June 2015

Understanding Tribal Exposures to Toxics

Clockwise from top left: Weaving and Maple Bark Workshops - Karuk and Yurok Tribes; Fish Processing - Yurok Tribe; Tulle Harvesting; Fish Processing - Bad River Band of Lake Superior; Clam Harvesting - Coeur d'Alene Tribe; Duckabush Clam Harvest - Port Gamble S'Klallam; Clam Harvesting - Lower Elwha Tribe; Cedar Bark Harvesting - Lower Elwha Tribe

This Report has been developed under the direction of the National Tribal Toxics Council as a first step to identifying the state of toxics affecting tribes.

To provide feedback to NTTC, contact us at www.tribaltoxics.org

Federal Trust Responsibility

The US Environmental Protection Agency (EPA) is responsible, in concert with Tribes, for ensuring that federal environmental laws are carried out on Tribal lands and that the Tribal government is not degraded. In November 1984, the EPA published its agency policy for the development and implementation of tribal environmental protection programs. The EPA Indian Policy provides the guidance necessary for the administration of environmental protection on Indian lands. This Policy was reaffirmed in the current administration by then-EPA Administrator Lisa Jackson in 2009 and is consistent with President Obama's Executive Order on Government-to-Government relationships when working to "protect the land, air, and water in Indian country."

Disclaimer

This Report and recommendations have been written as part of the activities of the National Tribal Toxics Council (NTTC), a tribal partnership group established in January 2012 that works with EPA's Office of Pollution Prevention and Toxics (OPPT) to provide tribes with an opportunity for greater input on issues related to toxic chemicals and pollution prevention.

This Report has not been reviewed for approval by the EPA, and hence, its contents and recommendations do not necessarily represent the views and the policies of the Agency, nor of other agencies of the United States federal government.

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National Tribal Toxics Council

P.O. Box 15004 Flagstaff, AZ 86011
928-523-2005 Office 928-523-1266 Fax
www.tribaltoxics.org

Council Members

DIANNE BARTON
NTTC Chair
Columbia River Inter-Tribal Fish Commission

RYAN CALLISON
Cherokee Nation of Oklahoma

FRED COREY
NTTC Vice-Chair
Aroostook Band of Micmacs

LARRY DUNN
Lower Elwha Klallam Tribe

SUZANNE FLUHARTY
Yurok Tribe

GARY HAY
Chickaloon Village Traditional Council

JOLENE KEPLIN
Turtle Mountain Band of Chippewa

RALPH MCCULLERS
Poarch Band of Creek Indians

RORY O'ROURKE
Port Gamble S'Klallam Tribe

VERNA POTTS
Prairie Band Potawatomi Nation

KELLY WRIGHT
Shoshone Bannock Tribes

June 22, 2015

Ms. Gina McCarthy
Administrator
United States Environmental Protection Agency
William Jefferson Clinton Building
1200 Pennsylvania Avenue, N. W.
Mail Code: 1101A
Washington, DC 20460

RE: Institutionalization of a Tribal Risk Assessment Policy and Process

Dear Administrator McCarthy,

Thank you for your continuing efforts to protect Native Americans and Alaskan Natives from the multitude of environmental issues that affect our cultural resources and health. We appreciate your sincerity in protecting our resources and health through EPA's regulatory authority and recent memo, dated December 1, 2014, that the agency has an obligation to honor and respect tribal rights and resources protected by treaties. We believe that EPA can strengthen its ability to ensure that Tribal people and resources are protected equally with other citizens by:

> *Developing and implementing a formal agency-wide directive to institutionalize the evaluation of tribal exposure pathways for risk assessment of toxic chemicals and cleanup standards to address the most highly exposed and disproportionately impacted populations.*

We believe this recommendation is aligned with EPA's FY2014-2018 Strategic Plan for advancing EPA's priorities and mission to protect human health and the environment by addressing a tribal-specific issue in all five of the FY2015-2018 Strategic Goals identified by the Agency. This recommendation also emphasizes the following cross-agency strategies that set clear expectations for the way EPA does business in achieving its results:

> *Working to Make a Visible Difference in Communities*
> *Launching a New Era of State, Tribal, Local and International Partnerships*

Your predecessor, Lisa Jackson, made protection of children's health one of her top priorities, which was an important step in providing environmental health protection for a vulnerable population. Your administration can make a positive impact in protecting tribal health and lifeways by institutionalizing a process to consider tribal exposure in risk assessment across EPA programs. Institutionalization of such a policy and process is clearly within EPA's regulatory authority, and does not afford special protection to Tribes and Tribal resources, but rather provides protection equal to that of other citizens who are less exposed and/or vulnerable to environmental contaminants.

The Members of the Council are offering their opinions on toxics issues and do not speak for individual tribes

Tribes are highly exposed based on higher consumption of contaminated foods, higher environmental exposures due to increased activities associated with environmental media, all of which are not currently considered in risk assessments across EPA programs or in EPA's TSCA risks assessments of individual chemicals prior to determining regulatory action. For your reference, please find attached an "Understanding Tribal Exposures to Toxics" document that was drafted by the National Tribal Toxics Council. This report provides information to enable readers to recognize situations that might require an understanding of how natural resources are used by tribes for food, medicine, cultural and traditional practices, and/or recreation. This is important for three reasons: (1) tribes may be exposed to higher doses of contaminants in natural resources than the general population because non-mainstream, traditional ceremonial and subsistence foods may carry higher toxic burdens which should be utilized in dose calculations, (2) tribes may be exposed to higher doses of contaminants due to longer durations or higher frequencies of exposure than the general population, and (3) impairment of natural resource uses affects tribal social and cultural well-being beyond nutrition and physical health. This understanding may help EPA and other regulators determine whether or not those uses are adequately protected under environmental statues, and may help regulators develop guidelines for evaluating risks and impacts to tribal well-being.

