl Ether (MtBE):

New Hampshire Maximum Value = 13.0 ug/L
Massachusetts Maximum Value = 20.0 ug/L

Proposed Effluent Limitations for Tert-Butyl Alcohol (TBA):

New Hampshire = 1,000 ug/L
Massachusetts - Monitor Only

Proposed Effluent Limitations for Tertiary-Amyl Methyl Ether (TAME):

New Hampshire & Massachusetts - Monitor Only

14. Naphthalene - Naphthalene is a common constituent of coal tars and petroleum. It is used as an intermediate in the production of dye compounds and the formulation of solvents, lubricants, and motor fuels. It is one of a number of polynuclear (or polycyclic) aromatic hydrocarbon (PAH) compounds (see further information in this section on PAHs) included as priority pollutants under the CWA. Naphthalene is only slightly soluble in water (approximately 30 mg/l), however it is highly soluble in Benzene and other solvents. The model permit for gasoline suggested that Benzene would be an appropriate indicator of removal of Naphthalene as well as the other BTEX compounds. Naphthalene is, however, also a significant component of fuel oils (several percent by volume) and is found as a contaminant at a number of older industrial sites such as former coal gas plant facilities and what EPA-NE refers to as "urban fill" sites.

In reviewing data submitted pursuant to approved site remediation projects, Naphthalene was noted in a wide variety of discharges. Therefore, EPA-NE is including Naphthalene both as a stand alone parameter and with the group of the other 17 PAH compounds (see Group II PAH compounds). EPA-NE evaluated both technology-based and water quality-based effluent limits for Naphthalene for this permit. In evaluating analytical information on contamination in water, however, it was important to note that Naphthalene may be reported by both volatile petroleum hydrocarbon analysis and extractable petroleum hydrocarbon analysis since it is within the dividing region between purgeable and extractible organics (see MADEP VPH/EPH Methods, June 2001).

As stated above, based on the chemical characteristics of Henry's law constant and Koc values similar to BTEX compounds (see Table V above), Naphthalene is expected to be removed to low concentrations (at or below laboratory reporting levels) by the standard treatment technologies. EPA has limited Naphthalene as a parameter at most petroleum fuel cleanup sites in MA and NH and other sites such as former coal gasification plant sites. Monitoring reports indicate typical influent concentrations of Naphthalene in the range of less than 10 to several thousand parts per billion in waters being treated. Effluent concentrations have typically been at the laboratory reporting levels using combinations of air stripping and/or carbon adsorption treatment.

The available water quality-based information for Naphthalene is limited. As with several of the BTEX compounds, EPA has previously published lowest observed effects levels numbers (LOELs) for the acute and chronic effects on freshwater and saltwater species. The most conservative value is 620 ug/L for freshwater chronic effects (see Appendix A of this Fact Sheet). Regarding human health effects, EPA has not published an MCL for Naphthalene for drinking water however the 2002 compilation of EPA drinking water standards and health advisories, lists Naphthalene as a Group C, possible human carcinogen. EPA's recommended level for a lifetime exposure via drinking water is 100 ug/L. The current ambient groundwater standard in NH and MA is 20 ug/L.

Given the concentrations demonstrated as readily achievable with standard treatment technology, EPA-NE is setting a technology based limit of 20 ug/L for discharges under this general permit.

<u>Proposed Effluent Limitation for Naphthalene</u>:
Maximum Value = 20 ug/L

<u>15. - 28. Chlorinated Volatile Organic Compounds</u> - A number of chlorinated volatile organic compounds have been commonly reported as contaminants in groundwater at many remediation and construction dewatering sites in MA and NH. These compounds are typically present in ground waters or in some cases surface waters, as a result of releases from manufacturing and other operations where these chemicals are or were used in production of products, as common industrial solvents or cleaners (e.g. paint thinners and removers, de-greasers, dry-cleaning agents, etc.), and due to the fact that many of these compounds are commonly found in household hazardous wastes. It is common to find mixtures of these compounds to be present at cleanup sites either due to use or storage of a variety of chemicals at a certain location or due to the weathering and chemical breakdown of a primary compound after release to the environment. The concentrations found typically range from several hundred to the tens of thousands of parts per billion (ug/L) both as individual compounds and as total VOC's.

To select the most appropriate chemicals to include as parameters in this permit, EPA-NE reviewed many applications and monitoring reports pursuant to approved site remediation projects to determine which of the compounds were most prevalent in discharges in MA and NH. Many of these compounds have similar chemical characteristics (see Table V above) which is important in evaluating potential treatment technologies. Based on prior monitoring reports, EPA expects that, in most instances, efficient control or removal of these compounds will also insure removal of other compounds with similar chemical characteristics which are not included as parameters in this permit. However, as a precaution, applicants will be required to identify all other chemical compounds found, or believed to be present at a site, and include them in the NOI for evaluation by EPA or the States.

The following 14 chlorinated volatile organic chemicals are selected as parameters for this permit:

i) Carbon Tetrachloride;
ii) 1,2 (or o)-Dichlorobenzene (o-DCB);
iii) 1,3 (or m)-Dichlorobenzene (m-DCB);
iv) 1,4 (or p)-Dichlorobenzene (p-DCB);
v) 1,1-Dichloroethane (DCA);
vi) 1,2-Dichloroethane;
vii) 1,1-Dichloroethylene (DCE);
viii) cis-1,2-Dichloroethylene;
ix) Dichloromethane (DCM), or Methylene Chloride;
x) Tetrachloroethylene (PCE);
xi) 1,1,1-Trichloroethane (TCA);
xii) 1,1,2 Trichloroethane;
xiii) Trichloroethylene (TCE); and
xiv) Vinyl Chloride.

Table V provides some of chemical characteristics of these selected compounds for comparative purposes to evaluate likely treatment and removal by the standard technologies. A number of other similar volatile organic chemicals were not included as parameters in the permit, however. The most significant reasons for not including a particular parameter include the infrequency in which a parameter has been reported at sites, lower toxicity, and the probable removal of the contaminant along with other included chemicals by standard technology.

To establish appropriate effluent limitations for these selected VOC's, EPA-NE evaluated both the technology and water quality-based information currently available. EPA-NE reviewed the substantial number of monitoring reports submitted pursuant to approved site remediation projects in MA and NH, as well as the published technology information available on various EPA and other internet sites, and the various water quality and cleanup standards published by EPA and the States (see Appendix A of this Fact Sheet).

In general, the technology-based effluent limitations are sufficient to meet the most conservative water quality standards, typically, human health based standards. The available information indicates that with few exceptions, properly designed and operated treatment units including air stripping and/or activated carbon, can achieve effluent concentrations at laboratory reportable values (often referred to as "non-detection" in reports). In the RGP, EPA-NE has set technology based limits for all of the chlorinated VOCs. For many of these compounds, the technology based limits coincide with, or are more restrictive than, EPA's and or the States' human health criteria, MCLs, and/or state adopted groundwater standards. For example, for 1,4 (or p)-Dichlorobenzene (DCB); 1,2 (or o)-Dichlorobenzene (DCB); 1,3 (or m)-Dichlorobenzene (DCB); 1,1 Dichloroethane (DCA); 1,1 Dichloroethylene (DCE); cis-1,2 Dichloroethylene (DCE); Dichloromethane (methylene chloride); and 1,1,1 Trichloroethane (TCA), the limits set are at or below water quality standards.

However, for a number of contaminants, including: Carbon Tetrachloride; 1,2 Dichloroethane, Tetrachloroethylene, 1,1,2 Trichloroethane; Trichloroethylene, and Chloroethene (Vinyl Chloride), the proposed limits are higher than the human health criteria. EPA-NE has evaluated the need for human health based limitations for these contaminants but determined that, except in rare circumstances, such limits are not necessary for the types of discharges covered by this permit for a number of reasons.

First, human health-based standards are typically developed to achieve certain risk-based concentrations based on long-term (e.g., 70 year or lifetime) exposure to the toxic material. However, the majority of discharges anticipated to be covered by the RGP are short duration (e.g., from a few days to 1-2 years). Second, the discharges covered by this permit are typically small volume discharges, designed with flow rates of a few gallons up to about 30 gallons per minute (approximately 40,000 gpd). Third, because a general permit is designed for a variety of potential situations, the effluent limitations have been set conservatively assuming zero dilution. But low flow or zero flow waters are not typically used as sources of drinking water. Further, discharges to public drinking water supplies (Class A) are essentially excluded from coverage under the permit. Also, in many instances, there will be some flow or dilution available in the receiving water.

