United States
Environmental Protection
Agency

Region 10
1200 Sixth Avenue
Seattle WA 98101

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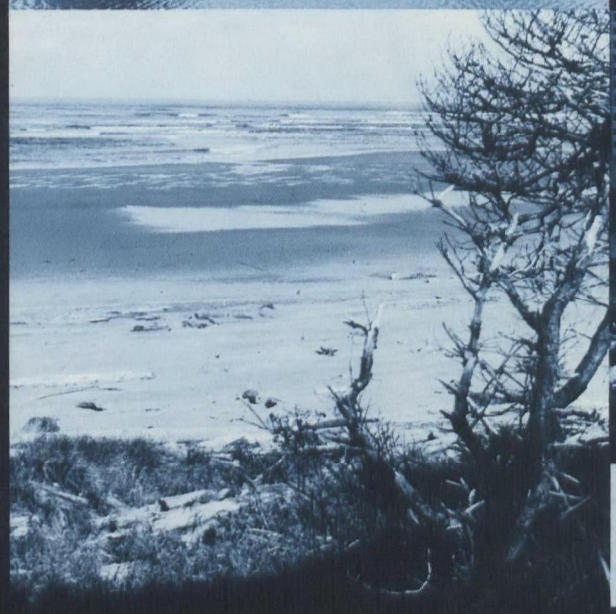
EPA

Washington

Environmental Quality Profile



Preface

This is the third annual report to the people of the State of Washington regarding the status of their environment. Information presented has been compiled by the Environmental Protection Agency (EPA) from numerous sources in the state and local government, especially the State Department of Ecology, as well as from other institutions.

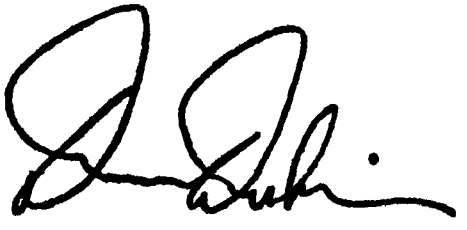
The report discusses progress in environmental preservation that has been made to date, addresses some of the related problems and issues faced by the people of the state, and identifies some solutions to those problems and issues.

The Northwest is growing—more industry attracts more people—and the results of that growth are not always environmentally beneficial. Consequently, the state faces a challenge: accommodating increased growth while retaining its greatest resource, a beautiful and healthy environment.

Naturally, the traditional industrial and muncipal pollution sources are of concern, but many of the region's problems are due to nontraditional sources of pollution. Agricultural and forest practices can significantly affect water quality especially on rivers with consistently low stream flows. Many chemicals, including some pesticides and herbicides have serious health effects that have been recognized only recently. Urban development itself, separate from industry, creates diverse pollution problems affecting the air, water, and land.

While Washington State and the Northwest may be seen as relatively environmentally "clean" when compared to other parts of the nation, continuing efforts are necessary to maintain that status, as well as to better understand and resolve current regional problems. An informed public is essential to this effort, and it is hoped that this document will provide a better perspective on some crucial resource management issues facing the state as well as the nation.

Space limits a complete presentation of many complex technical issues, therefore the reader interested in additional information is invited to contact the Region 10 office of EPA in Seattle for other publications that contribute to increased understanding of specific topics. Comments and suggestions are also solicited regarding improvements to future issues of this publication.



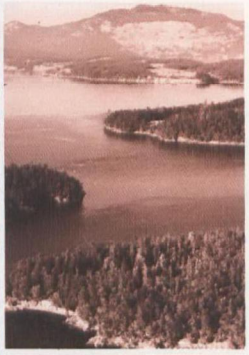
Donald P. Dubois
Regional Administrator, Region 10
U.S. Environmental Protection Agency
Seattle, Washington

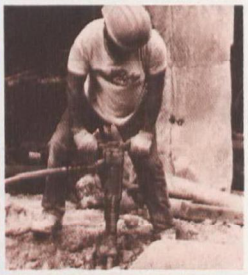
September, 1979

Washington Environmental Quality Profile
Errata Sheet

Page	Change		
2	**Figure 2**	—	Color in chart should be light blue - secondary standards exceeded.
3	**Figure 4**	—	Spokane County is brown - alert levels exceeded for CO.
4	**Figure 7**	—	Key for "standards attained" should be dark blue.
5	**Figure 8**	—	Vancouver CO box should be light brown - "primary standards exceeded".
	Figure 9	—	Key for "secondary standards exceeded" should be light blue.
11	**Figure 13**	—	Key should be corrected as follows: "unacceptable" should be brown, "no monitoring" should be gray, and a blank box should be added indicating "no data available for trend analysis".
14	**Figure 16**	—	Final portions of bars for the Spokane and Klamath Rivers should be gray.
17	**Figure 19**	—	Green Lake, Lake Sammamish and Long Lake should all be light brown.
19	**Figure 21**	—	Key for "conditionally approved" should be light brown; "closed to commercial harvesting" should be dark brown.

Contents/Summary





Summary of Environmental Indicators for Washington

MEDIA	INDICATOR	CURRENT STATUS	TREND
Air Quality	Number of areas exceeding standards	8	Little change
River Water Quality	Percentage of monitoring stations meeting water quality goals (based on worst 3 months)	50%	Little change
Lake Water Quality	Percentage of major recreational lakes with little or no use impairment	50%	Little change
Marine Water Quality	Percentage of classified shellfish harvesting waters open	68%	Little change
Drinking Water Quality	Percentage of population served by water supplies in compliance with regulations for bacterial contamination	77%	Improving
	Percentage of community water supplies in compliance with regulations for bacterial contamination	17%	Improving
Noise	Percentage of population living in areas with local noise control standards meeting state objectives	100%	Little change
	Degree to which noise control regulations are enforced	Fair	Improving
Solid Waste Disposal	Number of resource recovery or recycling facilities available	29	Improving
	Number of hazardous waste handling sites	4	Improving

Air Quality

The task of improving air quality in the Northwest continues to be a cooperative effort among Federal, state, and local environmental agencies, industry, and a concerned, informed public. Since the 1970 Clean Air Act, considerable investment has been made in time and money in the search for solutions to the most pressing pollution problems. However, much remains to be done, and this section gives some insight into the types of air quality problems faced by the citizens of Washington State.

Air Quality Standards — Their History and Definition

The Clean Air Act of 1970 directed EPA to establish National Ambient Air Quality Standards ("ambient" refers to outside or environmental conditions rather than indoor quality). In 1977, amendments to the Act required that all standards be met as soon as possible and practical. In the case of primary (health-related) standards, the new deadline is December 13, 1982. An extension to December 31, 1987 can be granted for carbon monoxide and ozone.

The more highly concentrated a pollutant is, the worse its effect on humans and their environment. Because some pollutants have both chronic and acute effects on health, standards are based on their average concentration over various lengths of time with a margin of safety included. Pollutants that exceed established "primary standards" pose a threat to public health. Exceeding "secondary standards" has detrimental impacts on agriculture and results in deterioration of many consumer products. If the pollutant concentration reaches the "alert level," individuals, industry, and government should take immediate action to protect human health by curtailing outdoor activities, use of automobiles, and certain industrial operations.

In Washington, standards have been set and concentrations established which meet or exceed Federal standards for five major pollutants. Table 1 lists the effects on health and property that are the normal result of exceeding those standards.

Table 1.
Effects of Major Air Pollutants on Health and Property

POLLUTANT	HEALTH EFFECTS	PROPERTY EFFECTS
Suspended Particulates	Correlated with increased bronchial and respiratory disease, especially in young and elderly.	Corrodes metals and concrete; discolors surfaces; soils exposed materials; decreases visibility.
Sulfur Dioxide	Upper respiratory irritation at low concentrations; more difficult breathing at moderate concentrations (3000 ug/m^3), correlated with increased cardio-respiratory disease; acute lung damage at high concentrations.	Corrodes and deteriorates steel, marble, copper, nickel, aluminum, and building materials; causes brittleness in paper and loss of strength in leather; deteriorates natural and synthetic fibers; "burns" sensitive crops.
Carbon Monoxide	Physiological stress in heart patients; impairment of psychomotor functions; dizziness and headaches at lower concentrations; death when exposed to 1000 ppm for several hours.	Corrodes limestone and concrete structures.
Ozone	Irritates eyes, nose, throat; deactivates respiratory defense mechanisms; damages lungs.	Deteriorates rubber and fabrics; corrodes metal; damages vegetation.
Nitrogen Dioxide	Combines with hydrocarbons in the presence of sunlight to form photo-chemical smog; irritates eyes, nose, throat; damages lungs.	Corrodes metal surfaces; deteriorates rubber, fabrics, and dyes.

How Air Quality is Measured

Air quality data are collected at monitoring stations located throughout Washington, primarily in concentrated population or industrial centers (the most likely sources of air pollution). Monitoring sites are designated in this report as commercial/industrial, residential, or rural. However, air pollution can originate away from the monotiring site. High pollutant levels in a residential area, for example, do not necessarily indicate the source is located in that area. Not all pollutants are monitored continuously at all stations, and monitors are not located in all counties,

primarily because of the high cost of installation and operation. However, all large metropolitan aras are monitored. EPA has estimated the percentage of days during which concentrations of the various pollutants exceeded the standards in Washington during 1978, then compared this information with 1977 data to obtain short-term indications of changes in air quality.

Air Quality in Washington

Areas where a combination of high emissions and weather conditions cause air quality standards to be exceeded have been designated as "non-attainment." Currently, eight areas in Washington fall in this category. In addition, the original determination of non-attainment was based on data for 1975 through 1977; therefore, areas that are presently classified as attainment may have exceeded the standards in 1978. It is difficult to determine precise boundaries for areas in which standards are exceeded, especially for ozone because it is transported for long distances. For that reason, county boundaries are used for display purposes although only a portion of the county may be affected by the pollutant.

Washington's major air pollutants and their sources are discussed in the following sections along with the progress being made to meet air quality standards.

Suspended Particulates

Suspended particulates are solid or liquid particles of different sizes and have health effects that vary with size and composition. Particulates can aggravate asthma and chronic lung diseases and increasing coughing and chest discomfort. Some particulates can be toxic or cancer-causing (lead or asbestos particles, for example). Particulate pollution may interfere with visibility, injure vegetation, and increase cleaning and maintenance costs in numerous sectors of the economy.

About two-thirds of the particulate emissions in Washington come from what are called "point sources" which are easily identified sources of emissions such as smokestacks. The remaining third cannot be pinpointed to a specific source. Examples of what is termed "fugitive" dust or emissions include dust created by certain industrial and agricultural operations, and vehicles on unpaved roads. In rural areas with little major industrial development and low population density, this fugitive dust is composed mostly of natural soil particles and is believed to be less harmful to the health. For this reason, rural areas are considered to be attaining air quality standards although particulate standards are exceeded. This is true for most of eastern Washington.

Figure 1 shows the Washington areas that exceeded suspended particulate standards, i.e., at least one monitoring site in the county exceeded one or more of the standards for total suspended particulates in 1978. Aside from counties where rural fugitive dust accounts for exceeding TSP standards (shown as brown), most violations are focused on seven urban areas. Data from these areas are charted in Figure 2, which shows the percentage of days monitored on which samples exceeded the standards.

In the Seattle, Tacoma and Spokane areas, fugitive dust from unpaved roads and construction sites and point-source industrial emissions caused TSP standards to be exceeded. However, each year from 1974 through 1978 less than 1% of the population in the Seattle-Tacoma metropolitan area was exposed to pollution levels above the annual primary standard. The main source of particulates in the Vancouver area has been traced to the Carborundum Company, a processor of inorganic minerals. In the Port Angeles, Longview, and Clarkston areas, suspended particulate levels are largely due to fugitive dust from log yards and emissions of the forest products industry. A major source of pollution for the Clarkston area is emissions from pulp mill operations in Lewiston, Idaho.

Figure 1.
Air Quality Status — Suspended Particulates

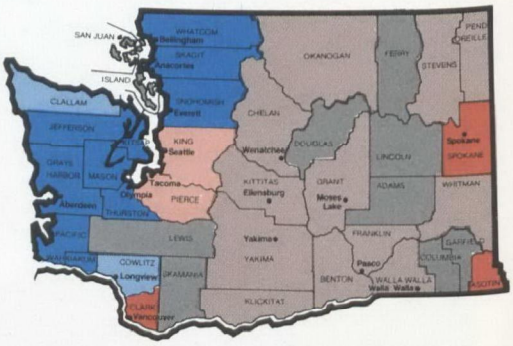
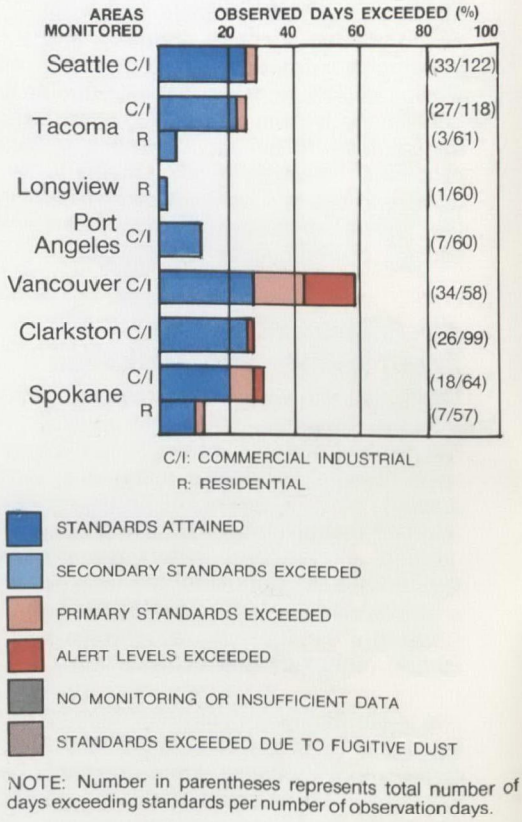


Figure 2.
Percent of Observed Days Suspended Particulates Exceeded Standards



NOTE: Number in parentheses represents total number of days exceeding standards per number of observation days.

To date, the concern in Washington State has been to reduce emissions from point sources. Emphasis has been placed on pollution control equipment for industrial plants and on reducing the ash content of fuels used in these plants. For example, the Carborundum Company in Vancouver is making production process modifications and installing additional control equipment that will significantly reduce particulate emissions. This, coupled with other efforts to control particulate emissions, should enable the Vancouver area to comply with standards by 1980. Paving roads and parking lots, street cleaning programs, and more stringent controls on slash burning are measures employed by the other nonattainment areas to control area sources of suspended particulate pollution.

Sulfur Dioxide

Sulfur dioxide is formed when coal or oil containing sulfur is burned or when sulfur is burned in industrial process. This gas can combine with moisture in the air to form sulfuric acid. Breathing air containing sulfur dioxide can produce adverse health effects similar to those described above for suspended particulates. Rain that comes in contact with sulfur dioxide in the atmosphere corrodes buildings, is harmful to vegetation, and can deteriorate the water quality of lakes and streams far from the source of the pollutant.