EPA does not identify tribes as a population that is highly exposed to some chemicals nor identifies exposure pathways specific to tribes when planning human health and ecological risk assessments. For example, EPA's 2010 exposure assessment of polybrominated diphenyl ethers (PBDE) overlooks reasonable risks to fish consuming tribal populations and thus misses the identification of significant exposure pathways and the need to establish corrective regulatory controls to better protect the health of tribal members as well as the general population. Additionally, EPA's Office of Pollution Prevention and Toxics, responsible for prioritizing work plan chemicals and developing TSCA-chemical risk assessments, did not consider recommendations to include the following factor in prioritizing chemicals for risk assessment: "chemicals detected in subsistence or traditional use resources,"[1] or consider recommendations to include tribal exposure pathways when developing conceptual models of potential pathways for their problem formulation and initial assessments of TSCA Work Plan Chemicals.

Tribal exposure must be considered and quantified across all media programs at the beginning of the risk assessment process by engaging tribes in the problem formulation and initial assessments. This also requires EPA technical assistance and funding for tribes to generate the data needed.

Thank you again for your sincere desire to assist with fulfilling obligations of the United States to protect Tribal resources for the benefit of American Indians and Alaskan Natives. Along with the fulfilling legal obligations, we believe that EPA has a duty to provide equal protection to all citizens, and through your enactment of an Agency-wide policy and process to ensure that Tribal risks are contemplated in all of EPA's risk assessment activities, you will significantly strengthen EPA's ability to protect human health and the environment.

If you have any questions or comments regarding our request, please contact us at your convenience: Dianne Barton, NTTC Chair, at (503) 731-1259 / bard@critfc.org or Fred Corey, NTTC Vice-Chair, at (207) 764-7765 / fcorey@micmac-nsn.gov.

Sincerely,

Dianne C. Barton, Chair
National Tribal Toxics Council

Fred Corey, Vice-Chair
National Tribal Toxics Council

[1] Recommended prioritization factor by Fred Corey in response to EPA's request for comments in Identifying Priority Chemicals for Assessment and Review, Topic 1(a) Prioritizations Factors to submit what other factors, if any, should the Agency add, and why (for Step 1 in which EPA planned to use a specific set of data sources to identify candidate chemicals that meet one or more of the priority factors identified). http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2011-0516-0003

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Acknowledgements

The National Tribal Toxics Council (NTTC) acknowledges the following NTTC consultants for their contributions in developing this report. We acknowledge their lifelong work in developing solutions to adequately protect tribal health by increasing US Environmental Protection Agency and other regulators' understanding of the risks and impacts of toxics to tribes: Dr. Barbara Harper, School of Biological and Population Health Sciences at Oregon State University, has worked with tribes and tribal risk assessment for over 20 years; and Catherine O'Neill, Professor of Law, Seattle University School of Law, whose work considers environmental issues affecting tribes' rights and resources.

Current NTTC members and support staff that contributed to the development of this report include:

National Tribal Toxics Council Members			
Dianne Barton	Columbia River Inter-Tribal Fish Commission	Council Chair	EPA R10
Ryan Callison	Cherokee Nation	Council Member	EPA R6
Fred Corey	Aroostook Band of Micmacs	Council Vice-Chair	EPA R1
Larry Dunn	Lower Elwha Klallam Tribal Community	Council Member	EPA R10
Suzanne Fluharty	Yurok Tribe	Council Member	EPA R9
Gary Hay	Chickaloon Village Traditional Council	Council Member	EPA R10-AK
BJ Howerton	Department of Interior, BIA	Ex-Officio Member	EPA R10
Myla Kelly	Peaks to Prairies P2 Center MSU	Ex-Officio Member	EPA R8
Jolene Keplin	Turtle Mountain Band of Chippewa	Council Member	EPA R8
Ralph McCullers	Poarch Band of Creek Indians	Council Member	EPA R4
Rory O'Rourke	Port Gamble S'Klallam Tribe	Council Member	EPA R10
Verna Potts	Prairie Band Potawatomi Nation	Council Member	EPA R7
Doug Stevens	Salish Kootenai College	Ex-Officio Member	EPA R8
Kelly Wright	Shoshone Bannock Tribes	Council Member	EPA R10
Institute for Tribal Environmental Professionals			
Mehrdad Khatibi	Director		
Jennifer Williams	Program Coordinator, Sr.	Council Support Staff	
Riley Smith	Graduate Student	Council Support Staff	

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Understanding Tribal Exposures to Toxics

Executive Summary

The production and use of chemicals are increasing worldwide. As of January 2015, more than 84,000 chemical substances are on the Toxic Substances Control Act Inventory of Existing Chemical Substances and 500-1000 are added each year.[1] Governments, organizations, committees, networks, scientists, and concerned individuals around the world are working toward toxic-free people and environments. With all the information that is available, it is widely recognized that there are data gaps with the risks that are generated by toxic chemicals that are being used in the products we use daily. While risks to the general public and other subpopulations may be addressed by other groups, NTTC's purpose is to identify ways that toxic chemicals may be specifically impacting American Indian tribes, Alaska Natives, and Native Hawaiians, identified as "tribes" throughout this document.

NTTC members are working with tribal representatives across the nation and OPPT to provide limited input on areas of concern for tribal communities that may influence OPPT's risk assessment process for the TSCA Work Plan chemicals. It is critical that all EPA programs consider how chemicals are affecting tribal communities' subsistence food and traditional activities, yet years of recommendations from National Tribal Councils, organizations, and researchers noted in Section 3 of this report have made little progress with incorporating tribal data into EPA's risk assessment process. Additionally, tribes and other organizations have been requesting assistance to collect and incorporate tribal-specific data for over two decades.

It is NTTC's perception that EPA has not adequately considered tribal concerns regarding exposure to toxic chemicals. NTTC members and experts in the field of tribal exposure and risk assessment have summarized key findings and recommendations in Section 4 of this report. Based upon NTTC's evaluation of TSCA and review of OPPT's risk assessment process, NTTC concludes that tribal populations are unnecessarily left at significant risk.