While not formerly considered in setting these limits, EPA believes that the long term human health risks will be effectively mitigated by the combination of the technology based limits and the dilution found in typical receiving waters. Finally, if any notice of intent (NOI) for discharge under this permit indicates unusual circumstances where the effluent limitation compounds may be problematic or human health criteria based limits are needed, EPA will issue an individual permit.

Table VII - Proposed Effluent Limitations for Chlorinated VOC Compounds:

Parameter	Maximum Value (ug/L)
15. Carbon Tetrachloride	4.4
16. 1,4 (or p)-Dichlorobenzene (p-DCB)	5.0
17. 1,2 (or o)-Dichlorobenzene (o-DCB)	600
18. 1,3 (or m)-Dichlorobenzene (m-DCB)	320
19. 1,1 Dichloroethane (DCA)	70
20. 1,2 Dichloroethane (DCA)	5.0
21. 1,1 Dichloroethylene (DCE)	3.2
22. cis-1,2 Dichloroethylene (DCE)	70
23. Dichloromethane (methylene chloride)	4.6
24. Tetrachloroethylene (PCE)	5.0
25. 1,1,1 Trichloroethane (TCA)	200
26. 1,1,2 Trichloroethane (TCA)	5.0
27. Trichloroethylene (TCE)	5.0

28. Chloroethene (Vinyl Chloride)	2.0

29. & 30. Acetone and 1,4 Dioxane - While New Hampshire and Massachusetts both have either proposed or adopted acetone and 1,4 dioxane limits for discharges to groundwater, neither EPA or the States have established water quality criteria for these compounds. Based on the limited information that EPA NE has on both acetone and 1,4 dioxane in surface water, at this time, the RGP only requires monitoring. EPA will evaluate the monitoring information received and in the future will decide whether to set a numeric limitation.

Proposed Effluent Limitations for Acetone and 1,4 Dioxane : Monitor Only

31. & 32. Total Phenol and Pentachlorophenol (PCP) - Phenol and Phenolic compounds are widely used as chemical intermediates such as the manufacture of phenolic resins, as disinfectants, antiseptics, and pesticides, and many other applications. Releases to the environment may occur from manufacturing, use of products containing phenols, and from combustion sources, coal gas, and natural decay of organic matter. Phenol and a number of other compounds including nitro-phenols and chlorinated phenols are listed as both priority and non-priority pollutants which have been evaluated for the establishment of water quality criteria. Phenol and a number of other phenolic compounds are also included in EPA's water quality criteria documents as having "organoleptic" (taste and odor) effects in water at low levels.

EPA-NE evaluated the available information from site remediation projects in MA and NH to determine the frequency with which phenol and phenol compounds were reported in the various discharges from activities to be covered by this permit. The occurrence of phenol or phenol compounds is infrequent, possibly due to rapid bio-degradation of phenol in the environment. Therefore, EPA-NE is proposing the inclusion of only phenol and pentachlorophenol as individual parameters in this permit: phenol, due to its wide use and distribution in the environment, and pentachlorophenol, due to its extensive use as a wood preservative. EPA-NE is not including the nitro-phenols and other chlorinated phenols, however. If an applicant is aware that the proposed discharge contains these other compounds, the information must be included in the NOI. This information will then be reviewed by EPA and the States who will determine if an individual permit is needed.

EPA-NE has evaluated existing technology based effluent limits and the need for water quality based effluent limits for phenol and pentachlorophenol. The current EPA drinking water life-time health advisory for phenol is 4,000 ug/L, however the currently published organoleptic effect criteria value for phenol is 300 ug/L (threshold value for taste and odor impacts in water). Other published water quality criteria including EPA "lowest observed effects levels" (LOELs) and the State of NH adopted criteria for freshwater and saltwater aquatic life range from 2,560 ug/L, the freshwater chronic value, to 10,200 ug/L, the freshwater acute value. Both NH and MA groundwater standards are currently 4,000 ug/L for phenol.

Phenol has a very low Henry's law constant of approximately 3 x10^{-7} and a Koc value of approximately 30 making treatment of phenol by air stripping difficult and removal by carbon adsorption somewhat difficult. EPA, however, does not expect phenol to be a significant treatment issue. Therefore, based on water quality criteria and available technology, and given the potential for discharge to low flow receiving waters, EPA is proposing a technology based effluent limitation for phenol at 300 ug/L, which is the threshold for causing taste and odor effects in water.

Pentachlorophenol (PCP) has been widely used as a wood preservative for utility poles, fence posts, and other wood preservation treatment, thus there is a potential for levels of this chemical to be found at sites generating waters subject to this permit. PCP is considerably more toxic to aquatic life and human health than phenol as shown by comparing the various published water quality standards for phenol and PCP in Appendix A of this Fact Sheet. PCP is classified as AB2" (probable carcinogen) in EPA's 2002 drinking water standards update. The toxicity of PCP is also dependent on the pH of the receiving water. The standard values published in the November 2002 update of EPA's Water Quality Criteria are calculated at a pH of 7.8 (see the EPA publication for formula for conversion at other pH values). The NH DES published water quality standards for PCP are calculated at a pH of 6.5.

EPA has evaluated both technology and water quality-based effluent limitation requirements for PCP. From a technical standpoint, due to a very low Henry's Law constant of approximately 4.5 x 10^{-7}, PCP will not be effectively removed by air stripping. However, the Koc values for PCP, depending on pH, can range from 1,250 - 25,000, making removal by carbon adsorption effective.

The water quality criteria for PCP are 19 ug/L for freshwater acute, 15 ug/L for freshwater chronic, and 13 ug/L saltwater acute. The current EPA drinking water MCL, and NH and MA groundwater standard for PCP is 1.0 ug/L. Unlike Phenol, the organoleptic effect criteria published by EPA for PCP is 30 ug/L, which is higher than the aquatic or human health criteria values. In order to be conservative, EPA-NE is proposing a technology-based effluent limitation for PCP at 1.0 ug/L (ppb).

Proposed Effluent Limitation for Phenol : Maximum Value = 300 ug/L

**Proposed Effluent Limitation for Pentachlorophenol (PCP) :
Maximum Value = 1.0 ug/L**

<u>33. & 34. Phthalates and Bis (2-Ethylhexyl) Phthalate</u> - There are many phthalate compounds which are produced and widely used as plasticizers, resin solvents, wetting agents, and insect repellants among other uses. EPA has included a number of specific phthalate compounds on the CWA priority pollutant list including Diethyl and Dimethyl Phthalate, Butylbenzyl Phthalate, and others which are not considered highly toxic to aquatic life or human health in water. One widely used Phthalate compound, Bis(2-Ethylhexyl) Phthalate or Di(2-Ethylhexyl) Phthalate, is considerably more toxic and is included as a separate parameter in this permit.

To date, EPA and the States have published limited information regarding acceptable water quality standards for most phthalate compounds. EPA-NE expects that due to the wide use of these chemicals, they are likely to be detected at remediation and construction sites where discharges covered by this permit may occur. EPA-NE has evaluated a technology based standard for individual phthalates and total phthalates for this permit based on the relatively high Koc values of phthalate compounds and the likelihood that these compounds will be adequately removed by standard treatment technologies such as carbon adsorption. The phthalate compounds are also likely to exist at cleanup sites in combination with other more toxic parameters being controlled by this permit which will require similar treatment technology.

Neither EPA nor MA have water quality criteria for total phthalates. However, in NH, the freshwater chronic surface water criteria for total phthalate esters is 3 ug/l and the saltwater chronic criteria is 3.4 ug/l. Therefore, EPA-NE is proposing a limitation for total phthalates, excluding Bis (2-Ethylhexyl) Phthalate, of 3 ug/L in the effluent.