Over 80 percent of Washington's sulfur dioxide pollution comes from industrial and power plants, so monitoring efforts are concentrated in urbanized areas, as Figure 3 demonstrates. About half the emissions in the state are from ASARCO's Tacoma smelting and refining operations. However, violations of standards have not occurred in Tacoma since December 1976. ASARCO has reduced their total emissions and uses a tall stack to disperse emissions, reducing operations when weather conditions (such as thermal inversions) prevent adequate mixing to occur.

Carbon Monoxide

Carbon monoxide is a colorless, odorless gas—high concentrations cause unconsciousness and death. At concentrations above the primary standard, this pollutant can interfere with mental alertness and physical activity, especially for persons with heart or lung disorders.

Carbon monoxide is a by-product of fossil fuels combustion. Its major source is motor vehicles, and the most severe violations of standards are recorded where automobiles are concentrated—in urban areas. Figure 4 illustrates the extent of the carbon monoxide problem in Washington, and Figure 5 compares the five areas not meeting the carbon monoxide standard.

Motor vehicles are responsible for about 90 percent of carbon monoxide emissions in non-attainment counties; therefore, plans for reducing such emissions center on improvements to individual automobiles and to the transportation system as a whole. As older cars are replaced by models with up-to-date pollution control equipment, carbon monoxide should decline. However, Seattle would still fall short of the standard by 1982, and the outlook is the same for Tacoma. The Washington State legislature recently authorized inspection and maintenance programs for those areas where standards will not be met by 1982 to ensure that vehicle emission control devices are functioning effectively. Seattle, for instance, plans a vehicle inspection program. Other measures for control include reducing the amount of traffic on heavily traveled roads, especially idling vehicles at peak hours. Spokane and Yakima have improved traffic flow, and plan or have implemented improvements to their public transit systems. Peak hour traffic volumes can be reduced by greater use of staggered work hours, mass transit, carpooling, and exclusive bike, car and bus lanes.

Figure 3.
Air Quality Status — Sulfur Dioxide

Figure 4.
Air Quality Status — Carbon Monoxide

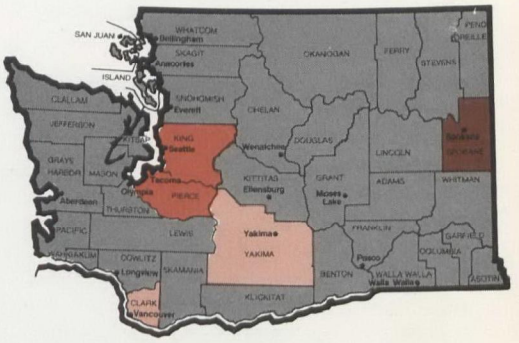
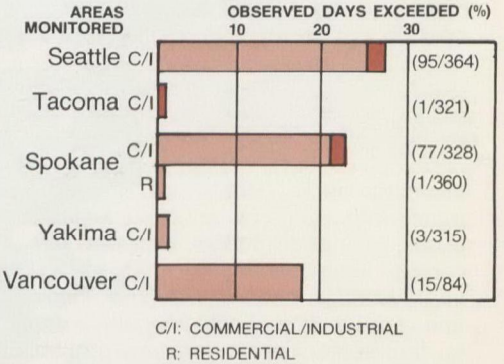


Figure 5.
Percent of Observed Days Carbon Monoxide Exceeded Standards



NOTE: Number in parentheses represents total number of days exceeding standards per number of observation days.

STANDARDS ATTAINED
PRIMARY STANDARDS EXCEEDED
ALERT LEVELS EXCEEDED
NO MONITORING OR INSUFFICIENT DATA

Ozone

Unlike the other air pollutants discussed in this report, photochemical oxidants are not given off by industries or automobiles. Rather, they are the product of a chemical reaction that occurs in the atmosphere when two other pollutants are present. These are oxides of nitrogen (which are discussed below) and hydrocarbons. The chief source of hydrocarbons is automobile exhaust. Volatile organic compounds (VOC), such as solvents and gasoline, also add to hydrocarbon emissions. Besides oxides of nitrogen and hydrocarbons, sunlight is necessary for the reaction. When all three are present, a class of chemicals known as photochemical oxidants is produced, the most common of which is the gas, ozone. Air quality standards refer to ozone and only ozone is measured by monitoring instrumentation.

Ozone irritates the eyes and respiratory system, aggravates asthma and chronic lung disease, and reduces lung and heart capacity. It also probably causes more damage to plants in the U.S.A. than any other pollutant. Because significant quantities of the substances that give rise to ozone come from automobiles, measures taken to reduce other automobile emissions, such as carbon monoxide, are also effective in controlling ozone. Regional transportation plans and enforcement of VOC regulations should help alleviate the ozone problem. The VOC regulations require improved practices in such areas as gasoline marketing, petroleum refining, surface coating, degreasing, and highway paving.

As Figures 6 and 7 show, ozone concentrations reached the alert level in Vancouver in 1978, and both Seattle and Tacoma exceeded primary standards. In order to attain standards, Seattle and Tacoma plan transit improvements including additional buses, park-and-ride lots, exclusive bus and carpool lanes, parking controls, traffic flow improvements, and bicycle lanes. Inspection and maintenance of vehicles will be required for the greater Seattle area, and probably for Vancouver.

Figure 6.
Air Quality Status — Ozone

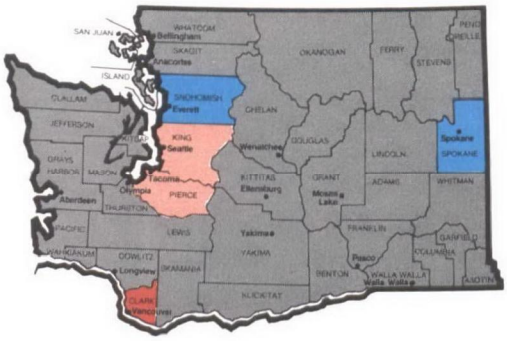
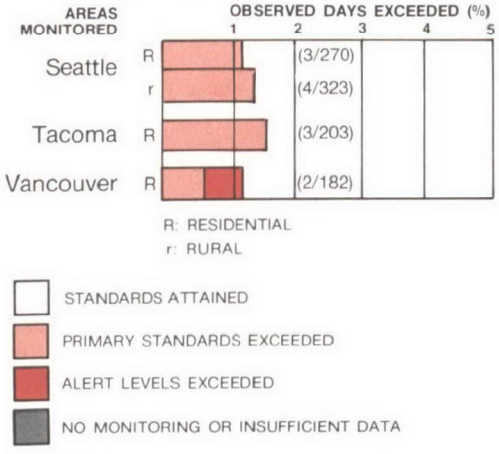


Figure 7. Percent of Observed Days Ozone Exceeded Standards



NOTE: Number in parentheses represents total number of days exceeding standards per number of observation days.

Nitrogen Dioxide

Oxides of nitrogen are gases formed mainly by combustion. Sources include automobiles and power plants. Besides irritating the eyes and respiratory tract and damaging metal, rubber, fabric and dyes, oxides of nitrogen contribute to photo-chemical oxidants, as described above.

During 1978, Washington complied with the nitrogen dioxide standard. In the state, as elsewhere in the nation, emission level of nitrogen dioxide from vehicles seems to be stable (even though the number of vehicle miles driven has increased in recent years) because each year proportionately more vehicles are equipped with better emission control devices.

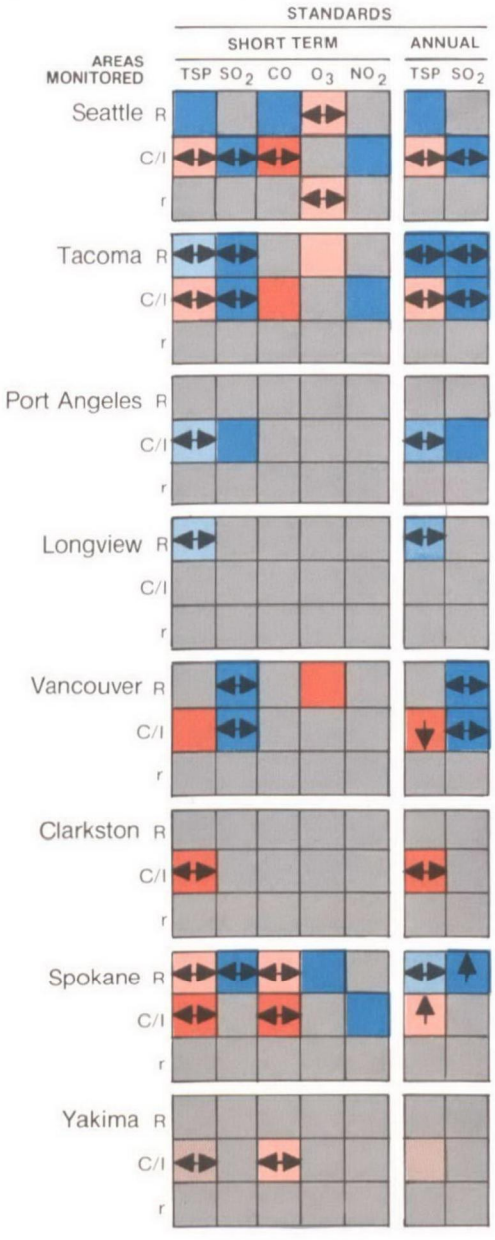
Lead

In 1978 EPA established an air quality standard for lead. The standard is required to be achieved by October of 1982. At this time the states in cooperation with EPA are gathering data to identify areas where the standard is being exceeded.

Other Hazardous Materials

In addition to the five major air pollutants discussed above, there are 14 known point sources of asbestos, beryllium, and mercury in Washington. Environmental concentrations of each of these toxic substances comply with national and state standards. EPA is analyzing other potentially hazardous pollutants, and standards for these will be developed.

Figure 8.
Air Quality Trends in Eight Washington Areas (Based on 1977-78 data)



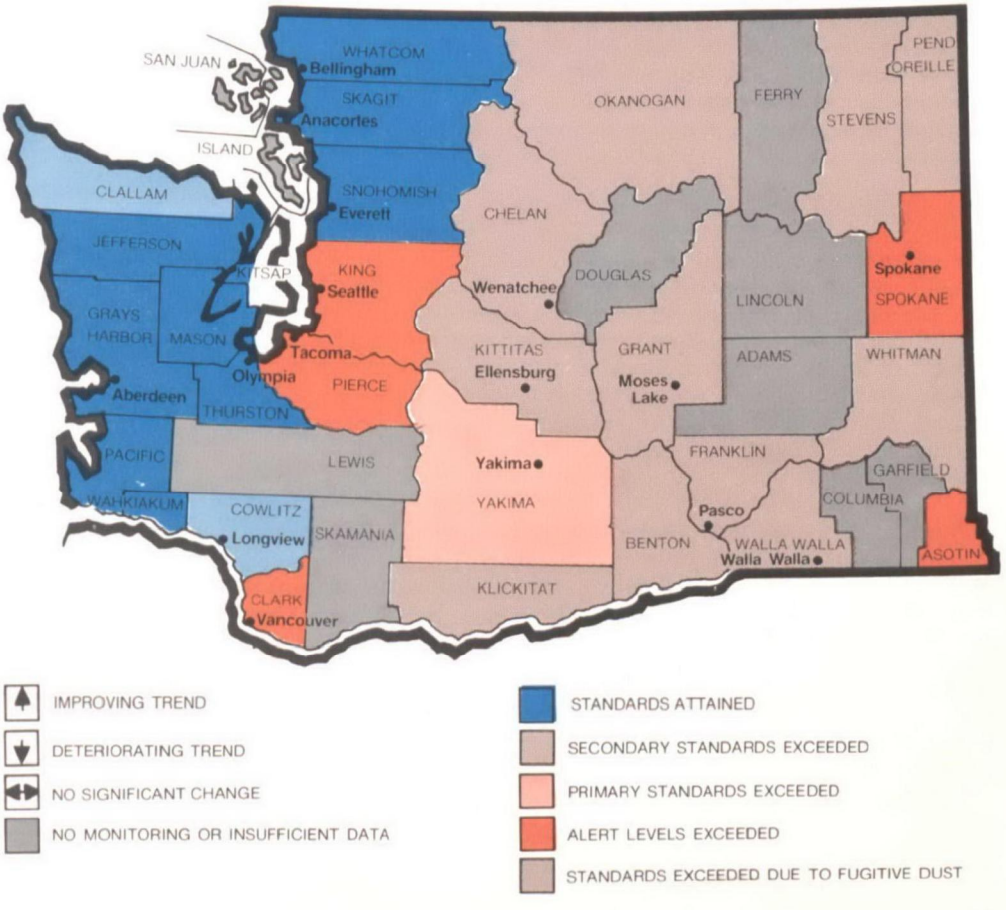
C/I: COMMERCIAL INDUSTRIAL
R: RESIDENTIAL
r: RURAL

Trends in Washington Air Quality

Trends in air quality indicate whether past pollution control activities have been effective. Figure 8 shows the urban areas in Washington in which air quality standards were exceeded in 1978. It also illustrates a two-year comparison of 1977 and 1978 data. Most of Washington's air quality has remained relatively unchanged from 1977, except for an increase in particulate concentrations near the Vancouver area.

In Figure 9 the areas that exceeded standards during 1978 have been color coded to reflect the worst violation of any pollutant standard experienced in at least one monitoring site within a county. The figure indicates that, except for Eastern Washington's problems with fugitive dust, the most severe violations of air quality standards are mainly in the heavily populated areas of the state.

Figure 9.
Washington Areas Exceeding One or More Air Quality Standards During 1978



The Regional Air Quality Outlook

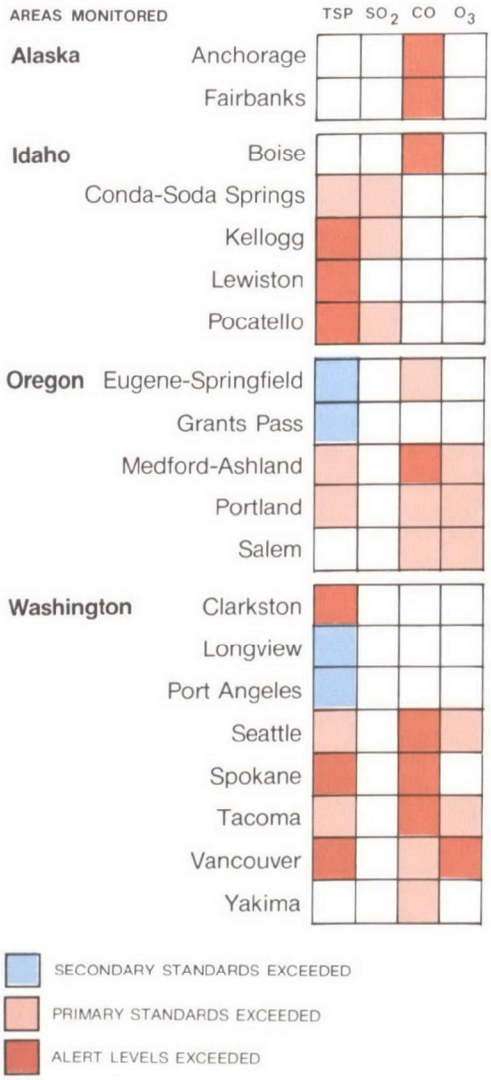
Region 10 has relatively few heavily populated urban centers; in the four states there are only 6.5 million residents. While air pollution is not confined to urban areas, it is most severe where human activity, especially vehicular activity, is heavily concentrated, namely, in the 20 communities shown in Table 2. Some violations of National Ambient Air Quality Standards occur in every state of Region 10, as shown in Table 2. Idaho, Oregon, and Washington each exceeded standards for three of the major pollutants during 1978, while Alaska exceeded standards only for carbon monoxide.