This report is intended to improve decision making by informing elected officials, representatives, tribal leadership, EPA regional administrators, national and regional tribal representatives of tribes' unique exposures to toxics that are not considered in current TSCA risk assessments (or in risk assessments conducted under other statutes that serve in lieu of TSCA risk assessments), as well as help guide NTTC and OPPT in providing a framework for TSCA risk assessments and policy development that are more protective of tribal health and the natural resources that have sustained tribes for generations.

Who are NTTC and OPPT?

The National Tribal Toxics Council (NTTC) is a United States Environmental Protection Agency (EPA) Tribal Partnership group established in January 2012, from a steering group established in 2011. NTTC works with EPA's Office of Pollution Prevention and Toxics (OPPT) to provide tribes with an opportunity for greater input on issues related to toxic chemicals and pollution prevention. OPPT was formed in 1977 with the primary responsibility for administering the Toxic Substances Control Act (TSCA) (TSCA Summary) and Pollution Prevention Act (PPA) (PPA Summary).

OPPT has developed two roles under TSCA: 1) to serve as a gatekeeper/guardian, using its regulatory authorities granted by Congress to keep potentially risky new chemicals out of the market while assessing and managing the potential risks of existing chemicals and 2) to promote environmental stewardship and sustainability, through collaborative programs with stakeholders and educational initiatives. In support of EPA's mission, OPPT goals include:

[1] http://www.epa.gov/opptintr/existingchemicals/pubs/tscainventory/basic.html last accessed January 12, 2015

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- **Promoting pollution prevention** as the guiding principle for controlling industrial pollution;
- **Promoting safer chemicals** through a combination of regulatory and voluntary efforts;
- **Promoting risk reduction** to minimize exposure to existing substances such as lead, asbestos, dioxin, and polychlorinated biphenyls; and
- **Promoting public understanding of risks** by providing understandable, accessible and complete information on chemical risks to the broadest audience possible.

OPPT's strategy for addressing potential risks from existing chemicals includes identifying priority chemicals for risk assessment and taking actions as appropriate. If an assessment identifies unacceptable risks to humans or the environment, EPA will pursue risk reduction activities. Therefore, it is important to briefly explain OPPT's Work Plan process for identifying priority chemicals for assessment to understand NTTC's recommendations for OPPT to assist tribes with identifying priority chemicals for review and assessment and include tribal exposure pathways in problem formulations, initial assessments, and final risk assessment for all TSCA Work Plan chemicals.

In 2011, OPPT used a two-step process to identify priority chemicals for review and assessment, which continues to direct the activities of OPPT's Existing Chemicals Program: Step 1) identify priority chemicals for review and Step 2) select specific chemicals for assessment. Step 1 identified 1,235 chemicals that matched at least one of the following criteria: reproductive and developmental effects; neurotoxic effects; persistent, bioaccumulative, and toxic (PBT); probable or known carcinogens; used in children's products; or detected in biomonitoring programs. Chemicals were then excluded either because they did not meet the intent of the prioritization criteria, they were not subject to action under TSCA (such as pesticides which are regulated under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)), or they were already the subject of TSCA action (such as polychlorinated biphenyls (PCBs)). Additionally, metals and their related compounds were grouped together. This process identified 345 chemicals to be evaluated in Step 2. Step 2 then scored the 345 chemicals identified in Step 1 based on three characteristics: hazard, exposure, and potential for persistence and/or bioaccumulation based on then-available information. EPA included 83 chemicals in their 2012 Work Plan and 90 chemicals in their 2014 Update.[2] Inclusion of a chemical on the Work Plan does not constitute any finding of risk under TSCA. Inclusion of a chemical on the Work Plan identifies the chemical for further review and assessment. Between 2012 and 2014 EPA has completed assessments for five TSCA Work Plan Chemicals.[3] As of June 2015, EPA has release the Problem Formulation and Initial Assessment for one TSCA Work Plan Chemical and initiated assessments for eight TSCA Work Plan Chemicals.[4]

NTTC Mission, Goals, and Priorities

The mission of the NTTC is to advance tribal toxics management policies and programs consistent with the needs, interests, and unique legal status of American Indian tribes, Alaska Native, and Native Hawaiians.[5]

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[2] http://www.epa.gov/oppt/existingchemicals/pubs/TSCA_Work_Plan_Chemicals_2014_Update-final.pdf last accessed January 18, 2015
[3] http://www.epa.gov/oppt/existingchemicals/pubs/riskassess.html last accessed June 21, 2015
[4] http://www.epa.gov/oppt/existingchemicals/pubs/riskassess.html last accessed June 21, 2015
[5] Tribes (used throughout this document) includes tribal people, resources, and other interests; interests (as sovereigns, seeking to govern/regulate tribal resources and as proprietors, i.e., holders of rights to land, water, fish, etc.) and the interests of individual Native people (whether they are tribal citizens or not; whether they live on a reservation or not); it is important to encompass tribal members who do not reside on tribal land, usual and accustomed areas, as well as treaty-protected resources; tribal lands as used in this report includes reservations, ceded lands, Usual and Accustomed areas (U&A) as well as communities inclusive of the Alaska Native Villages and Islanders and those without land bases.

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Understanding Tribal Exposures to Toxics

NTTC Goals

1. Minimize disproportionate adverse health outcomes to tribal members from increased exposure to toxics experienced through their unique cultural, ceremonial, and subsistence practices.

2. Increase tribal capacity to understand, monitor, assess, and mitigate toxics' impacts to local environmental media including subsistence foods and those resources handled, utilized, or consumed in tribal lifeways[6].

3. Enhance tribal consultation and coordination on national chemical risk management policy and pollution prevention initiatives.

4. Maintain a cooperative exchange of information between tribes, federal partners, and other organizations that represent tribal interests in chemical risk management and pollution prevention initiatives that impact tribal lifeways.