Bis (2-Ethylhexyl) Phthalate, also known as Di(2-ethylhexyl) Phthalate (or DEHP) is one of the most widely produced and used phthalate compounds. Primary use is as a plasticizer for polyvinyl chloride (PVC) and in other applications including insect repellants, cosmetics, soaps and detergents, synthetic rubber, and many other products. It is also in use as a replacement for PCBs as a di-electric fluid in transformers.

EPA has listed DEHP as class B2 or probable carcinogen in the 2002 drinking water standards update and in the 2002 surface water quality criteria update. EPA has published human health water quality criteria, however, has not yet published final aquatic water quality criteria for DEHP. EPA-NE has not historically limited DEHP at site remediation projects in NH and MA. However, due to the wide use and distribution of DEHP in the environment, EPA-NE is proposing to include this parameter in this permit.

EPA-NE has evaluated both technology and water quality criteria in setting an effluent limitations for DEHP. DEHP has a very low Henry's Law constant of approximately 1 x 10^{-7} which indicates that volatilization and removal by air stripping would not be efficient. However, the very high Koc values indicate that it is not highly mobile in soils and will adsorb readily with carbon treatment. Regarding water quality criteria, EPA published lowest observed effects levels criteria for DEHP at 400 ug/L acute and 360 ug/L chronic values in both fresh and salt waters. The current EPA human health criteria are 1.2 ug/L for water plus organism intake and 2.2 ug/L for organism intake only. The current EPA MCL, as well as the NH and MA groundwater standards for DEHP, is 6.0 ug/L.

As with Benzene and several of the chlorinated volatile solvents, EPA-NE is proposing to establish a technology based effluent limitation for DEHP at 6.0 ug/L. This limit is slightly higher than the human health criteria. However, EPA-NE has evaluated the need for water quality-based effluent limitation for this contaminant and determined that except in rare circumstances, a health based limit is not necessary for the types of discharges covered by this permit for a number of reasons.

First, human health-based standards are typically developed to achieve certain risk-based concentrations based on long-term (e.g., 70 year or lifetime) exposure to the toxic material. However, the majority of discharges anticipated to be covered by the RGP are short duration (e.g., from a few days to 1-2 years). Second, the discharges covered by this permit are typically small volume discharges, designed with flow rates of a few gallons up to about 30 gallons per minute (approximately 40,000 gpd). Third, because a general permit is designed for a variety of potential situations, the effluent limitations have been set conservatively assuming zero dilution. But low flow or zero flow waters are not typically used as sources of drinking water. Furthermore, discharges to public drinking water supply (Class A waters) are essentially excluded from coverage under the permit. Also, in many instances, there will be some flow or dilution available in the receiving water. While not formerly considered in setting these limits, EPA believes that the long term human health risks will be effectively mitigated by the combination of the technology based limits and the dilution found in typical receiving waters .
Finally, if any notice of intent (NOI) for discharge under this permit indicates unusual circumstances where the effluent limitation compounds may be problematic or human health criteria based limits are needed, EPA will issue an individual permit.

Proposed Effluent Limitation for Total Phthalates (excluding DEHP):
Maximum Value = 3.0 ug/L

Proposed Effluent Limitation for Bis(2-Ethylehexyl) Phthalate (DEHP):
Maximum Value = 6.0 ug/L

35. - 36. Poylcyclic Aromatic Hydrocarbons (PAHs) - There are many organic compounds included in a large group of chemicals known as polycyclic organic matter which have similar chemical structures and chemical characteristics. These are commonly known as Polynuclear, or Polycyclic, Aromatic Hydrocarbons (PAHs). They are found in fossil fuels, oil, coal, wood, and natural gas and are most often found in the environment from releases of petroleum products, the incomplete combustion/pyrolysis of fuels, and releases from products made from tars and pitches such as asphalt, various coatings, dyes, pharmaceuticals, insecticides and many other products. New England has many sites where PAHs have been found in soils and groundwaters. One common source is former coal gas production facilities which were once located in most urban areas to produce gas for street lighting and other uses. A number of PAH compounds are considered probable carcinogens. The PAHs also tend to bio-accumulate in fish and shellfish at low concentrations in water.

EPA has listed sixteen PAH compounds as priority pollutants under the CWA. For the development of this permit, EPA-NE has divided the priority pollutant PAH compounds into two groups based on carcinogenicity and based on their general use and likelihood of release to the environment. Included in these two groups are:

Group I PAHs: a. Benzo(a) Anthracene, b. Benzo(a) Pyrene, c. Benzo(b)-Fluoranthene, d. Benzo(k)Fluoranthene, e. Chrysene, f. Dibenzo(a,h) Anthracene, g. Indeno(1,2,3-cd) Pyrene

Group II PAHs: a. Acenaphthene, b. Acenaphthylene, c. Anthracene, d. Benzo(ghi)-Perylene, e. Fluoranthene, f. Fluorene, g. Naphthalene, h. Phenanthrene, i. Pyrene

In the past, EPA-NE has limited total PAH compounds at site remediation projects in MA and NH. Based on a review of information submitted by operators under this program, the more toxic/carcinogenic Group I parameters are not routinely reported in significant concentrations in the water being treated. The Group I compounds are mostly products of incomplete combustion of fossil fuels and, with the exception of Chrysene, are not produced commercially for use.

The Group II compounds are more common and are found as significant components of fuels, coal tar products, and from their use in manufacturing other products. Naphthalene is one of the most significant compounds typically reported in applications for discharges in MA and NH. Beside its manufacturing uses, it is a significant component in gasoline and fuel oil releases. Naphthalene has been grouped with the petroleum parameters discussed separately in this Fact Sheet. Other Group II PAH compounds commonly found in fuel oils include Acenaphthene, Fluorene, Phenanthrene, Pyrene, and Anthracene. PAH compounds are also reported at many contaminated construction dewatering sites located in urban settings due to former industrial activity, local power generation, coal gas production, and the historic disposal of ash from combustion.

From a technology standpoint, most of the PAH compounds are only slightly soluble in water and have high Koc values ranging from approximately 1 x 10^3 to 1 x 10^6 thus making them nearly immobile in soil and amenable to removal by carbon adsorption. EPA-NE reviewed data submitted with applications from contaminated construction site dewatering and found that groundwaters' from static monitoring wells at locations known to contain fuel oil releases, coal tars, or other PAH concentrations in soils, typically contain very low level PAH values due to their low solubility and immobility when released to the ground. However, PAH limitations and carbon treatment are found to be necessary due to the soil water mixing that occurs during construction.

All of the Group I and Group II PAH compounds have very low Henry's law constant values at the 10^{-4} to10^{-6} range. Therefore, air stripping alone would not be expected to be adequate for removal of PAH chemicals. Monitoring data received by EPA-NE, indicates that with proper treatment, the PAH compounds will be removed to detectable or laboratory reportable concentration levels (see Appendix VI of the RGP).

As can be seen from Appendix A of this Fact Sheet, the water quality standards which have been published by EPA and the States for the Group I "carcinogen" PAH compounds are all related to human health effects due to the extremely low calculated values required to be protective. The latest (November 2002) revisions to EPA's surface water criteria contain human health levels for the Group I PAHs at either 0.0038 ug/L for "water and organism" or 0.018 ug/L for "organism only" consumption. The published standards for the Group II PAHs vary considerably based on the current scientific information, however the target levels are typically orders of magnitude higher than the Group I compounds. Due to the widely varying nature of the discharges covered by this permit and the respective receiving waters quality, the proposed effluent limits are based on a conservative approach.

The Group I PAH compounds are limited at the human health concentration of 0.0038 ug/L, with compliance limits set for each compound at the most stringent minimum levels (MLs) associated with federally approved test methods (see Appendix VI of the permit). The permit also sets a technology based "default" limit of 10.0 ug/L for total Group I PAHs (sum of the individual isomers). Again, it is expected that the typical treatment technology will remove these compounds to below detection levels.

For the Group II PAH compounds, EPA-NE is proposing a technology based limit for the most common parameter, Naphthalene, at 20.0 ug/L, which is below the water quality standards. Additionally, a technology based total limit of 100 ug/L is being proposed for the Group II PAH isomers due to the variability of the water quality criteria for the individual isomer as well as the ability of adequate current treatment technology to consistently meet this limit.