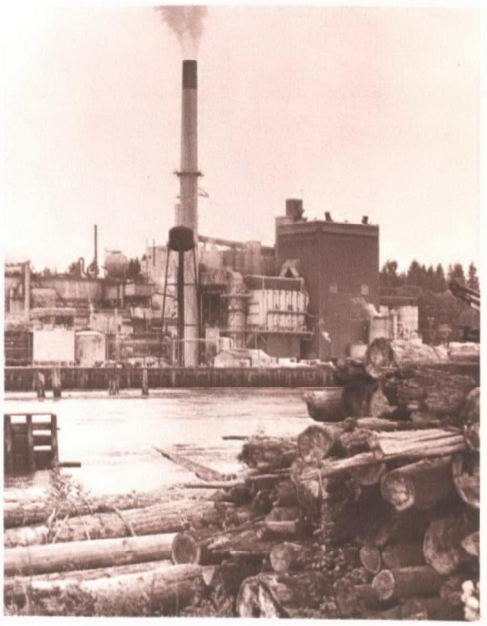
Region 10's air pollution problems in 1978 were mostly due to carbon monoxide and/or ozone concentrations. EPA is working closely with Alaska, Idaho, Oregon and Washington to control emissions from vehicles and to reduce the number of vehicle miles traveled in urban centers having high carbon monoxide levels through transportation controls previously discussed.

Ozone concentrations greater than the health standard have occurred in Western Oregon and Washington, and future monitoring may identify other areas. Many of the same transportation controls used to reduce carbon monoxide levels will be effective in reducing ozone levels. Also, measures that control volatile organic compounds indirectly lower ozone levels including, for example, floating roofs for oil storage tanks to reduce evaporative losses.

Suspended particulate matter is a widespread problem throughout the Northwest; it results from both stationary industrial sources and other sources (such as dust from roads, particulates from home oil heating, etc.). Particulate control devices such as baghouses, electrostatic precipitators, and scrubbers have been installed on many industrial sources and some plants are scheduled to further reduce emissions in the future. As existing plants are modified and new facilities are constructed, the best technology available to control suspended particulates will be required. Control of fugitive dust is more difficult to achieve. Paving roads and parking areas can help, as well as improved "housekeeping" in industrial areas (such as covering hoppers or conveyor belts or other equipment transporting raw materials). Construction sites can be wetted down to reduce dust. However, it is expected that reduction of fugitive dust will be very gradual due to the cost of control.

Table 2.
Air Quality Status in 20 Areas of Region 10





River Water Quality

When the U.S. Congress enacted amendments to the Federal Water Pollution Control Act in 1972, a national goal was set—"fishable, swimmable" waters by 1983. The State of Washington also adopted that goal. The 1972 amendments subsequently stimulated new cooperative Federal, state, and local water quality improvement programs dedicated to reducing pollutants in the Nation's waters. This section discusses programs that have been instituted in Washington, their effectiveness, and some problems that still remain to be resolved.

How River Water Quality is Determined

The purpose of the Federal Water Pollution Control Act is to protect the quality of U.S. waters for a variety of uses, including public water supply, wildlife, fish and shellfish, recreation, navigation, agriculture, and industry. Each water use depends on certain characteristics, such as temperature, concentration of dissolved oxygen, or absence of bacteria. These characteristics, called parameters, can be measured and used to evaluate water quality. They vary with the chemistry of the stream being mea ured, the season, and other factors. This report is based on the 10 related groups of water quality parameters listed in Table 3 which have been monitored at a network of 160 sampling stations throughout the state.

Washington, like the other states in Region 10, has specified certain water quality standards. To measure water characteristics and evaluate water quality however, a standardized set of criteria is necessary. These criteria are a synthesis of state standards, national criteria, information in the technical literature, and professional judgment, and they represent Federal water quality goals.

When these criteria are applied to a stream, they take into account the aquatic life and recreational uses expected for that stream. In Washington most streams are classified as "cold water fishery" streams and are suitable for trout and salmon. Criteria for these streams specify lower temperatures and higher levels of dissolved oxygen, for example, than criteria applied to "warm water fishery" streams, such as the Palouse River which supports bass and perch.

Table 3.
Criteria/Parameter Groups[1] for the Water Quality Index

CRITERIA/PARAMETER GROUP	AND EXPLANATION
Temperature	Temperature of water influences the type of fish and other aquatic life that can survive in a river. Excessively high temperatures are detrimental to aquatic life.
Dissolved Oxygen	To survive, fish and aquatic life must have certain levels of oxygen in the water; therefore, low oxygen levels can be detrimental to these organisms.
pH	pH is the measure of acidity or alkalinity of water. Extreme levels of either can imperil fish and aquatic life.
Aesthetics	Refers to oil, grease, and turbidity which are visually unpleasant. This group is mostly represented by the turbidity parameter, which is a measure of the clarity of the water.
Solids	Dissolved minerals and suspended material such as mud or silt. Excess dissolved minerals (hard water) interfere with agricultural, industrial, and domestic use. Excess suspended solids adversely affect fish feeding and spawning.
Radioactivity	May be in water as a result of radioactive waste discharges or fallout. Excess levels can harm aquatic and other life forms.
Bacteria	Bacteria indicate probable presence of disease-related organisms and viruses not natural to water (i.e., from human sewage or animal waste).
Trophic (Nutrient Enrichment)	Indicates the extent of algae or nutrients in water. Nutrients promote algae growth. When algae (one-celled water plants) flourish they make the water murky, and the growths make swimming and fishing unpleasant. Decomposition of dead algae can decrease dissolved oxygen concentrations to levels harmful to fish.
Organic Toxicity	Includes pesticides and other organic poisons that have the same effects and persistence as pesticides.
Inorganic	Heavy metals and other elements; excess concentrations are poisonous to aquatic and other life forms. Also includes percent saturations of dissolved gases in water which can affect the metabolism of aquatic life.

[1]Approximately 80 criteria/parameters were evaluated and condensed to the 10 groups shown here. More detailed information is available on request.

The water quality of an individual stream can be determined by measuring each parameter group and comparing it to the criteria. But to compare one stream to another, a single, inclusive number for each stream is useful; consequently, a Water Quality Index has been formulated The Index permits comparisons between very different situations, such as large rivers and small streams, or between streams in the moist, forested coastal zone and in the dry eastern farmlands of the state.

Figure 10 compares the water of principal rivers in Washington. The circle represents the annual average Water Quality Index for the river. The square represents the average value for the worst 3 consecutive months.

Water Quality Index

In this report, the Water Quality Index compares water quality measured during the last 6 years with the recommended Federal criteria. The data used to make these comparisons come from various Federal, state, and local agencies and are stored in EPA's computer systems. The final Index number for each station takes into account the 10 pollution categories shown in Table 3, adjusted to reflect the severity by which the criteria are exceeded. The Index numbers span a scale from 0 (no measured evidence of pollution) to 100 (severe pollution at all times). In this report, the scale is divided into three color ranges as follows:

Blue represents streams with Index numbers between 0 and 20. These streams either have no pollution or are minimally polluted and therefore meet the goals of the Federal Water Pollution Control Act.

Light Brown represents streams with Index numbers between 20 and 60. Such streams are intermittently and/or moderately polluted and are considered marginal with respect to meeting the goals of the Act.

Dark Brown represents streams with an Index number greater than 60. These streams are severely polluted and do not meet the goals of the Act.

The neutral color gray is used in the graphs when the water quality status is unknown because of inadequate data.

Figure 10.
Water Quality Index Values for Washington's Principal Rivers

Sources and Control of Water Pollution

Pollutants that reach Washington streams have two general origins: "point source" pollution, such as wastewater from industries, sewage treatment plants, and the like, that enters streams at an easily identified location; and less easily identified "non-point source" pollution, consisting of stormwater from urban areas, irrigation water, and runoff from farm, forest, and mining lands.

Industries that discharge waste effluent to streams must have a permit to do so. The permits are issued by EPA under the National Pollution Discharge Elimination System (NPDES) or by states that have assumed this responsibility. By this means, EPA can require that point source pollutants be removed before wastewater reaches the river. Since non-point sources cannot be so easily treated, "best management practices" are required instead. For example, agricultural best management practices might include waste storage areas to keep organic wastes from reaching nearby streams, or contour plowing to prevent erosion of soil into rivers.

The responsibility for developing such means to control non-point source pollution has been given to local and state agencies assigned to develop waste quality management plans, as provided by the Federal Water Pollution Control Act.

The Quality of Washington's Principal Rivers

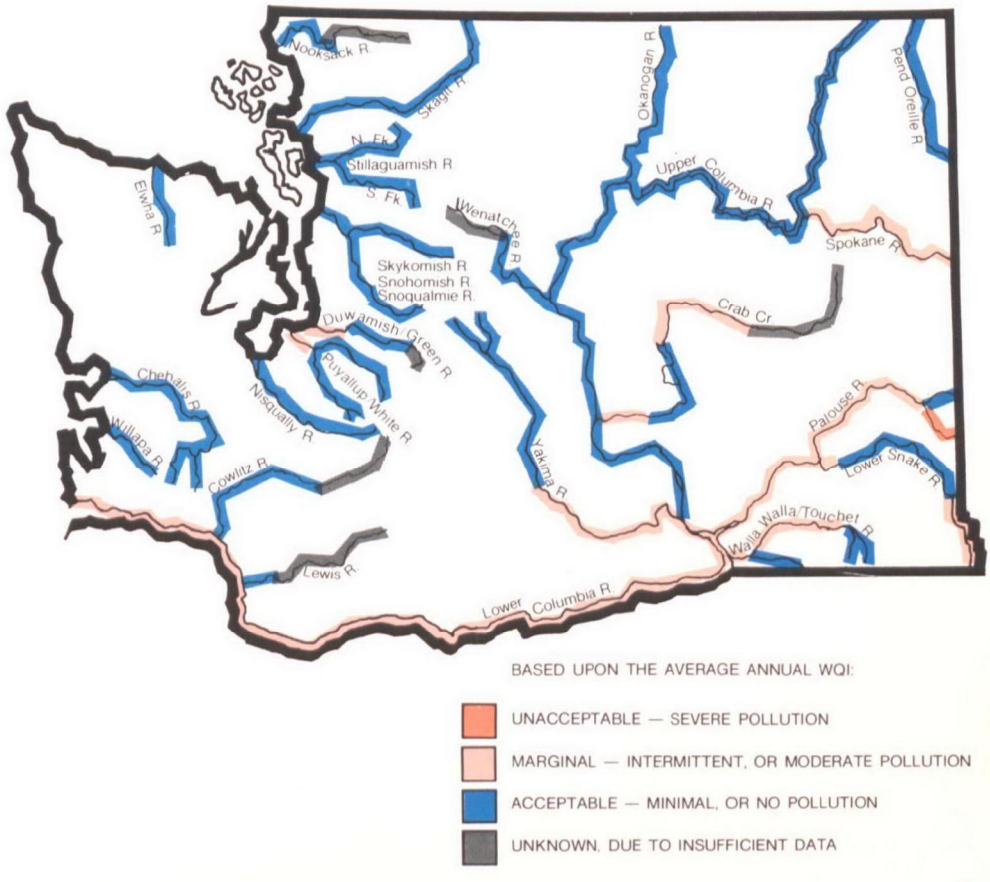
Of the 23 major rivers monitored in Washington, only one stretch of the Palouse River fails to meet Federal water quality goals. Another nine have stretches which only provisionally meet the goals. Because the Cascade Mountains exercise an influence on climate that is reflected in water quality, streams east and west of the mountains are discussed separately.

Water Quality West of the Cascades

Washington's major rivers west of the Cascades, including those of the Olympic Peninsula, Washington coastal area, and those entering the lower Columbia River, are generally of high quality, as Figure 11 indicates. Figure 12 illustrates the extent that each river meets the water quality criteria based on an annual average. The moderate temperatures and significant rainfall curtail the pollution problems due to low flow and high summer temperatures that are prevalent to the east. Unlike Eastern Washington, the western population and industrial centers are more concentrated, primarily along the shores of Puget Sound, and there are correspondingly more point source discharges. The effects of point source pollution, particularly in the rivers entering Puget Sound, are felt mainly in the lower reaches just before their confluence with marine waters. However, some industrial wastes are discharged in rivers such as the Chehalis and Lower Columbia.

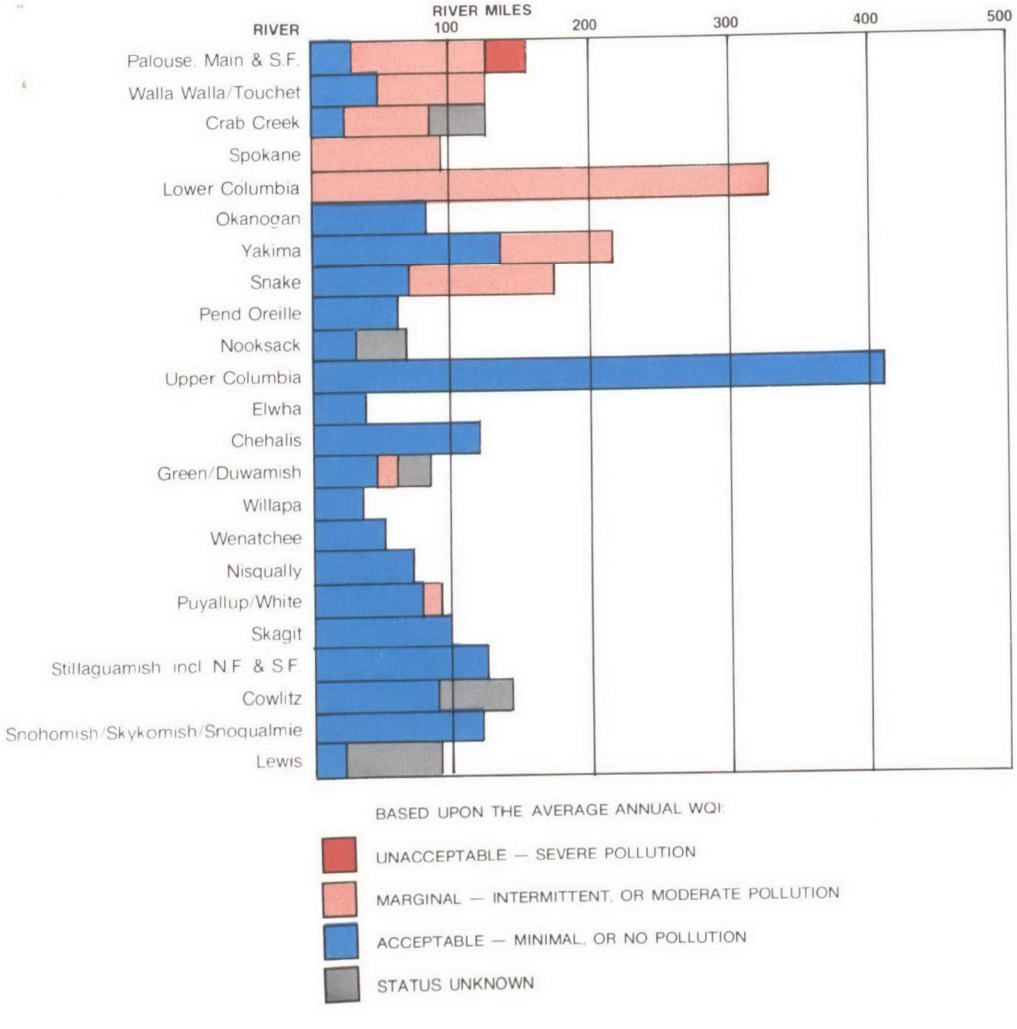
Non-point source problems are due primarily to forest harvest and related management activities, agricultural activities, and urban stormwater runoff including erosion related to land clearing and construction. The impact of non-point sources on these streams, especially small feeder streams, is of increasing significance as the population of this area continues to grow.