NTTC Priorities

Identify Tribal Exposures to Toxics: Address the environmental injustice of disproportionate adverse health outcomes to tribal members from increased exposure to toxic chemicals by encouraging the use of tribal exposure as a standard default in conducting risk assessment analysis of toxic, persistent, and bio-accumulative chemicals. *This priority is consistent with the OPPT requirement to perform risk assessments, and will help improve TSCA risk assessments by evaluating potential tribal exposures and risk in each chemical-specific review. Additionally, NTTC seeks to help OPPT define unreasonable risk, and help OPPT to robustly characterize the multiple and interrelated facets of the adverse impacts to tribes that result from of chemical exposures (and conversely to account fully and appropriately for the benefits of reduced exposures).*

Encourage Tribal Toxics and Pollution Prevention Program Development and Implementation: Prioritize informed and effective chemical risk management options and appropriate, diverse solutions that address tribal needs by requesting funding for tribes to understand, monitor, assess, and mitigate toxics' impacts.

Enhance Tribal Consultation and Collaboration: Influence policy change and advocate for tribal perspectives in decision making through consultation outreach, submitting comment letters, and facilitating tribal participation in the consultation process. *This priority is consistent with EPA's 1984 American Indian Policy, the Final Policy for Consultation and Coordination with Indian Tribes (2011), and other policies listed on EPA's American Indian Environmental Office's website.*[7]

Network, Collaborate, and Provide Outreach: Maintain and support national, regional, and individual tribes' needs and concerns by providing tools, resources, and outreach that help in the recognition and implementation of effective chemical management and pollution prevention policies, practices, and programs that impact tribal lifeways, including community members' health and the health of environmental resources. *This priority is consistent with OPPT's priority to promote safer alternatives in Indian Country.*

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[6] Tribal lifeways are inclusive of, but not limited to, economic, cultural, ceremonial, recreational, and subsistence practices.
[7] http://www.epa.gov/tribalportal/basicinfo/presidential-docs.html last accessed June 21, 2015.

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List of Acronyms and Abbreviations

AI/AN	American Indian and Alaska Native
BPA	bisphenol A
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CO	carbon monoxide
COCs	chemicals of concern
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CWA	Clean Water Act
EPA	United States Environmental Protection Agency
FCR	fish consumption rate
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
HI	hazard index
IRIS	Integrated Risk Information System
IRAC	Intertribal Risk Assessment Committee
kg	kilogram
MEA	Millenium Ecosystem Assessment
MeHg	methylmercury
NHANES	National Health and Nutrition Examination Survey
NIEHS	National Institute of Environmental Health Sciences
NIMHD	National Institute on Minority Health and Health Disparities
ng	nanogram
NEJAC	National Environmental Justice Advisory Council
NEPA	National Environmental Policy Act
NRDA	Natural Resource Damage Assessment
NTTC	National Tribal Toxics Council
OPPT	EPA's Office of Pollution Prevention and Toxics
PBDEs	polybrominated diphenyl ethers
PBTs	persistent, bioaccumulative, and toxic chemicals
PCBs	polychlorinated biphenyls
PF	potency factor
RFA	request for applications
RfD	reference doses
SDWA	Safe Drinking Water Act
SF	slope factor
STAR	EPA's Science to Achieve Results
TCE	trichloroethylene
TSC	Tribal Science Council
TSCA	Toxic Substances Control Act

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Section 1 Introduction

As of January 2015, more than 84,000 chemical substances are on the Toxic Substances Control Act (TSCA) Inventory of Existing Chemical Substances and 500-1000 are added each year.[1] Substances on the TSCA inventory are considered "existing" chemicals in US commerce and include all chemicals that have ever been placed on the TSCA inventory. The goal of TSCA is to understand the risk from a chemical before it is introduced into commerce in order to address unreasonable risks and prevent injury to human health and the environment and control risks of chemicals on the market. In 2014, the US Environmental Protection Agency's (EPA) Office of Pollution Prevention and Toxics (OPPT) identified 90 chemicals as candidates for assessment under the TSCA Work Plan, identified in this report as TSCA Work Plan chemicals.[2,3]

The National Tribal Toxics Council (NTTC) is concerned that tribal exposure to toxics from chemicals in commerce was not considered during OPPT's exposure ranking of chemicals in 2011. The exposure ranking was part of the screening methodology used to develop the TSCA Work Plan in 2012, prioritizing which chemicals would be identified for further assessment. A brief description of OPPT's process for identifying these chemicals is outlined in TSCA Work Plan Chemicals Methods Document[4] and detailed in EPA's Discussion Guide: Background and Discussion Questions for Identifying Priority Chemicals for Review and Assessment[5]. It is unknown if additional chemicals would be included or prioritized with a higher ranking in the TSCA Work Plan without considering the following factor recommended for prioritizing chemicals for risk assessment: "chemicals detected in subsistence or traditional use resources."[6] Additionally, the NTTC would like to ensure that OPPT considers tribal exposure to chemicals in commerce by including tribal exposure pathways when developing conceptual models of potential pathways for the problem formulations and initial assessments of TSCA Work Plan chemicals.

It is one of NTTC's priorities to work with OPPT to resolve this data gap and reinforce the need for EPA to identify tribes as a population subgroup that is highly exposed to some chemicals in heretofore unrecognized ways and identify exposure pathways specific to tribes when planning human health and ecological risk assessments. Tribes may be highly exposed based on geographical area, gender, racial or ethnic group or economic status. Such situations must be identified in EPA's human health and ecological risk assessment planning. Tribes may also be highly exposed due to consumption of contaminated foods, and incur higher environmental exposures due to increased activities associated with environmental media. None of these are systematically considered in risk assessments across EPA programs or in EPA's TSCA risks assessments of individual chemicals prior to determining regulatory action.

In addition to conventional human exposure and toxicity, tribal risks include both ecological and cultural exposure/toxicity. Conventional risk assessments typically focus solely on reducing human exposure with minimal attention given to environmental and ecological goals and none given to values-based indigenous cultural well-being. This report provides recommendations to enhance the action needed to implement the tribal policies that EPA has developed as directives for their commitment to protect the health of tribal communities across the country.

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1.1 Background: Why is tribal exposure important for analyzing risk?