Proposed Effluent Limitation for Group I PAH Compounds:

Individual Compounds Maximum Value = 0.0038 ug/L
Individual Compounds Compliance Limit = Minimum Level (ML)(see Appendix VI of RGP for MLs for each compound by EPA test method)
Total of Group I Isomers Maximum Value = 10.0 ug/L

Proposed Effluent Limitation for Group II PAH Compounds:
Naphthalene Maximum Value = 20.0 ug/L
Total of Group II Isomers Maximum Value = 100.0 ug/L

37. Polychlorinated Biphenyls (PCBs) - Chlorinated Biphenyls, commonly known as PCBs represent a group of chemical compounds produced for their specific characteristics such as insulating dielectric fluids in capacitors and transformers. Besides their use in electrical equipment, PCBs were also used as plasticizers in rubber and synthetics, adhesives, de-dusting compounds, inks, cutting oil, pesticides, and sealant compounds. Given their many uses, they are widely distributed in the environment through product use, releases or spills from electrical equipment (for example, improper disposal of appliances containing PCB capacitors) and large power transformers, as well as direct discharge from industries using PCBs.

Individual PCB congeners are categorized as Aroclors. They are identified by a four digit number, for example "Aroclor 1254," where the first two digits identify that the substance is a biphenyl and the second two digits represent the approximate weight percent of chlorine (the exception to this is Aroclor 1016 developed later in attempting to reduce the environmental threat of PCBs). Lower chlorinated Aroclors (1221, 1232, 1016, 1242, and 1248) are colorless mobile oils. Increasing chlorine content turns them into viscous liquids (1254) or sticky resin (1260 and 1262). At the high end (1268 and 1270) they are white powders.

Because of their wide distribution, there are many known PCB disposal or release sites, including sites in MA and NH, on federal or state superfund cleanup lists. Every year, there are newly discovered contamination sites, often where construction activities have been planned. Historically, there have been numerous site remediation projects involved in cleaning up PCBs where ground or surface waters have to be managed for discharge.

PCBs are only slightly soluble in water and have generally high Koc values. Therefore, they can be adsorbed to soil and sediments and are not very mobile in the environment. Since one of the characteristics of PCBs is their resistance to degradation, they tend to persist in the environment and they tend to bioaccumulate in living organisms. Due to their chemical characteristics, PCBs are not likely to be released to groundwater. However, treatment of the water is required for all cases regardless of whether the PCB is the only significant pollutant or whether there are mixtures of other pollutants at the same site. The standard treatment technology currently used for discharges to surface water is carbon adsorption.

In evaluating the water quality requirements for development of a PCB effluent limitation for this permit, EPA reviewed the current standards (see Appendix A of this Fact Sheet). PCBs are listed as a priority pollutant by EPA under the CWA, however individual congeners or Aroclors are not listed separately. EPA 's November 2002 surface water criteria document states that 'This criterion applies to total PCBs" or the sum of all congener, isomer, or Aroclor analyses. EPA has established surface water criteria for both freshwater (0.014 ug/L) and saltwater (0.03 ug/L) chronic levels as well as a human health criterion value (0.000064 ug/L 'calculated'). The EPA drinking water MCL value, as well as the MA and NH groundwater standards, is currently set at 0.5.

In setting the effluent limits for PCBs, EPA-NE is taking into consideration the toxicity, persistence and potential for bio-accumulation of PCBs in the environment. Therefore, EPA-NE is proposing an effluent limitation for Total PCB based on the current human health criterion of 0.000064 ug/L. EPA-NE has historically set a compliance limitation of 0.5 ug/L, which is the typical minimal laboratory level using EPA Method 608. Based on past performance data of control technology, EPA-NE anticipates that discharges containing PCBs, can adequately be treated to "non-detection" levels using carbon adsorption. Thus, in the RGP, EPA-NE is also setting a compliance limit at 0.5 ug/L, the minimum level (ML) associated with federally approved test method (Method 608). See Appendix VI of the RGP.

Proposed Effluent Limitation for Total Polychlorinated Biphenyls (PCBs)
Maximum Value = 0.000064 ug/L
Compliance Limit = 0.5 ug/L

39. to 50.- Metals Limitations

a. Background - Many types of metals can be found in the ground and surface waters around New England. Concentrations of these metals vary widely depending on the geology and types of activities that occurred on the site. Often, metals such as cadmium, chromium, lead, mercury, nickel, and silver, build up to toxic concentrations through industrial contamination. Many of these metals have been found in groundwater at remediation and construction de-watering sites in the region, particularly in urban areas that have had long histories of industrial and municipal activity. For example, when runoff from older industrial or municipal sites contain metals in toxic concentrations, those metals often make their way into the ground and surface waters. Other metals, such as arsenic and iron, frequently build up by leaching out of naturally occurring deposits under reducing conditions in surrounding bedrock or soils.

Human exposure to metals can lead to a variety of health problems. Severe effects include reduced growth, cancer, organ damage, nervous system damage, and in extreme cases, death. Exposure to some metals, such as mercury and lead, may also cause development of auto-immunity, in which a person's immune system attacks its own cells. This can lead to joint diseases such as rheumatoid arthritis, and diseases of the kidneys, circulatory system, and nervous system. The metals linked most often to human poisoning are lead, mercury, arsenic and cadmium. Other metals, including copper, zinc, and chromium, are actually required by the body in small amounts, but can also be toxic in larger doses.

Metals can be toxic to marine and freshwater organisms, as well as contaminating other plant and animal species. Often, water organisms are even more sensitive than humans to metals found in the water. Ultimately, metals can become concentrated in the human food chain. For instance, because of contaminated water, food sources such as vegetables, grains, fruits, fish and shellfish can become contaminated by accumulating metals from the soil and water used to grow them.

b. Selection of Parameters - To select the most appropriate metals to regulate in this general permit, EPA-NE reviewed a number of resources, including existing NPDES permits, as well as many applications and discharge monitoring reports submitted pursuant to approved site remediation projects, to determine which were most prevalent in discharges in MA and NH. The list of metal proposed for this new issuance are the existing 13 metals and one proposed new metal for the state of NH only. The selected as parameters to be limited by this general permit are:

i) Antimony, ii) Arsenic, iii) Cadmium, iv) Chromium (III), v) Chromium (VI), vi) Copper, vii) Iron, viii) Lead, ix) Mercury, x) Nickel, xi) Selenium, xii) Silver, xiii) Zinc, and Chlorides (NH Only).

Not all of EPA’s priority pollutant metals were selected for this permit, however. EPA did not select: **Beryllium, Thallium, Manganese,** and **Barium**. The most significant reasons for not including a particular metal (s) include the infrequency in which it has been reported at sites, lower toxicity, and probable removal of the contaminant along with other included chemicals by standard technology.

c. Selection of Limits - To establish appropriate effluent limitations for these selected metals, EPA-NE evaluated both the technology and water quality-based information currently available, including: the substantial information contained in monitoring reports from site remediation projects in MA and NH, the published technology information available on various EPA and other internet sites, and the various water quality and cleanup standards published by EPA and the States (see Appendix A of this Fact Sheet). In general, technology-based effluent limitations are sufficient to meet the most conservative water quality standards. The available information indicates that, with few exceptions, properly designed and operated treatment units, including: ion exchange, gravity settling, carbon adsorption, and chemical sequestration, can routinely achieve the effluent concentration limits set in this permit.

In fact, many of these metals have similar physical or chemical characteristics which are important in evaluating the appropriate control or removal technologies. EPA expects that several of the metals will be removed by employing the same control technologies. However, as a precaution, applicants will be required to identify all metals found, or believed to be present, at a site and include them in the NOI for evaluation by EPA or the States.

As noted above, many of the metals limited by this permit are more toxic to aquatic organisms than to humans. Generally, the EPA human health criteria are set at higher concentrations than those needed to protect aquatic life based on the available published "lowest observed effects levels" (LOELs) for aquatic life (see Appendix A of this Fact Sheet). Therefore, for most of the metals, rather than basing the limits on the human health criteria, EPA has adopted the more conservative of the acute or chronic water quality criteria, as effluent limitations.