Figure 11.
Water Quality Status of Principal Rivers



Water Quality East of the Cascades
Eastern Washington is much drier than the western part of the State and has more extreme variations in temperature. Water quality within this region varies from poor to excellent. It is generally good in areas of fairly high elevation; i.e., the eastern slopes of the Cascades, the Okanogan highlands, the Colville region, and the Blue Mountains (Figure 11). Water quality problems increase in the Yakima, Crab Creek, Walla Walla/Touchet, and Palouse drainages, where the effects of climatically induced low stream flows and high summer temperatures are aggravated by man's activities. Problems typically encountered include high levels of bacteria, turbidity, suspended solids, nutrients, and elevated summer water temperatures. Most of this degradation is attributed to agriculture-related non-point sources such as irrigation runoff and erosion from cultivated dryland areas.

Figure 12.
River Miles Meeting Water Quality Criteria In Washington



Causes of River Water Quality Problems

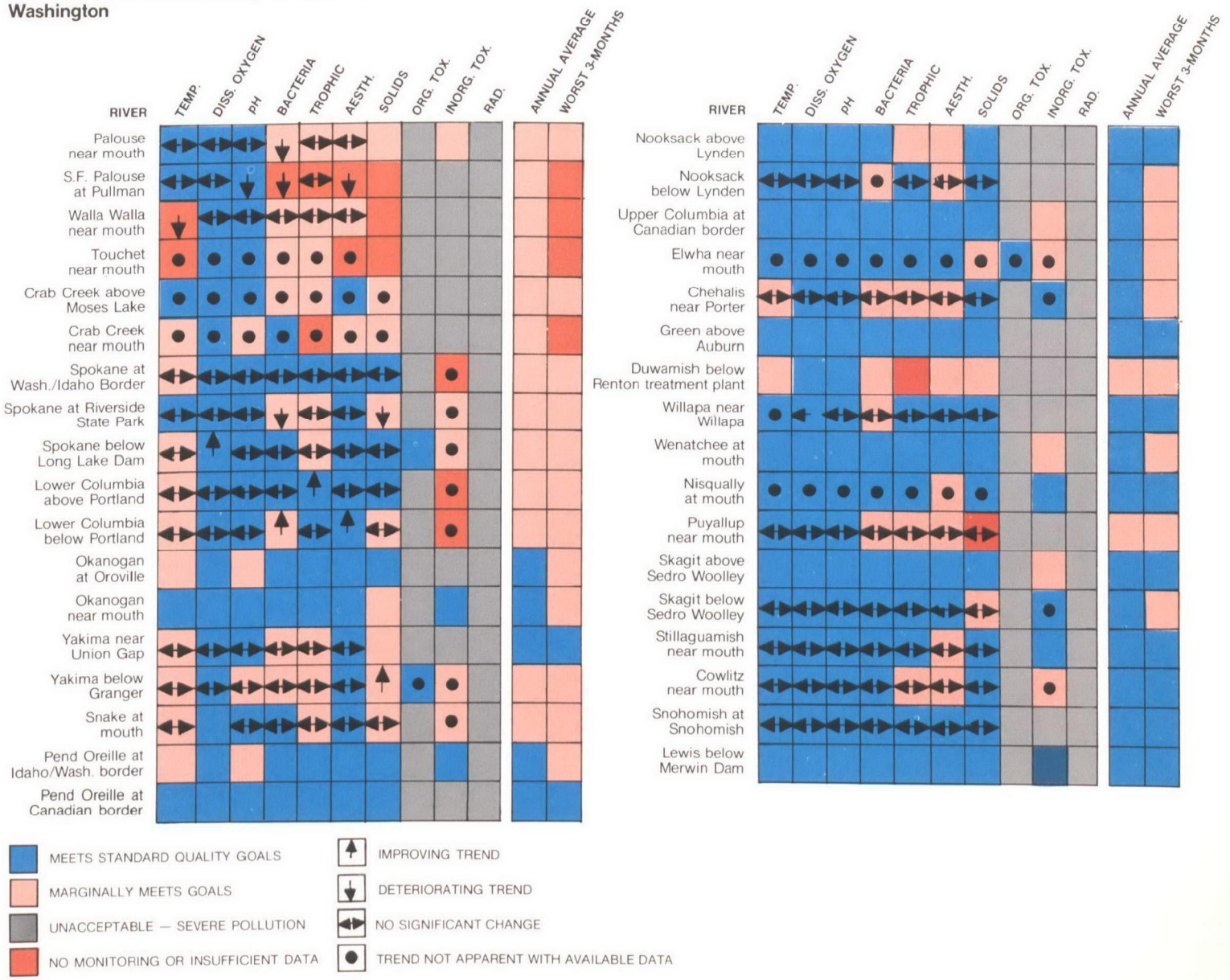
Figure 13 shows the status of 35 Washington river stretches with respect to each of the 10 pollution categories shown in the Water Quality Index. Most of the rivers in which temperature criteria were exceeded lie east of the Cascades; the most severe instance was in the lower Walla Walla drainage. Any human activities that decrease river flow or expose the water to sunlight will raise the water temperature. Irrigation diversions and return flows, impoundments, and the destruction of vegetation on stream banks are a few examples.

Only four river stretches experienced elevated summer pH values: Crab Creek, and the Okanogan, Pend Oreille, and Yakima Rivers. pH problems are generally related to nutrient availability in that excessive nutrients promote algae and weed growths, which influence the pH of the water through their daily respiratory cycles.

Peak bacteria levels exceeded the recommended criteria in portions of about half the streams evaluated. Violations occur on both sides of the Cascades, but the Walla Walla, Palouse, and Yakima drainages experience the most significant problems. Livestock wastes that wash into streams from pastures, grazing lands, and feedlots, and discharge from sewage treatment plants account for most of the bacterial contamination in Washington streams. Excessive nutrients, mainly phosphorous and nitrogen, which arise from the same sources as bacteria (agricultural run-off and sewage) followed a state-wide pattern similar to that described for bacteria.

The aesthetic quality of a river is largely related to whether the water is clear or muddy. Excessive turbidity generally means that there are high levels of suspended solids present, indicative of eroded soil carried into rivers. Most of Washington's significant erosion problems, as indicated by these two measurements, are in the agricultural areas of the Crab Creek, Palouse,

Figure 13.
Trends in River Water Quality Categories, Washington



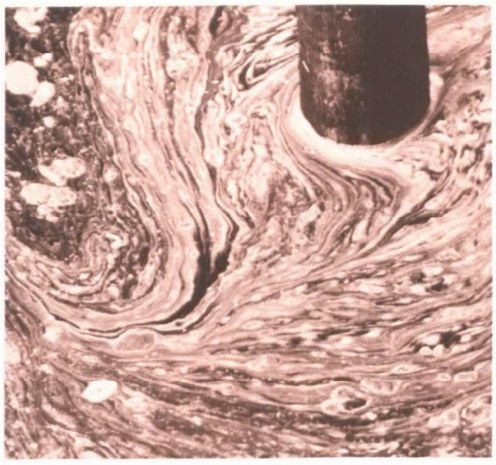
Colors represent recent (water years 1977/78) water quality during the worst 3 consecutive months of the year for each pollution category. The arrows portray general category trends resulting from the comparison of water years 1973-75 vs. 1976-78. Each river entry is represented by only one station.

and Walla Walla drainages, especially during periods of rainfall and snow-melt. Other factors besides agriculture, such as forestry and construction practices and glacial melt-waters, also influence the aesthetics and solids parameters.

Organic toxicants include pesticides and chemical substances poisonous to humans and other life. It was only recently that intensive monitoring began to detect minute concentrations of organic toxicants. Monitoring recently begun in the lower Spokane, Elwha, and Yakima Rivers for certain pesticides and herbicides, indicates that no significant levels of these compounds have been detected. More widespread sampling for a much larger number of organic toxicants is needed to better assess the extent of these compounds in Washington's streams.

Inorganic toxicants include the heavy metals zinc, lead, and nickel, which can harm fish and persons who eat contaminated fish. A number of eastern Washington rivers, as well as several west of the Cascades, appear not to meet recently refined Federal criteria for inorganic toxicants. However, it is unclear at this time whether there is a genuine problem with inorganic toxicants or whether it is simply a problem with insufficiently sensitive analytical and monitoring techniques.

EPA monitoring data on radiation in the Columbia River at Northport, Richland, and Westport are insufficient to calculate the Water Quality Index for this parameter. However, radiation levels are less than 3 percent of the drinking water standard, well below any level of concern.

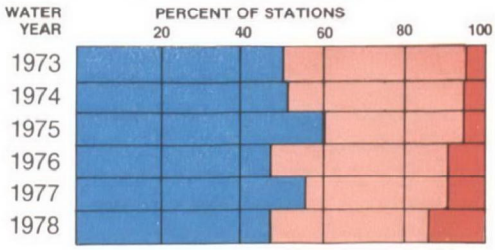


River Water Quality Trends

Figure 14 compares annual water quality conditions in Washington over the past 6 years, based on data collected at 38 representative monitoring stations. The trend has been relatively stable, though water quality may be deteriorating at those southern and eastern stations located in watersheds with intense agricultural use. Incomplete data from some of the monitoring stations prior to 1978 make any real trend difficult to confirm, and minor fluctuations in the percentages of stations meeting the goals may probably be attributed to variations in climatic conditions and sampling times.

The greater percentage of stations only provisionally meeting the Federal goals as shown on this year's graph, compared to the 1978 issue of this report, is mainly due to a change in analytical methods. Previous reports analyzed trends on the basis of data averaged over 12 months. The percentages shown in Figure 14 are based on data averaged over the worst 3 consecutive months at each station. This evaluation scheme is more sensitive to changes in water quality than using the average annual status.

Figure 14.
Water Quality Trends in Washington



Data based upon the worst 3-consecutive months status of 38 monitoring stations within, and bordering upon, Washington. (Organic and inorganic toxicant categories not included.)

UNACCEPTABLE — SEVERE POLLUTION

MARGINAL — INTERMITTENT OR MODERATE POLLUTION

ACCEPTABLE — MINIMAL OR NO POLLUTION

The Outlook for Washington

The NPDES permit system and implementation of areawide wastewater management plans being developed will correct many of the pollution problems discussed above. New and improved sewage treatment plants, improved operation of existing plants, and best management practices in agriculture and livestock operations will most noticeably improve water temperature, dissolved oxygen, bacteria, and nutrient and solids levels by the target year 1983. The effect of forest practices on erosion and temperature levels is being controlled through the Forest Practices Act, which requires road construction and logging activities to be done in a manner to minimize erosion and restricts logging adjacent to streams to protect stream cover.

There is good potential for improved water quality, particularly in significantly degraded streams east of the Cascades, in light of those best management practices described above. Dissolved gas supersaturation, which results when water passes over dam spillways, is harmful to fish. Although it did not occur in 1978 due to low flows, it is a persistent problem which can be controlled to some degree by spillway modification. Point source controls are expected to produce some improvement in certain stream segments affected by sewage treatment and industrial wastes.

New analyses of organic toxicants may reveal them as a problem in some areas of Washington. If significant levels are found, they are likely to be in metropolitan areas where the impact of both municipal and industrial waste discharges would be the greatest. Elevated levels may also be found in streams that drain agricultural areas with high pesticide usage.

The Regional Outlook

The Water Quality Index is used in Figure 15 to compare 26 major Pacific Northwest River Basins within Alaska, Idaho, Oregon, and Washington. Figure 16 depicts the relative extent of water quality degradation within each river basin, and Figure 17 shows similar information on a regional map.