The basics of risk analysis and risk assessment are provided here to provide context for the importance of understanding tribal exposure to toxics. Risk analysis incorporates risk assessment, risk management, and risk communication. Risk assessment is a process intended to estimate the risk to a target (sub)population or resources following exposure to a particular chemical.

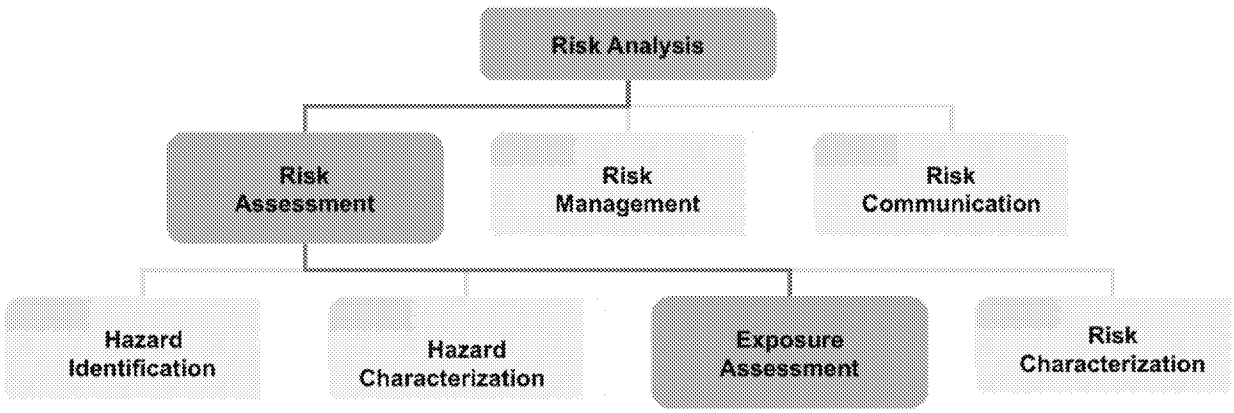

Figure 1. Risk Analysis Basics

Why is understanding tribal exposure to chemicals important in the risk assessment process?

Risk Assessment is a 4-Step Process:

- **Hazard Identification:** Identifies the type and nature of the adverse health effects; requires extensive knowledge of the chemicals present, chemicals of concern (COCs).
- **Hazard Characterization:** Toxicity assessments / dose-response assessments are developed and available by federal agencies such as the Integrated Risk Information System (IRIS). Reference doses (RfD) are developed for non-carcinogens and slope factors (SF) or potency factors (PF) are developed for carcinogens.
- **Exposure Assessment:** Evaluation of concentration of a chemical that reaches a target population. Exposure assessments depend on human activities and require an extensive knowledge of behaviors. There is a lot of "standard" data, but little data available for tribal subsistence lifestyles.

  Must be adjusted for tribal subsistence lifestyles!

  Chronic daily intake (CDI), is the "absorbed" dose (what's actually metabolized into the body) that must be computed for inhalation, ingestion, dermal contact - all where you need specific data on behaviors.
- **Risk Characterization / Computation:** Advice for decision making; integrates the information in steps 1-3 to yield information on the probability that the adverse affects described in the hazard identification will occur under the conditions described in the exposure assessment. Risk is a factor of hazard and exposure. For non-carcinogens, risk = Hazard Index (HI) = CDI / RfD. For carcinogens, risk = SF * CDI.

Exposure assessment requires extensive knowledge of behaviors!

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1.2 Report Purpose and Intended Audience

This report is the first in a series of reports that will assist NTTC in identifying the state of toxics affecting tribes. There is growing evidence that physical, spiritual, and emotional well-being of tribes and the practice of tribal lifeways are being affected by the presence of toxic substances. This report seeks to identify unique chemical exposures and risks to tribal communities and propose recommendations for EPA to develop and implement a formal agency-wide directive to institutionalize the evaluation of tribal exposures to address the most highly exposed and disproportionately impacted populations. EPA can do this by:

- referencing existing research, studies, and recommendations for exposure assessments;
- launching a new era of tribal and intra-agency partnerships for research that makes use of available tribal exposure data and existing body burden levels,
- working to make a visible difference in communities through funding community based-research, and
- providing measurable outreach and technical assistance to tribes.

This report provides information to enable readers to recognize situations that might require an understanding of how natural resources are used by tribes for food, medicine, cultural and traditional practices, and/or recreation, thereby identifying unique routes of exposure to chemicals after they have been released from commercial products into the environment (for example, flame retardants or PCBs that escape into the environment and find their way into natural resources such as fish) that are not currently considered or fully addressed in TSCA risk assessments or TSCA risk reduction activities.

This is important for three reasons: 1) tribes may be exposed to higher doses of contaminants in natural resources than the general population because non-mainstream, traditional ceremonial and subsistence foods may carry higher toxic burdens which should be utilized in dose calculations, 2) tribes may be exposed to higher doses of contaminants due to longer durations or higher frequencies of exposure than the general population and 3) impairment of natural resource uses affects tribal social and cultural well-being beyond nutrition and physical health. This understanding may help EPA and other regulators determine whether or not those uses are adequately protected under environmental statues, and may help regulators develop guidelines for evaluating risks and impacts to tribal well-being.

This report identifies existing research and recommendations from past and current tribal representatives. NTTC seeks to highlight national issues and associated data gaps, informing leaders and funding agencies with information that will allow future research and studies to fill these gaps. Although the information in this report is focused toward EPA action, it may also be used by non-EPA organizations and agencies such as National Institute of Environmental Health Sciences (NIEHS) and National Institute on Minority Health and Health Disparities (NIMHD) for filling data gaps identified herein. Additionally, this report may be used to inform other regulatory and land management agencies, such as the Department of the Interior and the Department of Agriculture, concerning the impacts of toxics to tribal lifeways across the country. This report will provide links to existing research and recommendations to use past and current input from tribal representatives to effect change.

The following topic areas are included in the four sections of this report:

Section 1 provides an introduction to the report including:

- why tribal exposure is important for analyzing risk,
- report purpose and intended audience, and
- scope.