However, as with Benzene and several of the chlorinated volatile solvents, EPA-NE is proposing to establish technology based effluent limitations for Arsenic and Iron. These limits are slightly higher than the human health criteria. However, EPA-NE has evaluated the need for water quality-based effluent limitations for these contaminants and determined that except in rare circumstances, a health based limit is not necessary for the types of discharges covered by this permit for a number of reasons.

First, human health-based standards are typically developed to achieve certain risk-based concentrations based on long-term (e.g., 70 year or lifetime) exposure to the toxic material. However, the majority of discharges anticipated to be covered by the RGP are short duration (e.g., from a few days to 1-2 years). Second, the discharges covered by this permit are typically small volume discharges, designed with flow rates of a few gallons up to about 30 gallons per minute (approximately 40,000 gpd).

Third, because a general permit is designed for a variety of potential situations, the effluent limitations have been set conservatively assuming zero dilution. But low flow or zero flow waters are not typically used as sources of drinking water. Furthermore, discharges to public drinking water supply (Class A waters) are essentially excluded from coverage under the permit. Also, in many instances, there will be some flow or dilution available in the receiving water. While not formerly considered in setting these limits, EPA believes that the long term human health risks will be effectively mitigated by the combination of the technology based limits and the dilution found in typical receiving waters .

Finally, if any notice of intent (NOI) for discharge under this permit indicates unusual circumstances where the effluent limitation compounds may be problematic or human health criteria based limits are needed, EPA will issue an individual permit.

d. Consideration of Hardness - The metals parameters and limitations proposed in this general permit are being considered similar to the way that EPA sets metals limits in most individual permits where the dischargers are not subject to effluent guidelines (as with discharges covered by this permit). With such discharges, as well as other discharges where a water quality based limit is needed, EPA uses its Recommended Criteria values for freshwater and saltwater, adjusted for hardness (where hardness dependent) and converts them to "Total Recoverable Metal" limits in the permit.

Generally, national water quality based criteria and effluent limits for metals are expressed at a hardness (H) value of 100 mg/L as calcium carbonate (CaCO3) in the receiving water. While this value may be appropriate for setting national criteria and limits, when setting more localized limits, e.g., in permits, the hardness value should be adjusted to reflect regional or local conditions. In determining the hardness dependent limits in this permit for dischargers in MA and NH, EPA has calculated the base limit for each metal using the current chronic criteria level for both freshwater and saltwater based on the National Criteria value. EPA has then adjusted the metals limits to an assumed average hardness of 50 mg/L as CaCO3 for sources in MA and 25 mg/L as CaCO3 for sources in NH. See Table VIII below and Appendices III and IV of the RGP. For coverage under the RGP, the limits calculated at these assumed hardness values apply.

The following is an explanation of the calculation that EPA used to determine the total recoverable limits for metals at the assumed hardness values. The Freshwater (FW) effluent limitations for metals included in Appendix III of the RGP for metals are presented as "Total Recoverable Metals" after application of appropriate conversion factors from dissolved metal at zero dilution. For "hardness dependent" metals, the values have been assumed at Hardness (H) = 50 mg/l for sources located in Massachusetts and H = 25 mg/l for sources located in New Hampshire. The water quality criterion values are the latest EPA published values as shown in Appendix A of the Fact Sheet and contained in EPA publication, "National Recommended Water Quality Criteria: 2002" (822-R-02-047), November 2002.

Additional information can be obtained at EPA and the States' web sites, including:
http://www.gencourt.state.nh.us/rules/env-ws1700.html
http://www.mass.gov/dep/bwp/iww/files/314cmr4.htm
http://www.epa.gov/ost/standards/wqslibrary/

For the assumed receiving water hardness concentrations in MA and NH, the RGP effluent limitations shown in Appendix III for metals have been adjusted according to the formulas provided in EPA's water quality publications as follows:

Chronic Criteria (CCC) - Used for RGP effluent limitations

CCC (dissolved) = exp {mc[ln(hardness)]+bc}

Where: CCC = Criteria Continuous Concentration

mc and bc = Pollutant-specific constants for calculating freshwater dissolved metals criteria for those metals which are hardness dependent

hardness = Receiving water column hardness in mg/l as $CaCO_3$

Total Recoverable Metal - EPA is required by 40 CFR Section 122.45(c) to express NPDES permit limitations as "total recoverable metal." In the following discussion, a conversion factor (CF) was applied to the dissolved metal criteria value in order to convert it to the total recoverable metal limits that appear in Appendix III of the RGP. See EPA publication, "National Recommended Water Quality Criteria: 2002" (822-R-02-047), November 2002, for applicable conversion factors.

Total recoverable metal concentration = (Dissolved concentration)/(CF)

e. Consideration of Dilution Factors - Under the RGP, dilution factors may be applied to the discharge concentrations of **metals only** and **only for discharges to freshwater**. Before applying a dilution factor, dischargers must first determine if the undiluted effluent would have the "reasonable potential" for violation of the applicable WQS and whether there is a need for additional treatment specific to metals removal. In the NOI, the permit applicant must select the appropriate parameters and, if necessary, an appropriate DF, where discharges of metals require effluent limits.

To facilitate the calculation of metals limits at various dilution ranges and hardness values of receiving waters, Appendix IV of the RGP contains the total recoverable metals limitations at selected dilution ranges and hardness values. Applicants must follow the two step process below to determine if dilution for metals is appropriate and if so, which limit in Appendix IV of the RGP applies to their discharge. EPA and MA or NH will approve or disapprove of the proposed effluent limitations during the application (NOI) process.

Step 1: Calculate Reasonable Potential - The applicant must evaluate all metals known or suspected to be present in the discharge subject to this permit. Additionally, certain "naturally occurring" metals such as dissolved and/or total Iron must also be evaluated since one of the primary purposes of the RGP is to control the discharge of contaminated ground waters to surface water which may have a lower background concentration of that metal in the water column. Also, in cases where the waters to be discharged may be mixed with contaminated soils such as at excavation sites, the applicant should also consider the mass concentrations (ug/kg) of metals in the soil and the potential for additional contamination of the water being managed due to soil/water mixing. Analysis for soil contamination is typically conducted at excavation sites due to state hazardous waste requirements for soil disposal.

Based on the concentration of each metal, an initial evaluation assuming "zero" or "no" dilution in the receiving water should be performed. Examples of zero dilution include extremely low flow or intermittent streams, wetlands, ditches or other conveyances to free flowing surface waters. The metal concentrations in the untreated (intake) waters should then be compared to the limits calculated at zero dilutions, i.e., the limits contained in Appendix III of the RGP. Metals with concentrations below these "baseline" concentrations may be excluded from further evaluation and are not subject to further permit limitations or monitoring requirements.

Step 2: Calculate Dilution Factor - Proposed discharges with metals concentrations exceeding the zero dilution baseline limits in Appendix III must then be evaluated by calculating a dilution factor (DF) in the receiving water. For sites/facilities located in Massachusetts, the applicant will need to calculate a dilution factor for metals. For sites/facilities in New Hampshire, the applicant will need to work with the NHDES in order to calculate the dilution factor. The dilution factor is then used to determine which effluent limit in Appendix IV of the permit applies. The basic calculation is as follows:

For facilities in NH:

DF = {(Qd + Qs)/Qd} 0.9

Where: **DF = Dilution Factor**

Qd = Permitted flow rate of the discharge in cubic feet per second (cfs) (1.0 gpm = .00223 cfs)

Qs = Receiving water 7Q10 flow where,

7Q10 = The minimum flow for 7 consecutive days with a recurrence interval of 10 years

0.9 = Allowance for reserving 10% of the assets in the receiving stream as per Chapter ENV-Ws 1700, Surface Water Quality Regulations

For Example:

a) A 100 gpm discharge into a stream with 7Q10 = 1 cfs : DF = 4.9
b) A 50 gpm " " " = 1 cfs : DF = 8.7
c) A 25 gpm " " " = 3 cfs : DF = 47.9
d) A 45 gpm " " " = 10 cfs : DF = 87.9

And in Massachusetts:

DF = (Qd + Qs)/Qd

Where:

DF = Dilution Factor
Qd = Maximum flow rate of the discharge in cubic feet per second (cfs) (1.0 gpm = .00223 cfs)
Qs = Receiving water 7Q10 flow where,
7Q10 = The minimum flow for 7 consecutive days with a recurrence interval of 10 years

For Example:

a) A 100 gpm discharge into a stream with 7Q10 = 1 cfs : DF = 5.5
b) A 50 gpm " " " = 1 cfs : DF = 10
c) A 25 gpm " " " = 3 cfs : DF = 55
d) A 45 gpm " " " = 10 cfs : DF = 100.