Figure 15.
Water Quality Index Values for Region 10 River Basins

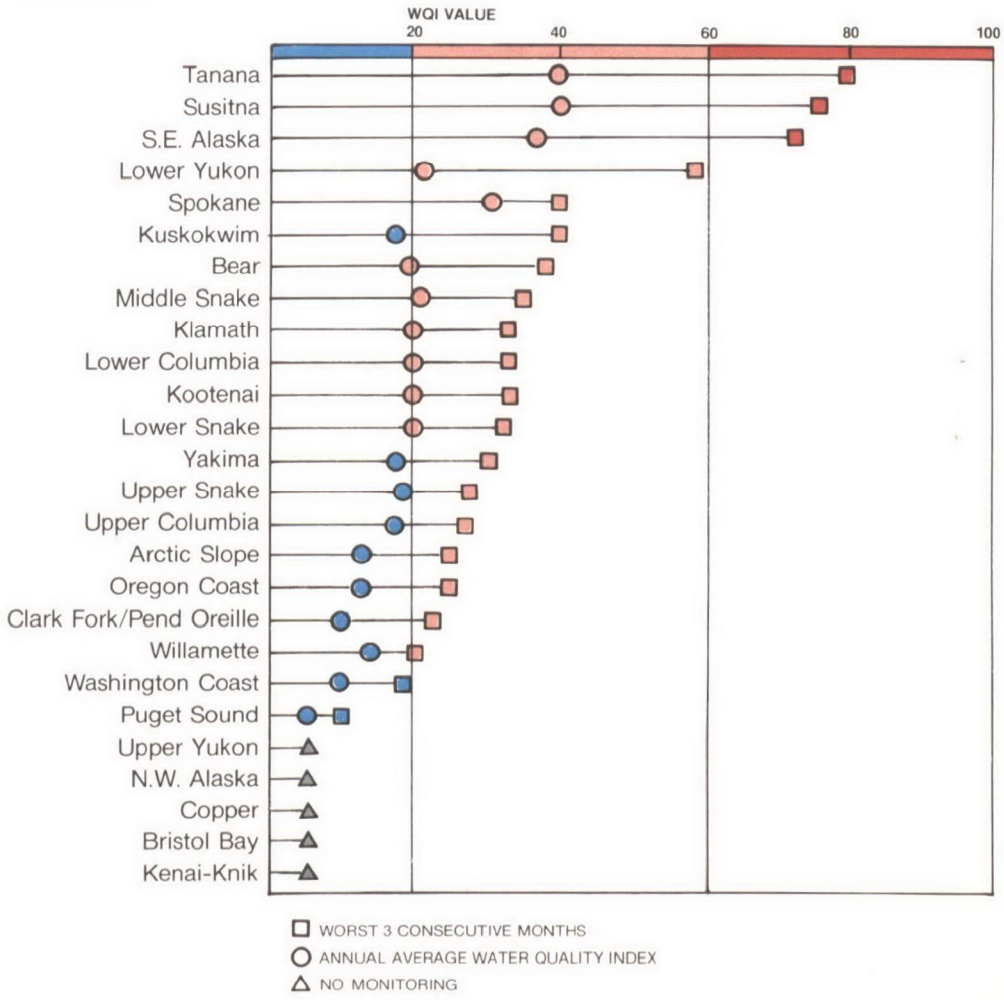


Figure 16 reveals that several Alaska river drainages have the highest Water Quality Index values in Region 10. These are caused by high levels of turbidity and suspended solids during spring and summer, which are primarily due to glacial melting and natural streambank erosion. Placer mining operations, however, may be causing unnaturally high solids levels in some of the smaller streams. More data are needed to assess the impact of these activities and to provide a general indicator of water quality in the five Alaska basins indicated as having an unknown status.

Only two of the Region's river basins have Index values less than 20 and clearly meet the Federal water quality goals. The majority of those that provisionally meet the goals drain arid or agricultural portions of the Region where non-point source pollution is difficult to control. Those criteria that were exceeded are in the categories of temperature, bacteria, trophic, aesthetic, and solids parameters. In Washington's Spokane Basin, high heavy metals concentrations from mining activities on the South Fork Coeur d'Alene River in Idaho are primarily responsible for the elevated Index values. Heavy metals of unknown origin are responsible for high Index values in the Lower Snake, Lower Columbia, and Kootenai Basins.

Figure 16.
Miles Within Principal Region 10 River Basins Meeting Water Quality Criteria

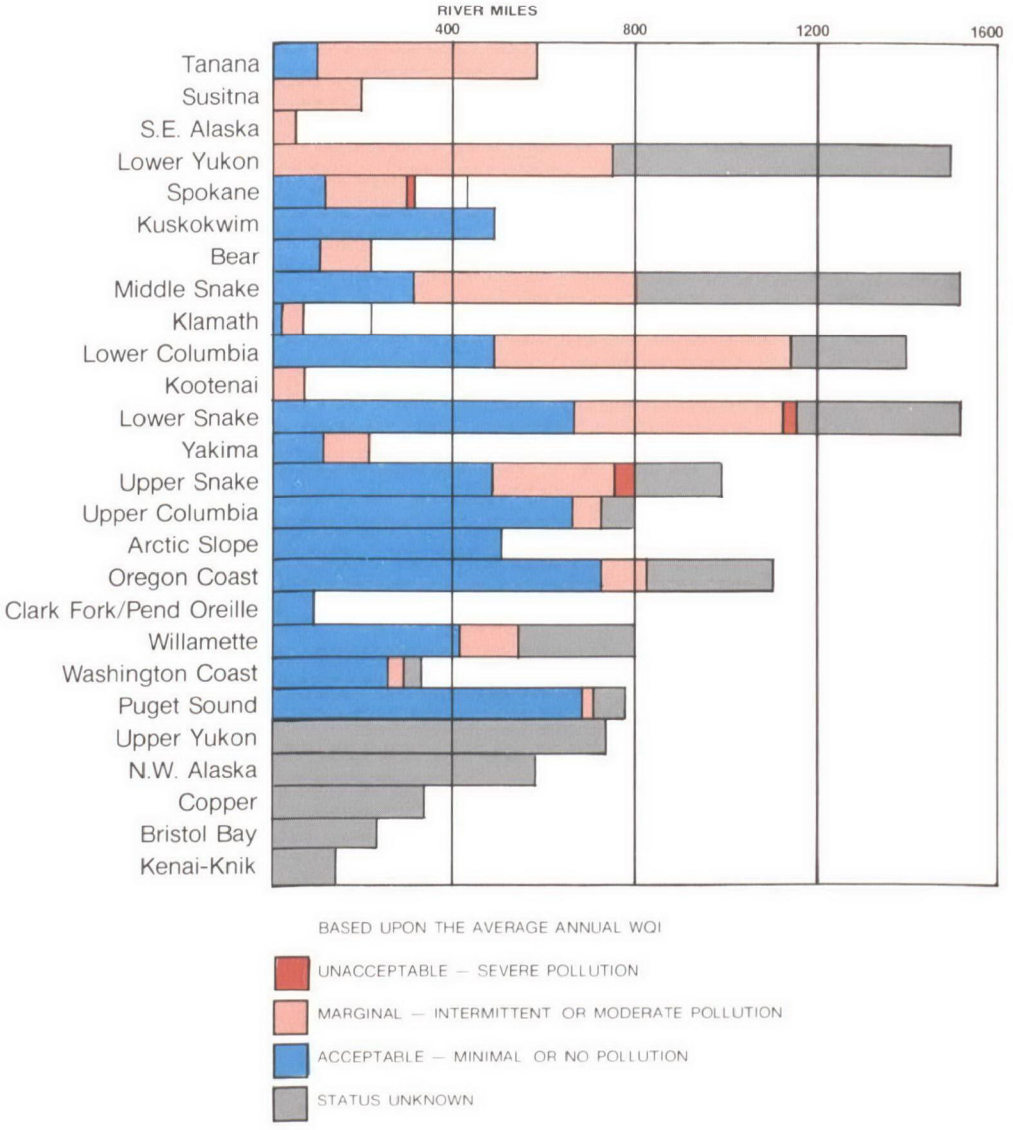
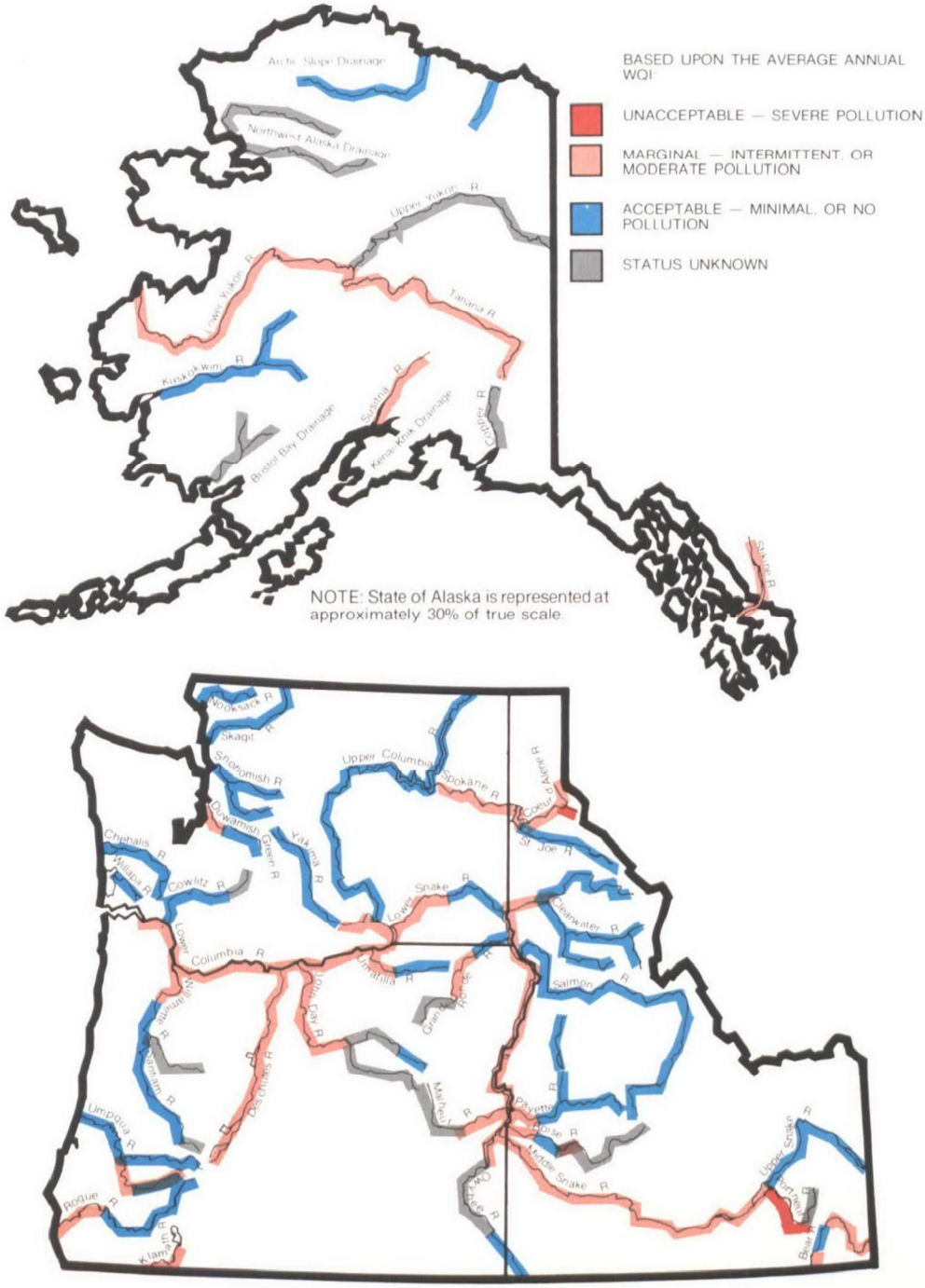
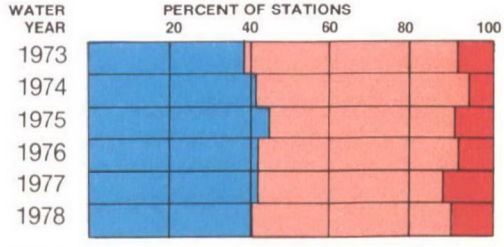


Figure 17.
Water Quality Status of Principal Region 10 River Basins



Regional water quality trends have been analyzed by comparing data from 84 representative monitoring stations over a 6-year period (Figure 18). Due to inadequate data, Alaska rivers could not be included in the analysis; nor were organic or inorganic toxicants included, since there have been significant changes in analytical techniques and reporting procedures over the time period considered. There has been little significant change at the stations since 1973. Although point source controls have made many improvements in Regional water quality, further plans to identify and control non-point sources are needed in order to improve water quality at those stations still not fully meeting water quality goals.

Figure 18.
Water Quality Trends in Region 10



Based upon the water quality status during the worst 3 consecutive months per station at 84 monitoring stations within Region 10. (Alaska stations, Itox and Otox pollution categories not included.)

Lake Water Quality

Inland lakes and waterways constitute one of Washington's most important recreational and commercial resources. Moreover, the quality of these waters affects the beauty and aesthetic character of the state. It is generally felt that the lake water quality in Washington and the Pacific Northwest is among the best in the Nation. Only a few of the major recreational lakes in the state have significant water quality problems which impair their recreational use.

How Lake Water Quality is Determined

A numerical water quality index has not been developed for lakes as it has been for rivers. Instead, the water quality of Washington lakes is evaluated on the basis of their ecological conditions and how they affect persons wishing to use the lakes for recreation.

If a lake is undisturbed by human activities, it undergoes a natural process of aging, known to ecologists as eutrophication. Once a lake is created, by whatever means, it begins to fill in. While it is filling in, the water chemistry and types of organisms that can survive in the lake also change. At first the water is clear (pristine) and has few nutrients (mostly minerals) and low populations of aquatic life. As the lake continues to age and becomes "eutrophic," sediments and nutrients from the surrounding watershed accumulate, stimulating frequent algae blooms. Floating mats of aquatic plants cover much of the surface and the water may appear bright green. The process by which dead algae are decomposed by bacteria can consume nearly all the dissolved oxygen in the water, which in turn kills fish. Fish populations in eutrophic lakes are typically stunted. Finally, the lake fills with soil and dead plants and becomes land.

The whole process happens naturally; it often takes thousands of years. But man can significantly accelerate the process by adding nutrients and other substances to lake water—a process referred to as "cultural eutrophication." Land use practices on farm land, forests, and construction sites often result in erosion of soils into streams and, subsequently, lakes. Nutrients, mainly nitrogen and phosphorus, are chief constituents of discharge from sewage treatment plants, urban runoff, pastures and feedlots, and certain industrial processes.

How Trophic Conditions Affect Recreational Uses

Water quality agencies are concerned with the trophic status of Washington lakes because many uses of lakes are closely related to their ecological condition. For example, growths of algae or other water plants may directly curtail or eliminate water recreation activities such as swimming, boating, and fishing; impart tastes and odors to water supplies; and hamper industrial and municipal water treatment.

To analyze the extent to which recreational uses are impaired in any given lake, and to compare one lake to another, the measurement scheme shown in Table 4 has been used. This scheme results in a numerical score for each lake ranging from a minimum of 4 to a maximum of 12. A score of 4 indicates that there is little, if any, impairment of swimming, fishing, boating, or aesthetics (visual enjoyment). A score of 12 indicates that all uses are severely impaired.

Figure 19 shows the lakes analyzed in this report. Table 5 indicates the degree and major cause of use impairment for recreational lakes in Washington. Vancouver Lake, Moses Lake, and Silver Lake are considered significantly impaired in two or more respects. Another 17 lakes are moderately impaired, mostly due to aesthetic conditions. Most of the lakes with water quality problems receive stormwater runoff and septic tank seepage from lakeside residential areas. Runoff due to forest practices also causes problems in some lakes. The large lakes and reservoirs of eastern Washington receive irrigation return flows and runoff from agricultural lands that contain fertilizers and animal wastes. This accelerates eutrophication processes.

Recreational use of lakes in itself can affect water quality. Power boats create waves that erode banks, contributing to sediment, nutrients, and muddy water. Removing vegetation along shorelines to enhance public access can also lead to erosion.

How Recreational Use is Being Restored

Some measures being implemented to improve lake water quality include dredging to remove nutrient-containing sediments and decomposing plant material that consumes oxygen, flushing, erosion control, aeration, physically removing aquatic plants, and both chemical and biological controls to prevent eutrophication.