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Section 2 describes how tribes are uniquely exposed to chemicals in and from consumer products by outlining the following tribal exposure topics:

- exposure science,
- tribal lifeways that influence tribes' exposure to harmful chemicals,
- how to determine when tribal resources and health are affected using exposure pathways and tribal exposure scenarios,
- additional exposure factors to consider, and
- other aspects of tribal well-being that are affected by the presence of toxic substances.

Section 3 provides a summary of existing tribal risk and exposure related research, including specific information and recommendations by:

- the National Environmental Justice Advisory Council,
- EPA's report "Documenting What We've Heard"
- EPA's "A Decade of Tribal Environmental Health Research"

Section 4 summarizes the conclusions and recommendations presented throughout the report.

1.3 Scope

NTTC was established as an EPA Tribal Partnership group to work directly with OPPT to address new and existing chemicals and their risks to tribal communities, engage tribal representatives in making recommendations for regulating the distribution and use of chemicals when they affect tribal communities, and find ways to prevent or reduce pollution through changes in production, operation, and raw materials before it gets into the environment and our bodies. Therefore, the original scope of this report was to identify risks to tribal communities from new and existing chemicals. As NTTC compiled research on existing tribal-specific data, reports, and recommendations, it became evident that OPPT's process for identifying and prioritizing chemicals for risk assessment did not include tribal exposures. Additionally, tribal-specific data was not included in the TSCA Work Plan chemical risk assessments currently being conducted.

The NTTC requested that OPPT include tribal exposure in their chemicals risk assessments. In response, OPPT staff has requested NTTC to provide the necessary data to consider tribal scenarios. Although some tribes may have data that OPPT is requesting, it became evident that funding for tribal-specific research is needed to provide multiple scenarios for consideration. Chemical-specific monitoring is also needed to determine if TSCA Work Plan chemicals that OPPT is conducting risk assessment on are present in subsistence foods and those resources handled, utilized, or consumed in tribal lifeways. It is unlikely that tribes can generate the necessary analytical data or compile the information OPPT needs to consider exposure pathways for TSCA Work Plan chemicals without specific project funding or technical assistance by EPA to complete tribal risk assessments.

Therefore, in addition to addressing OPPT-specific requests for tribal recommendations, NTTC expanded the scope of this report to provide a foundation for requesting studies that could serve OPPT's needs for incorporating tribal-specific data and exposure scenarios into TSCA chemical risk assessments. This report includes a broader picture for describing important factors and existing resources necessary for providing lessons learned by other EPA offices and researchers for making recommendations that will support a holistic path forward to address the most highly exposed and disproportionately impacted populations.

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Section 2 How are tribes uniquely exposed to chemicals in and from consumer products?

Chemicals in consumer products can expose tribal members in two ways that are over and above the general population: (1) unique and/or non-standard uses of conventional products, and (2) exposure to chemicals after they have been released from commercial products into the environment (for example, flame retardants or PCBs that escape into the environment and find their way into natural resources such as fish). The emphasis of this report is on the second mechanism.

Unique exposure pathways may exist due to gathering of wild foods, medicines, and materials in non-residential areas (such as national forests or utility rights-of-way), and uses of those resources in traditional practices. Some of these pathways are unique to tribal practices, some may be the same pathway as for the general population but result in higher doses, and some may be the same as for the general population in both quantity and quality. Further, these natural resource uses (also termed ecosystem services) may be integral to the culture and community, and therefore restrictions on access and use due to the presence of chemicals can ripple more intensely through the tribal community causing social, cultural, economic, security, religious, and other harms.

This report attempts to identify tribal exposure pathways that are not currently considered or fully addressed in EPA risk assessment or risk management decisions, with specific emphasis requesting that OPPT identify, characterize, and address tribal exposures to toxic chemicals, particularly those exposures derived from contact with the chemical in the environment, while conducting TSCA risk assessments.

2.1 Exposure Science[7]

Exposure science is relatively young, and its development has been shaped by a variety of forces. In some cases, scientists began with observed data identifying sources of contamination (e.g., an oil refinery; 55-gallon drums leaking chemicals) and worked "forward" to trace the releases downwind or down-gradient until they reach humans whose location and activities may result in contact with potentially harmful concentrations over a relevant time. In other cases, scientists have started from epidemiological information – whether of a cholera epidemic in 1854 or a rash of deaths and neurodevelopmental disorders first discovered in 1956 – and worked "backward" to inquire into commonalities in human behaviors that resulted in exposure to a likely source of the harmful agent (e.g., drinking water from a well at Broad Street, Soho, London; eating fish from Minamata Bay, Japan). In either instance, scientists have often had to piece together the exposure puzzle, relying on a combination of data and intuition about the human behaviors and activities that might result in contact with the toxicants at issue. In many cases, available data were often sparse, and data gaps were large -- yet the health impacts were real and identifiable. Where more comprehensive data existed, the risk assessments tended to reflect the lifestyles and practices of the mainstream, general U.S. population, not those of the most significantly affected portions of the population.

Agency risk assessors typically employ assumptions about people's circumstances of exposure – their characteristics, daily activities, and lifeways that may bring them into contact with toxic substances.

An exposure assessment measures or models the frequency, duration, and intensity of human contact with an environmental contaminant.[8] The three steps in the process are (1) identifying exposure

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pathways based on the media and resource that is contaminated, (2) identifying the route of exposure (what is the portal of entry into the person), and (3) developing exposure factors (the numerical representations of the exposures). Ideally, exposure assessments take into account total exposure and all sources of human contact with a chemical (e.g., a person may contact a given chemical through use of a product, through occupational encounters, through dietary intake, and through activity proximate to a contaminated site).