The 7Q10 for receiving water may be estimated by use of available information such as nearby USGS stream gauging stations directly or by application of certain "flow factors," using historic stream flow publication information, calculations based on drainage area, information from state water quality offices, or other means. In many cases the States of MA and NH have calculated 7Q10 information using "flow factors" for a number of streams in the state. The source of the low flow value(s) used by the applicant must be included on NOI application form. Flow data can also be obtained from web applications such as STREAMSTATS (for MA) located at: http://ma.water.usgs.gov/streamstats/. As described above, for sites in New Hampshire, the applicant must contact the State for this information.

Once the DF is calculated, the corresponding maximum effluent limitations for the various metals can be obtained from the appropriate DF range column on Appendix IV of the RGP. If the intake (untreated) water concentrations are less than the value given, no further limitations or monitoring for that metal is required. All other metals exceeding the maximum value must be treated or otherwise controlled to less than the limit prior to discharge. Due to the variability of site information obtained from studies, monitoring wells, or other up-front testing, the operator must assume a conservative approach and include parameters for limitation and monitoring which may exceed the maximum limits during the life of the discharge. The person signing the NOI application form will be responsible for insuring the accuracy of this information.

In order to assist the applicants in determining the applicable metals limits, in the Appendix IV of the RGP, we have listed the freshwater metal limits at the most common dilution ranges, as well as a "Ceiling Value" never to be exceeded, regardless of dilution. The ceiling value limits are generally based on published effluent guidelines (e.g., metal finishing point source category - 40 CFR Part 433; centralized waste treatment - 40 CFR Part 437; landfills - 40 CFR Part 455; etc.), where technology based limits have been set by regulation. These ceiling values are often more stringent than the limit calculated at higher dilutions but given the existence of the regulatory limits, EPA believes that these ceiling values are achievable using standard technology.

<u>f. Description and Rationale for Limits</u> - Below is a brief description of and limit for each of the selected metals:

Antimony - EPA has set the antimony limits in this general permit considering a number of factors, including: the water quality criteria and the surface water limits in MA and NH (see Appendix A of this Fact Sheet). EPA has not published fresh water or salt water acute or chronic quality criteria for antimony. But, EPA's human health criteria for antimony are 5.6 ug/L (water and organism) and 640 ug/L (organism only). In New Hampshire, the surface water standards for antimony are 9,000 ug/L (acute) and 1,600 ug/L (chronic) for freshwater. NH's human health criteria are 14 ug/L (water and organism) and 4,300 ug/L (organism only). Based on the performance of control technology currently in use, EPA is setting the total recoverable limitation for antimony at 5.6 ug/L, the national human health criterion for surface water.

Arsenic - EPA has set the arsenic limits in this general permit considering a number of factors, including: the water quality criteria, the surface water limits in MA and NH (see Appendix A of this Fact Sheet), and other available information. EPA's water quality criteria and the surface water standards for arsenic in NH are 340 ug/L (freshwater acute), 150 ug/L (freshwater chronic), 69 ug/L (saltwater acute), and 36 ug/L (saltwater chronic). However, based on the performance of the types of technology currently in use, EPA is setting a technology based limit at 10 ug/L for freshwater. For saltwater, the permit limit is 36 ug/L, based on the saltwater chronic criteria value.

Cadmium - EPA has set the cadmium limits in this general permit considering a number of factors, including: the water quality criteria, the MCL, and the existing limits in MA and NH (see Appendix A of this Fact Sheet). EPA's water quality criteria for cadmium are 2.0 ug/L (freshwater acute at hardness of 100 mg/L $CaCO_3$), 0.25 ug/L (freshwater chronic at hardness of 100 mg/L CaCO3), 40 ug/L (saltwater acute), and 8.8 ug/L (saltwater chronic). NH's surface water standards for cadmium are 0.95 ug/L (freshwater acute at a hardness of 25 ug/L CaCO3), 0.8 ug/L (freshwater chronic at a hardness of 25 ug/L CaCO3), 42 ug/L (saltwater acute), and 9.3 ug/L (saltwater chronic).

Using the most conservative of the criteria, EPA is basing the limits for cadmium on the fresh and salt water chronic criteria values. Since cadmium is hardness dependent, in this permit, EPA has set the total recoverable metal limitation for cadmium separately for MA and NH due to different average hardness values for receiving waters. Based on the water quality criteria for chronic exposure, for discharges to freshwater in MA, the limit is 0.2 ug/L (based on a hardness of 50 ug/L CaCO3) and for discharges to freshwater in NH, the limit is 0.8 ug/L (based on a hardness of 25 ug/L CaCO3). For saltwater, the limit for MA is 8.9 ug/L and 9.3 ug/L for NH.

Chromium - EPA has set the chromium limits in this general permit considering a number of factors, including the water quality criteria, the MCL, and the existing limits in MA and NH (see Appendix A of this Fact Sheet). EPA's water quality criteria for chromium III (trivalent) is 570 ug/L (freshwater acute at hardness = 100 mg/L CaCO3) and 74 ug/L (freshwater chronic at hardness = 100 mg/L CaCO3). EPA does not have criteria for chromium III in saltwater. For chromium VI (hexavalent), EPA's water quality criteria and NH's surface water standards are 16 ug/L (freshwater acute), 11 ug/L (freshwater chronic), 1100 ug/L (saltwater acute), and 50 ug/L (saltwater chronic). In MA and NH, the groundwater standard for chromium III is 100 ug/L and in MA, the groundwater standard for chromium VI is 50 ug/L.

Since the concentration of chromium III, or Cr^{+3}, is dependent on the hardness of the receiving waters, in this permit, EPA is setting the total recoverable metal limitation for Cr^{+3} in freshwater separately for MA and NH due to different assumed average hardness values for receiving waters. For discharges to freshwater in MA, the Cr^{+3} limit is 48.8 ug/L (based on a hardness of 50 mg/L CaCO3). For discharges to freshwater in NH, the Cr^{+3} limit is 27.7 ug/L (based on a hardness of 25 mg/L CaCO3). These limits are based on EPA's chronic water quality criteria for Cr^{+3}. EPA does not currently have saltwater criteria. Therefore, for saltwater in both States, the Cr^{+3} limit in this permit is set at 100 ug/L, based on the performance of current technology.

Since the concentration of chromium (VI), or Cr^{+6}, is not dependent on the hardness of the receiving waters, EPA has set the same Cr^{+6} limit for both MA and NH. Based on the national recommended water quality criteria for chronic exposure, EPA is setting the total recoverable limits for Cr^{+6} at 11.4 ug/L for freshwater and 50.3 ug/L for saltwater.

Copper - EPA has set the copper limits in this general permit considering a number of factors, including: the water quality criteria, the MCL, and the existing limits in MA and

NH (see Appendix A of this Fact Sheet). EPA's water quality criteria for copper are 13 ug/L (freshwater acute at hardness = 100 mg/L CaCO3), 9 ug/L (freshwater chronic at hardness = 100 mg/L CaCO3), 4.8 ug/L (saltwater acute), and 3.1 ug/L (saltwater chronic). Using the most conservative of the criteria, EPA is basing the limits for copper on the fresh and salt water chronic criteria values. Since the concentration of copper (Cu) is dependent on the hardness of the receiving waters, in this permit, EPA is setting the total recoverable metal limitation separately for MA and NH due to different assumed average hardness values for their receiving waters. For discharges to freshwater in MA, the Cu limit for this permit is 5.2 ug/L (based on a hardness of 50 mg/L CaCO3). For discharges to freshwater in NH, the Cu limit is 2.8 ug/L (based on a hardness of 25 mg/L CaCO3). For saltwater in both States, the Cu limit is 3.7 ug/L.