For example, Medical Lake was treated with alum to precipitate phosphorous and algae to the lake bottom, where it forms a layer over the bottom sediments that prevents nutrients from being released into the water. The alum treatment resulted in a 90% reduction in phosphorous and eliminated the blue-green algae. Spada-Chaplain Lake had high levels of turbidity which were reduced by rerouting stream channels and stream beds to reduce erosion of clay into the lake. Revegetating the banks of the lake also assisted in reducing turbidity. Plans to improve water quality in Vancouver Lake and Lake Sacajawea include dredging, dilution, and control of polluting urban and agricultural runoff.

The Clean Lakes program provides Federal grants to local agencies to improve lake water quality.

Successful restoration requires both measures such as those named above and, equally important, a continuing program to maintain water quality. For instance, Silver Lake has significant turbidity problems arising from forestry practices in the area, but unless there is a program for maintaining water quality, a Clean Lakes grant cannot be approved.

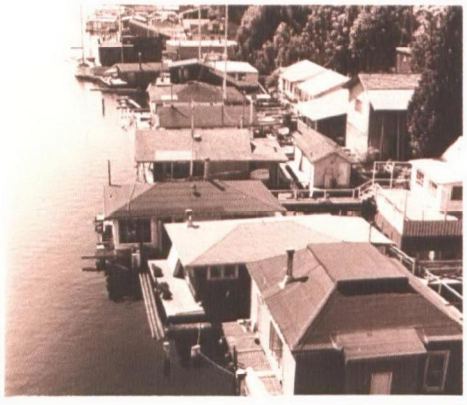


Figure 19.
Water Quality of Washington's Principal Recreational Lakes

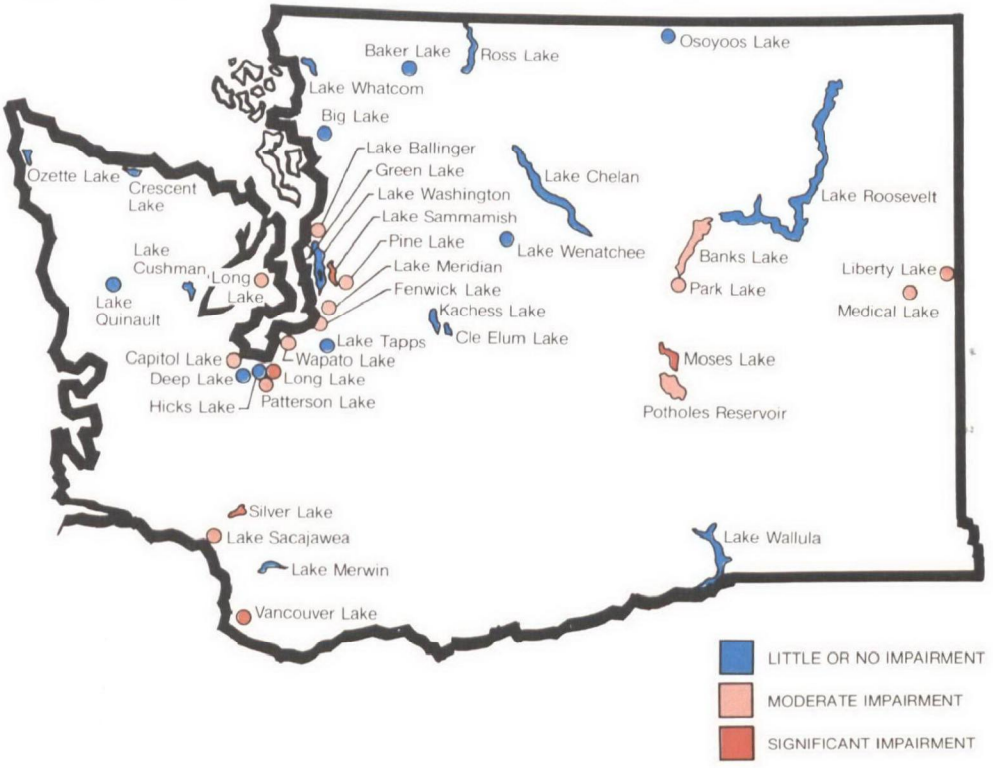


Table 4.
Criteria for Evaluating Impairment of Lakes

RECREATIONAL USE	DEGREE OF IMPAIRMENT: NONE — CRITERIA	SCORE	MODERATE — CRITERIA	SCORE	SIGNIFICANT — CRITERIA	SCORE
Swimming	Very low bacteria levels (Fecal coliforms geometric mean less than 50 per 100 ml)	1	Moderate bacteria levels (Fecal coliforms 50 to 200 per 100 ml)	2	Unhealthy bacteria levels (Fecal coliforms greater than 200 per 100 ml)	3
Fishing	No adverse conditions. Healthy fish population.	1	Slightly adverse conditions. Slight reduction in fish population.	2	Adverse conditions. Significant reduction in fish population.	3
Boating	Less than 10% of surface area affected by aquatic weeds	1	10% to 30% affected	2	More than 30% affected	3
Aesthetics	Objects visible in water to depth of 10 feet or more and low phosphorus (Secchi Disc* at 10 feet; total phosphorus of less than 10 ug/l**)	1	Objects visible from 1.5 to 10 feet and moderate phosphorus level (Secchi Disc at 1.5 to 10 feet; total phosphorus 10 to 20 ug/l)	2	Objects not visible beyond 1.5 feet or high phosphorus level (Secchi Disc at less than 1.5 feet; total phosphorus greater than 20 ug/l)	3
SCORE	(No uses impaired)	4	(All uses moderately impaired)	5-8	(All uses significantly impaired)	9-12

*A Secchi Disc is a round black and white plate suspended on a chain and used to determine water clarity.
**ug/l = micrograms per liter, a measurement used for low concentrations of dissolved substances.

Table 5.
The Recreational Impairment and Trophic Status of the Principal Recreational Lakes in Washington

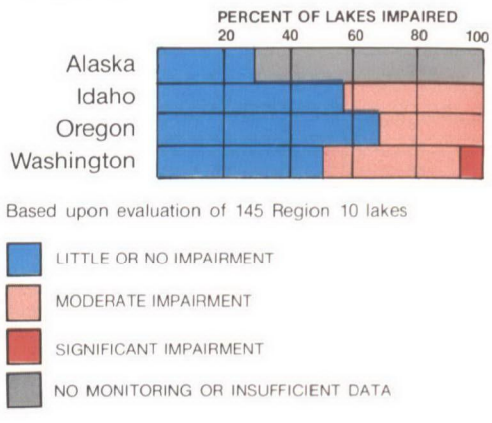
NAME	SURFACE AREA (ACRES)	SWIMMING	FISHING	BOATING	AESTHETICS	TOTAL RATING	TROPHIC STATUS	CAUSE OF PROBLEM
Vancouver Lake	2,600							Stream-fed nutrients
Moses Lake	7,000							Agricultural runoff/erosion
Silver Lake	3,000							Forest practices
Long Lake/Kitsap	340							Stormwater
Long Lake/Thurston	330							Stormwater/Septic tanks
Patterson Lake	270							Stormwater/Septic tanks
Lake Ballinger	100							Stormwater
Pine lake	86							Stormwater/Septic tanks
Lake Sacajawga	61							Stormwater
Capitol Lake	270							Stormwater/Stream-fed nutrients
Fenwick Lake	24							Stormwater
Wapato Lake	28							Stormwater
Liberty Lake	700							Strmwtr/Septic tanks/Solid waste
Green Lake	260							Stormwater
Potholes Reservoir	20,000							Agricultural runoff
Park Lake	350							
Lake Sammamish	5,000							Stormwater
Banks Lake	25,000							Agricultural runoff
Medical Lake	160							Nutrients in sediments
Lake Meridian	150							Stormwater
Big Lake	520							
Hicks Lake	160							
Deep Lake	65							
Lake Quinault	3,700							
Lake Cushman	4,000							
Crescent Lake	5,100							
Lake Whatcom	5,000							
Lake Ozette	7,800							
Lake Merwin	4,000							
Lake Tapps	2,300							
Lake Washington	22,000							
Ross Lake	11,500							
Lake Chelan	33,500							
Lake Wenatchee	2,500							
Kachess Lake	4,500							
Cle Elum Lake	4,800							
Baker Lake	3,600							
Osoyoos Lake	2,000							
Lake Roosevelt	79,000							
Lake Wallula	19,000							

A Regional Overview

Lakes are one of the most important resources of the Pacific Northwest and Alaska. In Region 10, there are 140 lakes and reservoirs that are 10 square miles or more in surface area, and thousands of smaller lakes.

For the most part, the 145 most heavily used lakes within Region 10 are of high quality, with few impairments related to human activities. Figure 20 compares the percentage of lakes impaired for recreational use in each state. More than half the lakes in Washington, Oregon, and Idaho have little or no impairment. All of the lakes in Alaska for which data are available are unimpaired. However, some major lakes within the Region are approaching a level of eutrophication that interferes with their selected uses. Some is from the natural aging of the lakes. The challenge for the future is to prevent further cultural eutrophication and where possible to correct present problems. The Clean Lakes program is providing for the rehabilitation of damaged lakes along with a management plan to assure that the rehabilitated lakes remain clean. Through programs such as this, many of the high-use recreational lakes in the Region are being restored and preserved for future generations.

Figure 20.
Impairment Status of Recreational Lakes in Region 10



Marine Water Quality

The coastal and estuarine waters of the State of Washington contribute greatly to the commercial and recreational assets of the Northwest. While the majority of these waters are relatively clean, pollution problems do exist in some areas, particularly in waters near population and industrial centers on certain Puget Sound bays and inlets, and in the Grays Harbor area.

How Marine Water Quality is Determined

Since direct measurement of marine water is a complex and expensive undertaking, the quality of marine water can be inferred from the condition of shellfish. Shellfish concentrate disease-causing bacteria, viruses, toxic chemicals, and other contaminants from the water in which they live. Consequently, shellfish indicate the degree of pollution in marine waters and provide an indirect way of assessing the success of pollution control efforts.

In this report, marine water quality determinations are based upon criteria established by the U.S. Food and Drug Administration for the National Shellfish Sanitation Program. Waters that are free from fecal contamination (bacteria from sewage), industrial wastes, radioactive elements, and biotoxins (certain naturally produced poisons) are classified as "approved for commercial shellfish harvesting." "Conditionally approved" waters may be closed when seasonal increases in population, freshwater runoff containing contaminants at certain times of the year, or temporary malfunctioning of wastewater treatment plants result in failure to meet the criteria. Waters found to be contaminated or suspected of being contaminated, which would produce shellfish unsafe for human consumption, are classified as "closed."

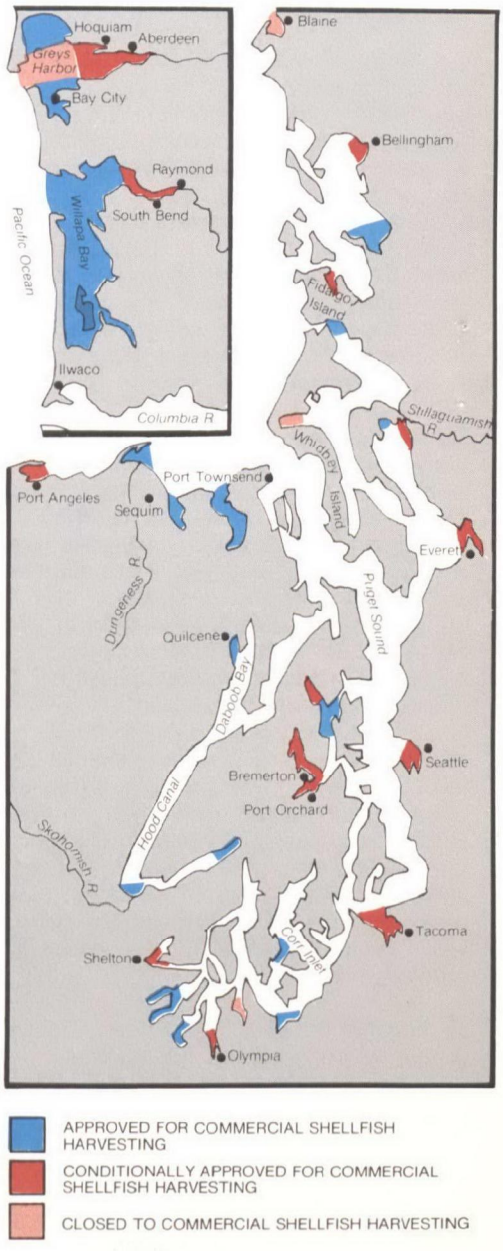
Washington's Marine Waters

Of the 228,900 acres of classified commercial shellfish growing waters in Washington, about 68% are currently approved for commercial harvesting and 11% are conditionally approved, depending on specific conditions that are monitored throughout the year. The remaining 21% are closed and cannot be used to produce shellfish for human consumption. Figure 21 shows the location of classified waters in Washington.

The approved areas include most of Willapa Bay, Northern and Southern Puget Sound, the Strait of Juan de Fuca, and all of Hood Canal and the Pacific Ocean beaches. Central Puget Sound is mostly closed, due to potential pollution arising from the urban-industrial areas of Seattle, Tacoma, and Bremerton. Municipal sewage treatment plant discharges and septic tank problems, also contribute to closures. In Burley Lagoon, for instance, 135 acres of oyster-growing area were closed when the lagoon was polluted with fecal material from domestic septic tanks and nearby pastures. Industrial waste discharges along the Tacoma waterfront have occasionally degraded water quality and caused fish kills.

On occasion, harvesting has had to be restricted in Northern Puget Sound because of increased levels of paralytic shellfish poison (PSP) in shellfish. This poison is a naturally occurring substance *Gonyaulax catenella* (known commonly as "red tide"). Some improvements have been noted in Everett and Bellingham due to reduced effluents from the pulp mills in the area. Additional improvements are still needed, however.

Figure 21.
Water Quality Map of Washington's Classified Commercial Shellfish Growing Areas



area. Additonal improvements are still needed, however.

Less than half of the available shellfish growing area of Grays Harbor is approved for use. Major point source contributors are pulp mills and inadequate sewage treatment although improved waste treatment programs have reduced the contribution of these sources. Agricultural activities, coupled with seasonal fluctuations in freshwater runoff also contribute to water quality problems. In Willapa Bay discharges from municipal sewage treatment plants in the vicinity of South Bend and Raymond are primarily responsible for the closure of a small part of the Bay to oyster harvesting. The extent of closures in the various commercial shellfish areas is compared in Figure 22.

Because of wastewater treatment programs, marine water quality in Washington has improved in recent years. For example, improved water treatment programs at Grays Harbor pulp mills have reduced the contribution of these sources and should reduce them further in the future. However, further reductions in contamination from sewage treatment plants and industrial discharges will be required to restore those waters conditionally approved or closed to shellfish harvest. At the same time, care must be taken to maintain high quality areas. Pierce County Commissioners have passed a resolution establishing Burley Lagoon and three other shellfish growing areas in Pierce County as "environmentally sensitive" areas. Population growth along Hood Canal, for instance, could create a problem in the future.