Lead - EPA has set the lead limits in this general permit considering a number of factors, including: the water quality criteria, the MCL, and the limits in MA and NH (see Appendix A of this Fact Sheet). EPA's water quality criteria for lead are 65 ug/L (freshwater acute at hardness = 100 mg/L CaCO3), 2.5 ug/L (freshwater chronic at hardness = 100 mg/L CaCO3), 210 ug/L (saltwater acute), and 8.1 ug/L (saltwater chronic). Using the most conservative of the water quality criteria, EPA is basing the limits for lead on the fresh and salt water chronic criteria values. Since the concentration of Pb is dependent on the hardness of the receiving waters, in this permit, EPA is setting the total recoverable metal limitations separately for MA and NH due to different assumed average hardness values for their receiving waters. For discharges to freshwater in MA, the Pb limit is 1.3 ug/L (based on a hardness of 50 mg/L CaCO3). For discharges to freshwater in NH, the Pb limit is 0.5 ug/L (based on a hardness of 25 mg/L CaCO3). For saltwater in both States, the Pb limit is 8.5 ug/L.

Mercury - EPA has set the mercury limits in this general permit considering a number of factors, including: the water quality criteria, the MCL, and the limits in MA and NH (see Appendix A of this Fact Sheet). EPA's water quality criteria for mercury are: 1.4 ug/L (freshwater acute), 0.77 ug/L (freshwater chronic), 1.8 ug/L (saltwater acute), and 0.94 ug/L (saltwater chronic). While NH has human health criteria of 0.05 ug/L (water only) and 0.051 ug/L (water + organism) which were based on EPA's previous criteria, EPA published new human health criteria for organic mercury (methyl-mercury) as of January 8, 2001 as 0.3 mg/kg. At that time, EPA's prior human health criteria were withdrawn. Therefore, rather than basing the mercury limit on the withdrawn criteria, EPA is proposing a limit based on the national recommended water quality criteria chronic values expressed as the total recoverable mercury at 0.9 ug/L for freshwater and 1.1 ug/L for saltwater.

Nickel - EPA has set the nickel limits in this general permit considering a number of factors, including: the water quality criteria, the MCL, and the limits in MA and NH (see Appendix A of this Fact Sheet). EPA's water quality criteria for nickel are 470 ug/L (freshwater acute at hardness = 100 mg/L CaCO3), 52 ug/L (freshwater chronic at hardness = 100 mg/L CaCO3), 74 ug/L (saltwater acute), and 8.2 ug/L (saltwater chronic). Using the most conservative of the criteria, EPA is basing the limits for nickel on the fresh and salt water chronic criteria values. Since the concentration of Ni is dependent on the hardness of the receiving waters, in this permit, EPA is setting the total recoverable metal limitations separately for MA and NH due to different assumed average hardness values for their receiving waters. For discharges to freshwater in MA, the Ni limit in this permit is 29.0 ug/L (based on a hardness of 50 mg/L CaCO3). For discharges to freshwater in NH, the Ni limit in this permit is 16.1 ug/L (based on a hardness of 25 mg/L CaCO3). For saltwater in both States, the Ni limit is 8.2 ug/L.

Selenium - EPA has set the selenium limits in this general permit considering a number of factors, including: the water quality criteria, the MCL, and the limits in MA and NH (see Appendix A of this Fact Sheet). EPA's water quality criteria for selenium are 5.0 ug/L (freshwater chronic), 290 ug/L (saltwater acute), and 71 ug/L (saltwater chronic). EPA does not have an acute freshwater criteria for selenium. Based on the most conservative national recommended water quality criteria, i.e., the chronic values, EPA is setting the total recoverable limits for selenium at 5.0 ug/L for freshwater and 71 ug/L for saltwater.

Silver - EPA has set the silver limits in this general permit considering a number of factors, including: the water quality criteria, the MCL, and the limits in MA and NH (see Appendix A of this Fact Sheet). EPA's water quality criteria for silver are 3.2 ug/L (freshwater acute at hardness of 100 ug/L CaCO3) and 1.9 ug/L (saltwater acute). EPA has not published water quality criteria for chronic exposure to silver. Using the most conservative of the criteria, i.e., the fresh and salt water acute values, EPA is basing the limits for silver on the acute criteria values. Since the concentration of silver is dependent on the hardness of the receiving waters, in this permit, EPA is setting the total recoverable silver limitations separately for MA and NH due to different assumed average hardness values of their receiving waters. For discharges to freshwater in MA, the silver limit in the RGP is 1.2 ug/L (based on a hardness of 50 mg/L CaCO3). For discharges to freshwater in NH, the silver limit in the RGP is 0.4 ug/L (based on a hardness of 25 mg/L CaCO3). For saltwater in both States, the silver limit is 2.2 ug/L.

Zinc - EPA has set the zinc limits in this general permit considering a number of factors, including: the water quality criteria, the MCL, and the limits in MA and NH (see Appendix A of this Fact Sheet). EPA's water quality criteria for zinc are 120 ug/L (freshwater acute at hardness of 100 mg/L CaCO3), 120 ug/L (freshwater chronic at hardness of 100 mg/L CaCO3), 90 ug/L (saltwater acute), and 81 ug/L (saltwater chronic). Using the most conservative of the criteria, EPA is basing the limits for zinc on the fresh and salt water chronic criteria values. Since the concentration of zinc is dependent on the hardness of the receiving waters, in this permit, EPA is setting the total recoverable metal limitations separately for MA and NH due to different assumed average hardness values for their receiving waters. For discharges to freshwater in MA, the zinc limit in the RGP is 66.6 ug/L (based on a hardness of 50 mg/L CaCO3). For discharges to freshwater in NH, the zinc limit in the RGP is 37 ug/L (based on a hardness of 25 mg/L CaCO3). For saltwater in both States, the zinc limit is 85.6 ug/L.

Chloride - This is a new requirement for NH permittees. NHDES has decided to include the chloride requirement because chloride is present in groundwater near highways and salt sheds. In certain water bodies there will be reasonable potential that the chronic water quality standard for chloride will be violated. NHDOT is aware the cumulative capacity of this pollutant on NH roads and highways if remain untreated will causes a water quality concern for the state agency.

The relevant state statute and rules for the need for chloride limits is identical to that for metals indicated above for the State of NH this includes RSA 485-A:13, I(a), Env-Wq 1700, and specifically the “no toxics” prohibition in Env-Wq 1703.21(a) and the criteria for toxic substances in Env-Wq 1703.21(b). Similarly to metals, the limits for chloride are based on dilution. One exception to this is for chloride impaired waters where the limit would need to be equal to the water quality standard of 230 mg/l. Please see NH’s Appendix IV.

Iron - EPA-NE has reviewed many treatment system operational reports and monitoring reports which outline common treatment system operation and maintenance problems which develop as a result of high levels of naturally occurring iron in groundwater in New England. Iron in groundwater (ferrous Fe^{+2}) will oxidize to insoluble ferric hydroxide (Fe^{+3}) upon mixing and exposure to air. As Fe^{+3}, it will foul the treatment units, cause growth of iron bacteria in the units, and may discolor the effluent or cause localized sediment deposits in storm drains or receiving waters.

Some operators add chemical sequestering agents specifically developed to keep the ferrous iron in solution through the treatment units and into the discharge due to the added expense of pre-treatment and iron removal. Since most of the discharges covered by the RGP are from contaminated ground waters which may contain elevated iron concentrations, two issues affecting surface water quality need to be addressed: 1) transfer of high iron content ground water to the surface water (e.g. system pass-thru) and 2) impacts on treatment efficiency of the system being used to control the primary chemicals of concern in the discharge.

Table VIII - Proposed Effluent Limitation for Metals:

Parameter	Maximum Value (ug/L)			
	@ H = 50 mg/L CaCO3 (for dis-charges in MA)		@ H = 25 mg/L CaCO3 (for dis-charges in NH)	
Antimony	5.6		5.6	
Arsenic	FW[1]= 10	SW[2] = 36	FW= 10	SW = 36
Cadmium	FW = 0.2	SW = 8.9	FW= 0.8	SW = 9.3
Chromium III	FW = 48.8	SW = 100	FW= 27.7	SW = 100
Chromium VI	FW = 11.4	SW = 50.3	FW= 11.4	SW = 50.3
Chloride	------------	--------------	FW=230	-------------
Copper	FW = 5.2	SW = 3.7	FW= 2.8	SW = 3.7
Lead	FW = 1.3	SW= 8.5	FW = 0.5	SW = 8.5
Mercury	FW = 0.9	SW = 1.1	FW= 0.9	SW = 1.1
Nickel	FW = 29.0	SW = 8.2	FW= 16.1	SW = 8.2
Selenium	FW = 5.0	SW = 71	FW= 5.0	SW = 71
Silver	FW = 1.2	SW = 2.2	FW= 0.4	SW = 2.2
Zinc	FW = 66.6 SW=85.6		FW = 37 SW = 85.6	
IRON	FW= 1000	SW = 0	FW= 1000	SW = 00

Water Quality Derived Limits

These provisions include:

A. Solids, Color, and Turbidity

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[1]FW = freshwater.

[2]SW = saltwater.

While the RGP contains numeric effluent limitations for total suspended solids (TSS), there are no numeric limits on color or turbidity in the RGP. EPA-NE has determined that narrative requirements are sufficient to insure that discharges covered by the permit do not violate state water quality standards.

B. pH

The pH of a discharge water is an indicator of the relative acidity or alkalinity of that water. The States have established numeric water quality criteria for pH for classes of surface water to protect sensitive species. It has been common practice for EPA and the States to establish effluent limitations for pH equal to the ranges (low-high) established for the class of receiving water. In Massachusetts, the operator may demonstrate that a lower or higher pH may be discharged within a narrow set of conditions but in no case outside of the range 6.0 - 9.0 s.u.

The pH requirements established as common conditions for all categories of dischargers covered by the RGP are shown in Table IX below.

Table IX: pH Limitations

State	Water Classification	pH Limitation
Massachusetts	Class A (Water Supply)	Discharge Prohibited 3
	Class A and B	6.5-8.3 S.U.
	Class SA	6.5-8.5 S.U.
New Hampshire	Class A	Discharge Prohibited4
	Class B	6.5-8.0 S.U.

C. Total Residual Chlorine (TRC)

[3] Discharges to Outstanding Resource Waters in Massachusetts, as defined by 314 CMR 4.06(3), including Public Water Supplies (314 CMR 4.06(1)(d)1.) which have been designated by the state as Class A waters, are prohibited, unless a variance is granted by MADEP under 314 CMR 4.04(3)(b).

[4]Discharges to Outstanding Resource Waters in New Hampshire, as designated by RSA 483:7-a are prohibited, unless allowed under Env-Ws 1708.05(b).

Chlorine compounds may be added during certain types of activities covered by the RGP or in other cases, as necessary for maintaining treatment systems. Among other activities, chlorine compounds may be used in well rehabilitation, pipeline and tank cleaning and hydrostatic testing, as well as for algae and bacteria control in treatment units. Activities covered by the RGP do not manage sanitary wastes or domestic sewage, thus chlorine is not routinely used as a disinfectant, however in certain situations such as at construction sites, incidental domestic sewage may be encountered in which case disinfection may be required. In cases where chlorine or chlorine compounds are added to the waters being managed under the RGP, de-chlorination of the effluent would be required.

D. Iron Fouling, Deposition, and Related Water Quality Issues

EPA-NE has reviewed many operational and monitoring reports which describe common operation and maintenance problems which develop as a result of high levels of naturally occurring iron in groundwater in New England. In general, iron in groundwater (ferrous Fe^{+2}) oxidizes to insoluble ferric hydroxide (Fe^{+3}) on mixing and exposure to air and fouls the treatment units, causes growth of iron bacteria in the units, and may discolor the effluent or cause localized sediment deposits in storm drains or receiving waters. To avoid this problem, some operators add chemical sequestering agents specifically developed to keep the ferrous iron in solution through the treatment units and into the discharge. From a control technology standpoint, the concentration of iron in the influent is also important to consider. High concentrations of iron can adversely affect the performance of the equipment designed to remove the other hazardous compounds (e.g., petroleum, volatile organic compounds, other heavy metals, etc.) of the discharge.

Since most of the discharges covered by the RGP are from contaminated ground waters which may contain elevated iron concentrations, two issues affecting surface water quality need to be addressed: i) the transfer of high iron content ground water to the surface water (e.g. system pass-thru) and ii) the impacts on treatment efficiency of the system being used to control the primary chemicals of concern in the discharge.

EPA-NE recognizes that iron compounds are generally not toxic in the environment. However, excessive amounts of iron may cause or contribute to violations of water quality standards including color, turbidity, solids, and odor. The EPA has considered the fact that iron may be “naturally occurring” and that treatment systems are designed primarily for control of more toxic pollutants in balancing the need for an effluent limit for total iron versus the added costs of treatment and the impact on receiving water quality.

Based on the water quality standards and criteria, as well as technology considerations and the information available to the Region from discharge reports, the RGP contains a number of iron-specific requirements. First, the permit requires monitoring information regarding dissolved iron concentrations in the influent and effluent. Second, the permittee is required to submit Material Safety Data Sheets (MSDS) for chemical additives used to control iron fouling prior to use. Finally, the RGP sets an iron limit of 1,000 ug/L (ppb) as an effluent limitation for total recoverable iron for discharges to receiving waters at zero to five dilutions. At five dilutions or more, the RGP sets the discharge limit for iron at 5,000 ug/L since an iron concentration greater than 5,000 ug/L (5 mg/L) causes iron fouling of the control system.

E. Heat

In most cases, the activities covered by the general permit are not expected to raise the temperature of the receiving water, however, there are groundwater remediation technologies that heat the water prior to treatment. Therefore, EPA-NE is including a daily maximum temperature limit for discharges from the activities covered by the RGP. The applicable temperature limit depends on whether the receiving water is a warm or cold water fishery, i.e., 83 degrees Fahrenheit for warm water fisheries or 68 degrees Fahrenheit for cold water fisheries. This approach is based on the limits set in water quality standards and EPA-NE's general permit for non-contact cooling water (FR 65, No. 80, pp. 24195, April 25, 2000).

Additionally, for sites located in Massachusetts, the RGP includes a maximum change in temperature limit as well. See Table X below.

Table X: Maximum Change in Temperature for Discharges under the RGP

Class of Water Body	Type of Fishery or Subcategory	Maximum Change in Temperature
A		1.5 ^{o}F
B	Warm Water	5 ^{o}F
	Cold Water and Lakes/Ponds	3 ^{o}F
SA	Coastal	1.5 ^{o}F
SB	June – October	1.5 ^{o}F
	October – June	4 ^{o}F

F. Use of Chemical Additives

Chemical agents are commonly utilized for enhancement of wastewater treatment, for the control of undesirable conditions caused during treatment, or due to the chemical makeup of the water being treated. For example, chemical additives are used to control foaming, algae and bacteria growth, and are added to control “naturally occurring” dissolved iron or other minerals in groundwater which may foul treatment systems, discolor the discharge, or cause sediments in the receiving water. While many additives are advertized as being “non-toxic” or “biodegradable”, there are instances where specific compounds in the additive may be unacceptable for discharge to certain receiving waters.

EPA-NE has reviewed many requests for chemical addition along with various cover letters, monitoring reports and other information submitted by consultants for use of chemical additives pursuant to approved site remediation projects in MA and NH. Typically EPA-NE has required the Material Safety Data Sheets (MSDS) for the proposed product to be submitted for review prior to approving chemical additives. When filing the NOI for coverage under this permit, the operator must identify the chemical additives being used or proposed to be used, the purpose of use of the additive, and attach the MSDS sheet(s) for the additive(s). EPA may request further information regarding the chemical composition of the additive, potential toxic effects, or other information to insure that approval of the use of the additive will not cause or contribute to a violation of state water quality standards.

Approval of coverage under the RGP will constitute approval of the use of the chemical additive(s) that are described in the Notice of Intent (NOI). If coverage of the discharge under the RGP has already been granted and the use of a chemical additive becomes necessary, the operator must submit a Notice of Change (NOC) (see Appendix V of the RGP).