A Regional Overview

A total of 349,000 acres has been classified as commercial shellfish growing area in Region 10. This represents approximately 2% of the classified growing waters in the Nation. Of the regional growing area 72% is classified as approved, 9% conditionally approved, and 19% closed (Figure 23). Regionally, Washington contains the largest percentage of the total classified area (65% or 228,900 acres), followed by Alaska (27% or 92,400 acres), and Oregon (8% or 28,100 acres), as shown in Figure 23.

Fecal contamination, or the great potential for such contamination due to proximity to municipal sewage treatment facilities, accounts for most of the closed area. The conditionally approved areas are characterized by excessive coliform contamination from seasonal increases in freshwater runoff from agricultural and forestry activities as well as the occasional malfunctioning or bypassing of sewage treatment plants. Although the presence in shellfish of a naturally occurring biotoxin, paralytic shellfish poison (PSP), has resulted in the closure of growing areas, commercial shellfish harvesting has not been restricted because of chemical or radioactive contamination.

Sewage wastes associated with population growth appear to pose the greatest threat to approved shellfish growing areas in Region 10. Because of the small size of Oregon's shellfish industry and the generally undeveloped nature of Alaskan clam resources, future changes in Washington's commercial shellfish areas would probably have the greatest impact on the regional economy.

Figure 22.
Status of Classified Shellfish Areas in Washington

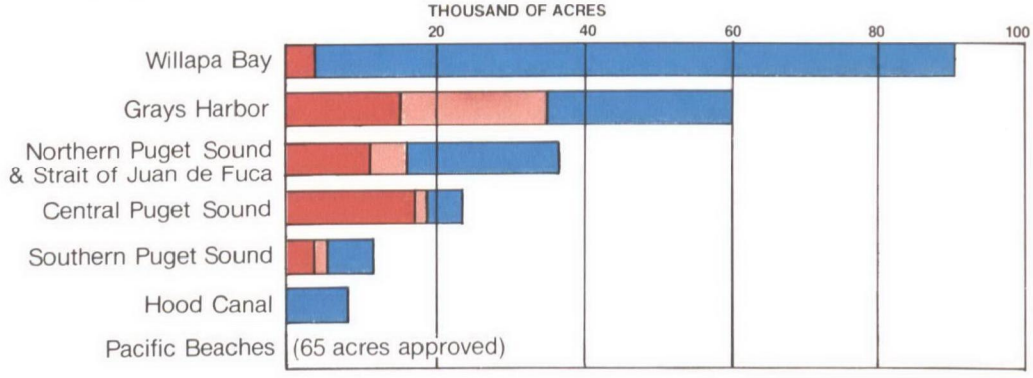
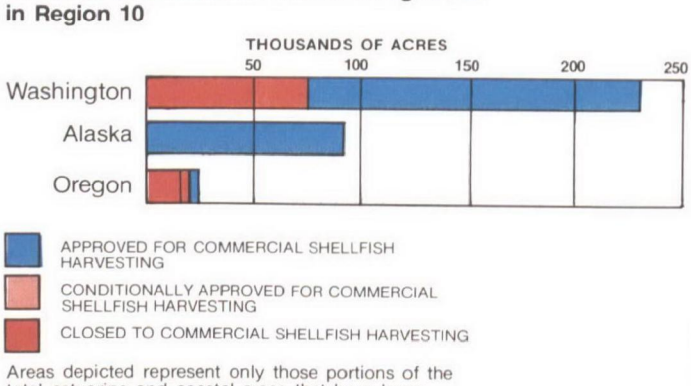
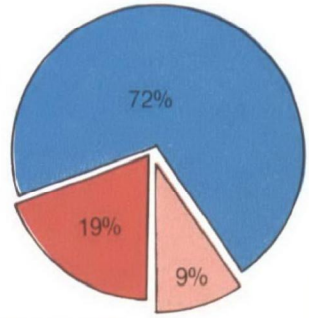


Figure 23.
Status of Classified Shellfish Growing Areas in Region 10

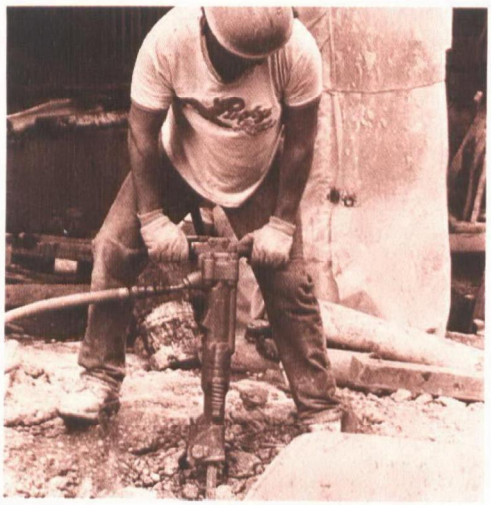


Areas depicted represent only those portions of the total estuarine and coastal areas that have been classified by the state shellfish control agencies.



Regional Summary: Percentage of the Region's active shellfish areas that are open for harvesting.

Noise



When sound levels become loud enough to be disagreeable and are instead called noise (unwanted sounds), they also become a threat to human health. The problem is not limited to acute situations such as occupational noise that can cause hearing loss, but also includes chronic community noise, which affects us physically and mentally by causing nervousness, tension, and loss of sleep. In an annual housing survey conducted by the U.S. Department of Housing and Urban Development, noise has consistently been the most frequently cited undesirable condition in residential neighborhoods, and has been one of the leading reasons for residents wanting to move.

The Federal Noise Control Act of 1972 gives EPA authority to set standards for cars, trucks, interstate railroads, aircraft, etc. However, the primary responsibility for control of noise rests with state and local governments. EPA has assisted Oregon and Washington in developing noise regulations; has helped Anchorage, Seattle, and Portland in developing noise control ordinances; and has assisted with monitoring of noise levels from railroad locomotives, ferries, and auto and motorcycle racetracks.

The Washington Noise Control Act of 1974 gave the State Department of Ecology (DOE) the authority to establish standards for stationary noise sources, such as commerce and industry, as well as for motor vehicles. The DOE is authorized to enforce standards related to land use, while the State Patrol enforces standards for motor vehicles. Lack of funds has hampered this effort. Since DOE's budget for noise enforcement is also small, the approach used in Washington to date has been to encourage local government to adopt and enforce corresponding land use and motor vehicle regulations. Table 6 lists the cities and counties in Washington, as well as Oregon and Alaska, that have passed noise ordinances, and indicates the level of enforcement by the agencies responsible.

Table 6.
Region 10 Cities and Counties with Local Noise Ordinances

CITIES/COUNTIES WITH ORDINANCES	TYPE OF ORDINANCE	ORDINANCE CURRENTLY ENFORCED
WASHINGTON		
Columbia	E,M,N	E,M,N
Dupont	E,M	E,M
Everett	E (com & res only)	E - Safety
	M	M - Police
Lynnwood	N	N - Police
Monroe	N	N - Police
N. Bonneville	E	E - Police/Planning
Olympia	M	M - Police
Othello	N	N - Police
Poulsbo	E,M,N	EMN - Police
Seattle	E,M,N	E - Health Dept
		M,N - Police
Snohomish	E,M,N	E - City Manager
Winslow	E,M,N	M,N - Police
Clallam Co.	E	U
Clark Co.	N - dog control	N - Humane Society
Kitsap Co.	E	E - Sheriff
Snohomish Co.	E - res only	E - Sheriff/Health
King Co.	E,M,N	E - Health Dept
		M,N - Police
OREGON		
Eugene	M	M - Police
Milwaukie	N,O	N,O - Police
Dallas	N	N - Police
Monroe	M	M - Police
Portland	E,M,N,O	E - Neighborhood Env.
		M,N,O
Salem	N	N - Police
West Linn	N	N - Police
Winston	M	M - Police
Multnomah Co.	O	O - Police
ALASKA		
Anchorage	E,M,N	E - Health & Env. Protection

E- Environmental/land use
M- Motor Vehicle
N- Nuisance
O- Offroad Vehicles

Drinking Water Quality

The drinking water in most homes in the Pacific Northwest today is generally considered safe, mainly because of the high standards set by public water supply systems. Although waterborne diseases are not common, they do occasionally occur; one outbreak of viral gastroenteritis affected 400 persons in Washington in 1978. In addition, chronic diseases may result from ingesting water containing high levels of inorganic or organic chemicals or radioactive materials.

Public Water System Program

The Safe Drinking Water Act, passed in 1974, gave EPA primary responsibility for establishing drinking water standards, but intended that the states implement programs to ensure that the standards are met.

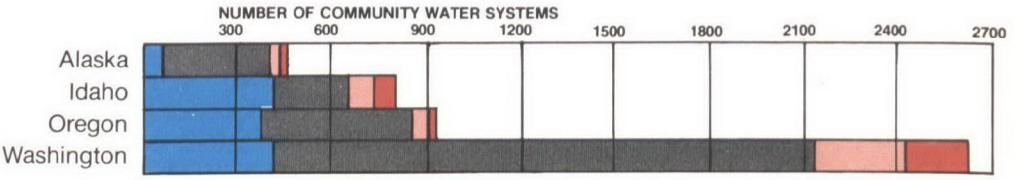
Washington State has over 2,600 community water systems, and over 2,000 non-community water systems that serve non-resident populations in such facilities as campgrounds and highway rest stops. To implement the program with this large number of water systems, the State identified as its basic objective the development and encouragement of responsible, capable public water systems with adequate financial resources to carry out their responsibilities.

In order to meet this objective the state has developed programs that provide for certification of water system operators, control the proliferation of inadequate systems, and ensure proper management and operation of small public water systems. In addition, to assist publicly owned water systems in making facility improvements the State's voters approved a $50 million bond measure in 1972. These funds provided financial assistance for over 350 construction projects and almost 100 planning and engineering projects. The funding program has resulted in the most intensive improvement to public water systems in the history of the state. The 1979 legislature authorized $10 million to provide further funding over the 1980-81 biennium. In the 1980 general election, the voters will decide whether $75 million in additional state general funds should be made available for water system improvements.

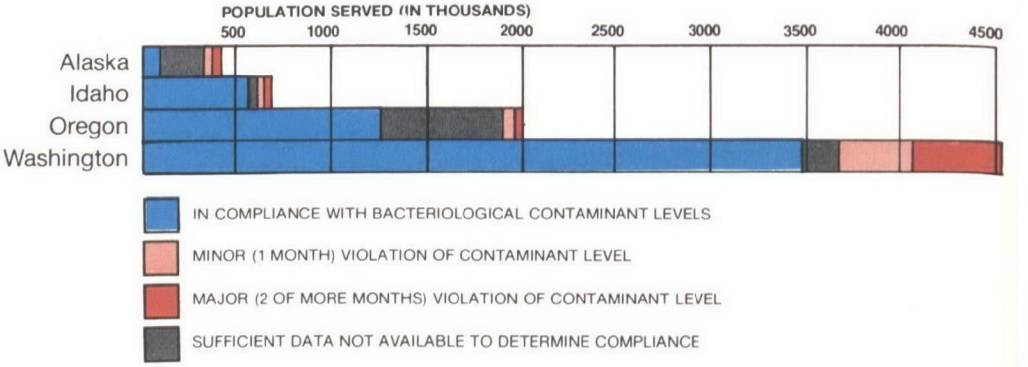
Figures 24a and b show the degree of compliance with EPA regulations attained in Washington in 1978. Although only 440 community systems (17%) comply with regulations for bacterial contamination, these systems serve 77% of the state's population using community water systems. Data for 65% of the systems, serving 180,000 people, are insufficient to judge compliance. Eighteen percent of the community systems, serving approximately the same percentage of people, experience major or minor violations.

Figure 24.
Compliance with EPA Drinking Water Standards

a. Community Water Systems

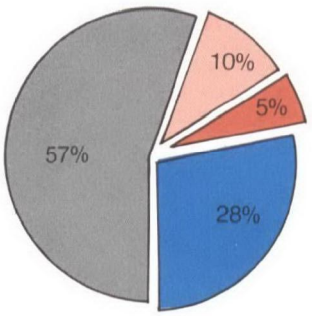


b. Persons Served by Community Water Systems

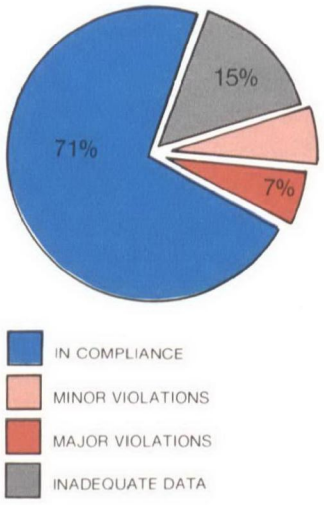


On a regional basis, only 28% of the community water systems comply with regulations for bacterial contamination; however, this includes 71% of the population served by such systems (Figure 25). Fifteen percent of the systems reported major or minor violations of regulations on bacterial contamination. Data are inadequate to assess compliance in 57% of the systems.

Figure 25.
a. Regional Summary Based on Percentage of Community Water Systems

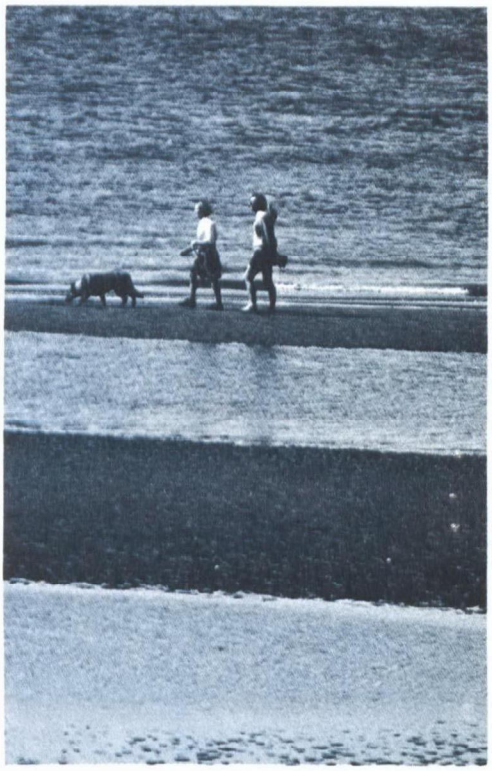


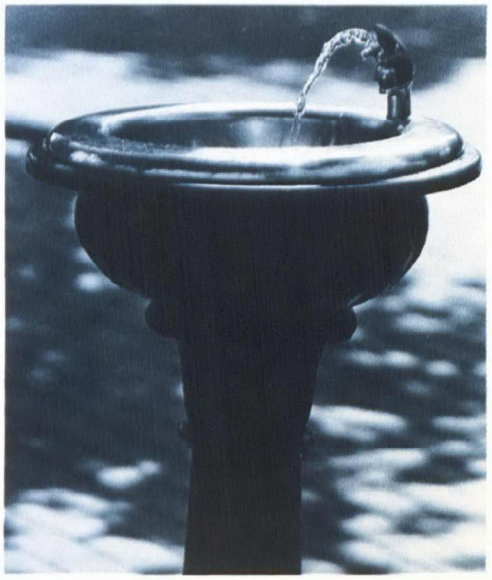
b. Regional Summary Based on Population Served by Community Water Systems



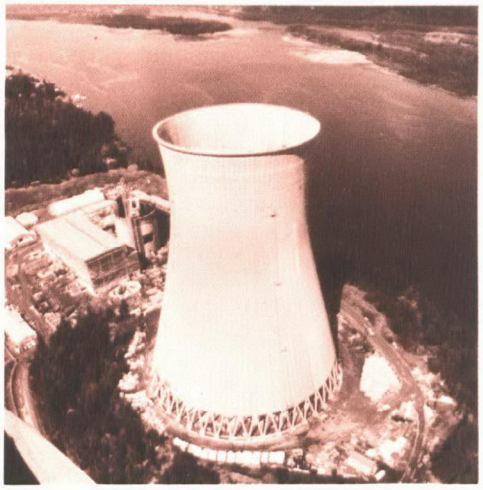
Groundwater Protection

The Safe Drinking Water Act also established a program to protect underground sources of drinking water (groundwater). One feature of the national program is referred to as the "sole source" designation for aquifers. (Aquifers are porous underground rock layers containing water.) EPA has designated the Spokane Valley-Rathdrum Prairie Aquifer for sole source protection. This aquifer provides water for about 40,000 Idaho residents and 300,000 Washington residents in the Coeur d'Alene and Spokane areas. The designation prohibits any Federal agency from financially assisting any project that EPA determines may contaminate this important aquifer. Another program is the ongoing nationwide assessment of the potential for groundwater contamination from surface water impoundments (such as ponds and sewage lagoons).





Solid Waste and Hazardous Substances



When a product has reached the end of its useful life, it is normally thrown away. Discarded items typically end up in a landfill or are illegally dumped elsewhere—out of sight, out of mind. Scarcity of land for solid waste disposal, concern about limited resources, and serious health hazards arising from improper disposal of toxic substances prompted Congress to pass the Resource Conservation and Recovery Act (RCRA) in 1976. The following section summarizes the waste problems addressed through RCRA in the Pacific Northwest, as well as hazards dealt with by other means.

Solid Waste Disposal

The Resource Conservation and Recovery Act provides for criteria to be established for landfill operations. In the past, municipal landfills have often been open dumps. Open burning of wastes has been virtually eliminated from Region 10, but many environmental problems related to improper disposal of municipal waste remain. Water pollution is the major concern. Rainwater draining over the surface of a fill, or filtering into the ground through the wastes, can dissolve (leach) such undesirable substances as chemicals and bacteria into streams and groundwater. Because of the higher rainfall and greater population west of the Cascades, leachate problems there have been more numerous and serious than in more arid parts of Region 10. Recently constructed landfills such as those in Lane County, Oregon, and Snohomish County, Washington, have been engineered for leachate collection and treatment. Older landfills which had serious leachate problems, such as the Cedar Hills landfill in King County, Washington, are beginning to install leachate collection systems which pump leachate into the sewage treatment system. Other landfills may have to be closed altogether.

There are other disposal problems, some of which result from improper practices. For example, when garbage decomposes, methane gas is produced as a by-product. Methane is toxic to vegetation and is explosive in certain concentrations. Decomposition can also produce odors. Household wastes, in particular, may attract disease-carrying rodents and insects. Proper disposal operation, including daily cover and proper compaction, will reduce many of these problems. Sewage sludge disposal is an increasing problem as water pollution requirements become stricter and landfill space becomes scarce. Alternatives such as incineration and using the sludge on farm or forest land are being tried. Certain areas have special disposal problems. In Alaska, for example, severe cold makes disposal difficult.

Resource Recovery

RCRA provides financial assistance for cities and public solid waste management authorities to develop and implement comprehensive solid waste plans, including environmentally sound disposal methods and resource recovery and conservation programs. Some municipal wastes, such as glass, metal, and newspaper, can be recycled, and much of the rest can be converted to "refuse-derived fuel" or burned to create steam or electricity. Lane County, Oregon, and Tacoma, Washington, are testing RDF plants. Portland and Roseburg, Oregon, and Cowlitz County, Snohomish County, and King County, Washington, are also studying the feasibility of converting waste to energy (Figure 26). The economics of recycled materials are typically very good in the Portland and Puget Sound areas, but recycling programs in Idaho and Alaska suffer from higher transportation costs.

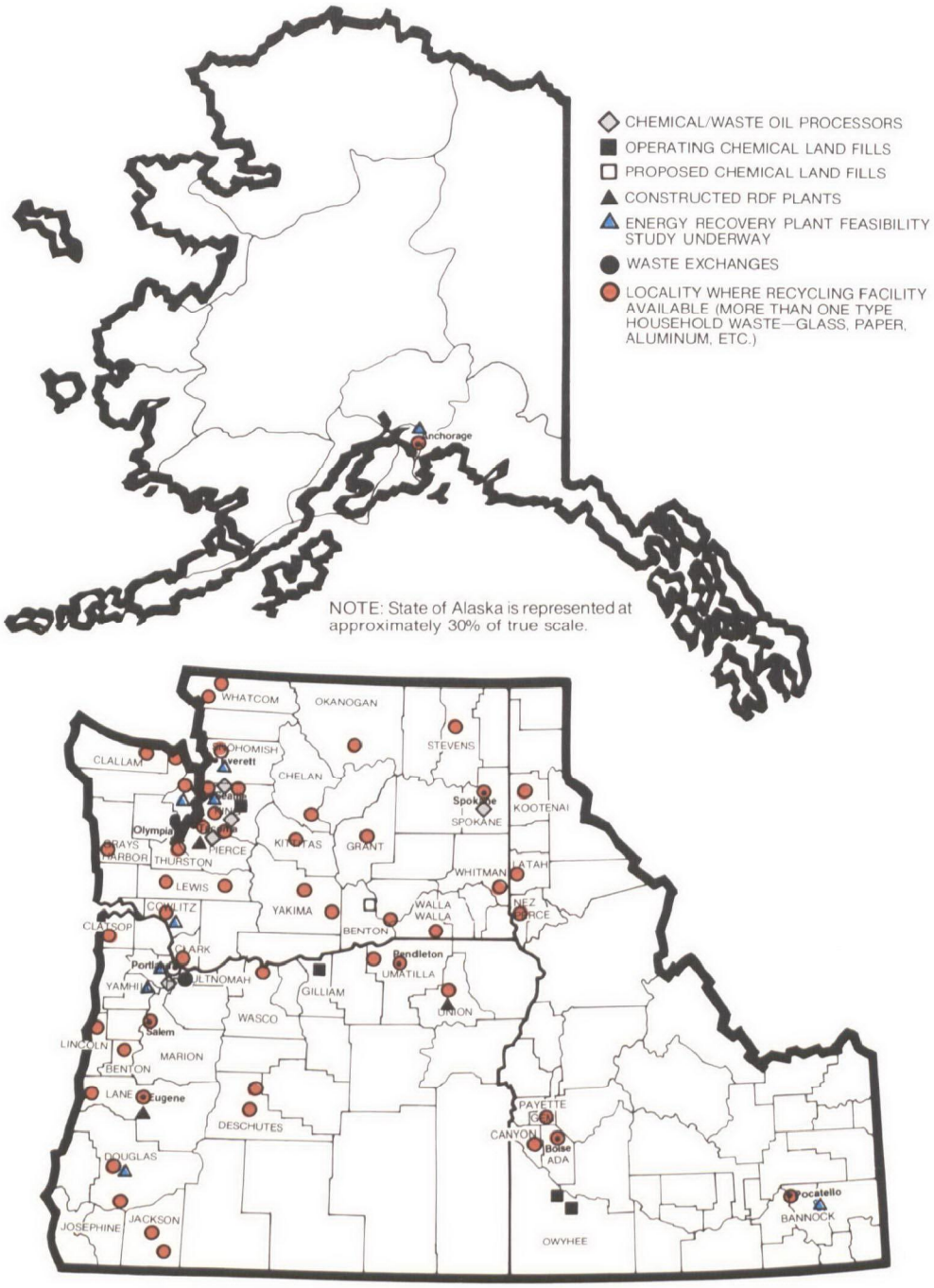
Other wastes, which have potential for recovery and at the same time present serious disposal problems, include tires, lubricating oil, and wood waste. Discarded tires gradually work to the surface in a landfill, where they trap water and become a breeding place for mosquitos; and they are a fire hazard. Recently, shredded tires have been used as a fuel in boilers at the Georgia-Pacific plywood mill in Toledo, Oregon. Waste lubricating oil used on roads as a dust suppressant can contaminate air and water, and lead in the oil makes indiscriminate burning or disposal undesirable. Oregon recently passed a Used Oil Collection Act, providing for designated collection centers, which will encourage re-refining of waste oil. Wood waste, which can pollute water resources and consume significant space in landfills, is presently being used to produce steam in several northwest timber mills and utilities. It may also be used in combination with refuse-derived fuel.

Hazardous Materials

The Resource Conservation and Recovery Act mandates government control of hazardous waste from its generation to ultimate disposal, including a manifest system and a permit system for treatment, storage, and disposal facilities.

Compared to other parts of the country, there are fewer industrial sources of hazardous waste in Region 10. Most of it is created by manufacturers of chemicals, pesticides, and metals; petroleum refineries; and electroplating operations. These sources are concentrated around Puget Sound and in the Willamette Valley. In agricultural areas of the region, the primary source of hazardous waste is discarded pesticide containers.

Figure 26.
Location of Hazardous Waste and Recovery Sites in Region 10



For RCRA to be effective, acceptable waste disposal sites must be available. There are two state-licensed chemical landfills in Region 10 at Arlington, Oregon, and Grandview, Idaho. A third has been proposed on the U.S. Department of Energy's Hanford Reservation in Washington. The availability of such landfills, coupled with the active involvement of Region 10 states in hazardous waste management, has helped prevent serious incidents involving hazardous wastes from occurring in the Region. Nevertheless, there is opposition to using these landfills to dispose of wastes from out of state. In addition, RCRA does not address the problem of abandoned facilities, which have posed serious health hazards elsewhere in the country in several documented instances. A national trust fund for cleanup of abandoned sites has been proposed, and an inventory of such sites is being conducted.

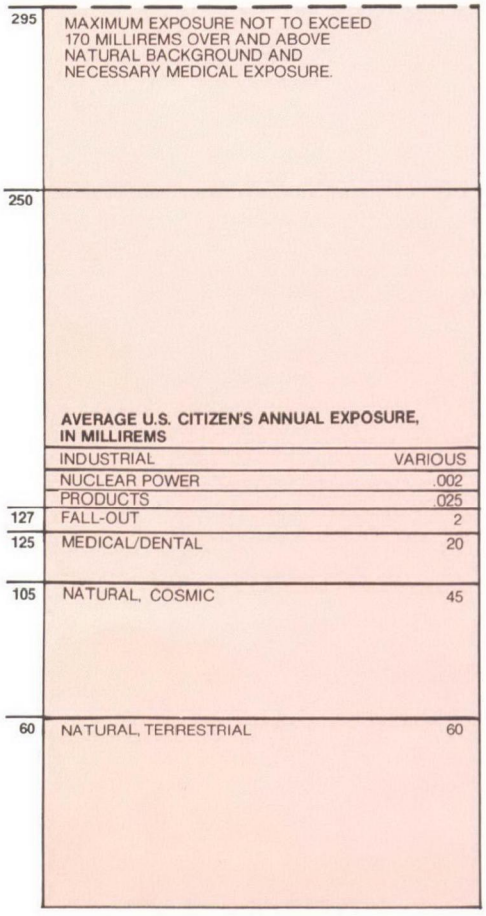
Besides landfilling, there are several other approaches taken to waste management in the Northwest. Waste exchanges in Portland and Seattle assist parties wishing to dispose of a hazardous substance in locating a second party that can use or recycle the material, thereby eliminating a need for disposal. The second party may be a chemical processor that uses the waste as feedstock for another product. Regulations determine how some substances are used; for instance, labeling and disposal procedures have been established for the more than 800 facilities in Region 10 using or storing polychlorinated biphenyl (PCB's), a highly toxic substance used in electrical transformers and capacitors. Some efforts have also been made to rectify past uses of hazardous substances. Each state in Region 10 will participate in a voluntary national program to reduce the exposure of school children to asbestos fiber found in older school buildings. In addition to long-term management plans, emergency response plans have been developed. Units within several fire departments, including Seattle and Tukwila, Washington, have been trained to deal with incidents involving hazardous materials.

Radiation

As Figure 27 shows, every person is exposed to radiation from naturally occurring, inescapable sources like cosmic rays and soil. Normally, less than half a person's radiation exposure is man-made. The data in Figure 28 are based on national statistics, but are representative for Region 10 as well.

Because the genetic and cancer-causing effects of radiation are thought to be additive or cumulative, the radiation dose to individuals must be kept to the lowest practicable level. EPA limits the radiation dose to individuals and to the total population by monitoring radiation and by setting and enforcing regulations on radioactivity in air, drinking water, surface water, and waste materials, and from nuclear power plants.

Figure 27.
Average Amount of Exposure to Radiation, Per Person Per Year



Pesticides

Pesticides are poisons for controlling insects, weeds, or rodents. Improperly used, they can harm other organisms besides their target, causing illness or death. The regulation of pesticides poses some complex policy and technical issues. Conventional chemical pesticides, by their very nature, are hazardous; but they are widely viewed as necessary to maintain agricultural productivity. In addition, the hazards of pesticides—especially the long-term chronic effects—are difficult to assess. The law that gives EPA authority to regulate pesticides is the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Pesticide producers are inspected, and they and their product must be registered with EPA. Testing of pesticides products, labeling for consumer use, and annual reporting are also required of manufacturers.

The EPA and state agencies work together to regulate the manufacture and use of pesticides. During 1979, EPA had cooperative enforcement agreements with the Idaho, Oregon, and Washington State Departments of Agriculture. This means that primary enforcement responsibilities covering such things as fines, restricting use, and suspending licenses, rest with the state; but EPA can take further action if warranted.

The major thrust of the FIFRA program is directed toward pesticide users. Since 1976, EPA has worked with the states in developing training and certification programs. Applicators of restricted use pesticides (pesticides with greater potential for causing adverse effects) must be certified to ensure that they are competent in the use of these pesticides. EPA and the states combine efforts to see that pesticides are being used according to label directions.

After pesticides are used, the Food and Drug Administration is responsible for checking that pesticide residues on raw agricultural commodities are within required limits.

Environmental monitoring for pesticides, through the offices of EPA, is conducted by certain state health departments through EPA grants.

Pesticide registration and resulting use can be discontinued at any time that EPA determines that unreasonable adverse effects outweigh the benefit from continued use of the pesticide. If further restricting use of the pesticide cannot correct the problems, ultimately the product can be cancelled or suspended. For example EPA recently took emergency action to suspend products containing 2,4,5-T and Silvex.

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