For some contaminants and routes of exposure, an individual's exposure can be measured directly with high precision, e.g., certain air pollutants can be detected by means of a personal exposure monitor worn constantly by an individual.[9] In other situations, indirect methods use a combination of measured and modeled data to estimate populations' exposure. For example, an approach to assessing exposure to carbon monoxide (CO) might combine measurements of CO concentrations in various microenvironments (e.g., outdoors at work; inside a motor vehicle; indoors at home) with diary-based information recording human activity patterns or with survey-derived information recalling human activity patterns and, enlisting an exposure model, to predict population exposure in certain urban areas.[10]

Thus, exposure assessors must consider data about what products people use (e.g., polybrominated diphenyl ether (PBDE)-laden sofas or bisphenol A (BPA)-infused plastics); where they reside (e.g., in close proximity to an industrial emissions source or a transportation corridor); how much time they spend engaged in various activities at differing levels of cardiovascular vigor (e.g., sleeping, sitting, exercising, hunting) in various locations (e.g., indoors at work; outdoors in a garden; gathering wild foods in a national forest or utility right-of-way); the quantities of various food and drink items ingested; and how all of these change over a lifetime. For the general population, such data about human behaviors and activity patterns have typically been gathered via retrospective surveys or activity diaries (e.g., food frequency questionnaires), which are then combined with demographic and other data. In some cases, the methods used to gather general population data can be useful to describe relevant behaviors and activity patterns for tribal people, while recognizing that contemporary tribal exposure patterns may be substantially different from the traditional heritage lifestyle that was intended to be surveyed. Thus, it is generally inaccurate simply to extrapolate general population data to tribal populations. Contemporary survey methods will not adequately capture exposures received during a fully traditional tribal subsistence lifestyle. Challenges include the difficulty of measuring tribal people's exposures as they practice subsistence activities, and the impossibility of measuring exposures during cultural and religious activities where this is prohibited by cultural norms. Additionally, as elaborated elsewhere in this report, current practices may be constrained due to issues of depletion, contamination, and altered access to the relevant natural resources. For all of these reasons, exposure assessors may need to enlist exposure scenarios, in which potential rather than present actual exposures are considered, in order to adequately comprehend tribal exposures associated with subsistence and other cultural practices.

2.2 What tribal lifeways may influence tribes' exposure to harmful chemicals?

"Native American ties to the environment are much more complex and intense than are generally understood by risk assessors."[11] Many tribal cultures are essentially synonymous with and inseparable from the land and its resources. This lifestyle is resilient and has persisted through floods, droughts, cataclysms, upheavals, and warfare. All of the foods and implements gathered and manufactured by the traditional American Indian are interconnected in at least one way, but more often in many ways.

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Therefore, if the link between a person and his/her environment is severed through the introduction of contamination or physical or administrative disruption, the person's health suffers, and the well-being of the entire community is affected."[12]

Burger and Gochfeld summarize nonstandard exposures as follows:

"Nonstandard exposure pathways occur under four circumstances: (1) qualitatively nonstandard exposures (e.g., dietary, medicinal, or cosmetic use of unusual plants), (2) quantitatively nonstandard exposure (i.e., high consumption rates, children eating dirt, a very large meal [feast of fish], high exposure relative to other foods, body size, or age), (3) both nonstandard and excessive exposure (i.e., applying a chemical or cosmetic to skin, potential exposure to chemicals through cultural activities such as sweat baths), and (4) inadvertent exposure as byproducts of other consumptive, social, or cultural practices (i.e., mercury exposure from cultural practices)." [13]

2.3 How to determine when tribal resources and health are affected using exposure pathways and tribal exposure scenarios

Tribal exposure scenarios for various exposure pathways will reflect traditional lifeways and associated data that are unique to each tribe and that may be applied for estimating exposure. Figure 2 is a visual representation of tribal exposure pathways based on a subsistence lifestyle.

"Tribal lifeways" are inclusive of, but not limited to, economic, cultural, ceremonial, recreational, and subsistence practices. Examples of tribal lifeways that may influence tribes' exposure to chemicals in consumer products and the environment include but are not limited to:

- Hunting, fishing, gathering
- Husbandry (farming/growing)
- Gathering, consumption, and everyday use of plants and plant materials (food, teas, different types of combustibles for smoke generation, collection of firewood or tipi poles, etc.)
- Water collection (untreated)
- Collecting materials for, and making baskets and other weaving, arts, tools, clothes (using feathers, skin, bones, hides, oils, antlers, etc.; wood or stone carvings)
- Building/carving canoes, sweat lodges, other structures
- Bathing/sweat lodge use
- Traditional medicine
- Ceremonial or powwow activities (dancing, traditional games)
- Smoke houses and ceremonies with smoke (fire, sage, etc.)
- Making and use of traditional pottery (made from local clays, etc.)

Identifying exposure pathways is a several-part process used to determine when tribal resources and health are affected. This can be done by answering a series of questions, detailed in the following Sections of this report:

2.3.1 Are tribal resources affected?

2.3.2 How are the resources used?

2.3.3 How much are people exposed (frequency, intensity, and duration of exposure)?

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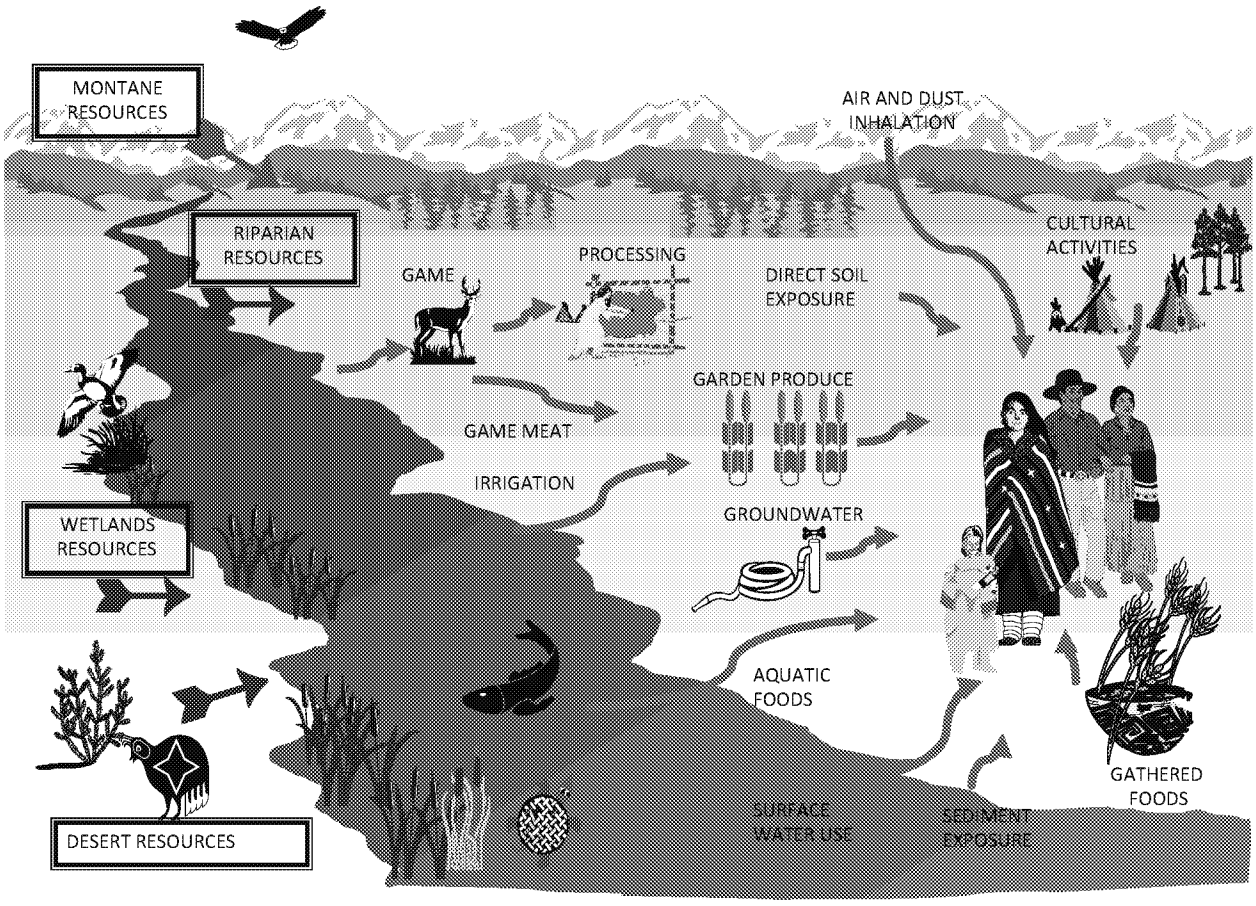

Figure 2. Tribal Exposure Pathways Based on a Subsistence Lifestyle; BL Harper, AK Harding, T Waterhous, and SG Harris (2007). Traditional Tribal Subsistence Exposure Scenario and Risk Assessment Guidance Manual. Corvallis: Oregon State University. http://superfund.oregonstate.edu/outreachevents; and https://app.box.com/shared/70r3579u5gh7ysdugfv7

2.3.1 Are tribal resources affected?

The ecological description of the affected area where the chemical may come to be located provides information about plants, animals, biodiversity, relative proportions of different habitat types, seasonality, and physiographic features of the environment. This information is needed to understand the natural dietary staples (the edible resources that are most abundant and reliable and therefore the target of gathering), and environmental characteristics that affect contact rates with soil, sediment, and water (for example, the ratio of wetlands to upland habitats).

Cultural regions overlap with ecological regions, as would be expected, since cultural practices are largely integrated with ecological resources.[14] Knowing this, the assessor or regulator should logically consider the following questions:

- Will resources that tribal members use be impacted by the use or inadvertent release of this chemical?

- Will areas that tribal members live in or visit be impacted by the use or inadvertent release of this chemical?
- Will the use or inadvertent release of this chemical affect resources managed by a tribe or lands that are held in trust for a tribe?
- Will the use or inadvertent release of this chemical affect an area within a tribal historic area (usual and accustomed area or ceded area), a traditional cultural property, or a tribally important landscape? Note that public lands are often, or usually, within the usual and accustomed area of one or more tribes.
- Will the use or inadvertent release of this chemical affect an area linked ecologically, culturally, visually, or hydrologically to other tribal resources or uses? For example, is a water recharge area (wellhead) linked to a down-gradient spring of cultural importance, or is a resource that is gathered in one area required in a cultural practice in another area?

2.3.2 How are the resources used?

The answer to this question requires some understanding of the lifeways of the affected tribe as described in Section 2.2. This information is generally not needed in extreme detail (i.e., not requiring data-intensive surveys or confidential or proprietary data), but in enough detail to identify the major affected natural resources and their uses. Examples of these descriptions are given in "Traditional Tribal Subsistence Exposure and Risk Assessment Guidance Manual."[15]

Examples of subsistence, traditional, and ceremonial/spiritual activities that should be considered as affected by chemicals in consumer products and the environment include but are not limited to:

- Collection and use of edible and medicinal resources and cultural materials on public lands such as utility rights of way, streambeds, and marshes. This may include wading and constant soaking of hands in water during collection activities.
- Preparation of traditional materials, including cleaning in surface water and other activities such as chewing sinew and fish skins for additional uses.
- High consumption of plants gathered and animals (including shellfish and other invertebrates) collected locally, including non-standard consumption such as fish skin, fats, or other parts of animals not readily available in the supermarket.
- Meditation, bathing, steam baths, cooking, cleaning, soaking traditional materials (also placed in mouth while conducting multiple activities), and drinking local surface water.
- Smoking hides, burning out canoes, cultural burning to stimulate material production, and heating rocks for cooking, shaping wood and sweat lodges.

Occupational and environmental exposures are also often overlooked. For example, a study of malignant mesothelioma found that Native American silversmiths routinely used asbestos mats to insulate worktables while making silver jewelry,[16] which exposed them to a hazard, asbestos, that was seemingly unrelated to the occupational activity (silversmithing).

2.3.3 How much exposure is there?

This step consists of analyzing tribal lifeways, identifying direct exposure factors (frequency, intensity, duration of exposure) and resource use, and quantifying exposure factors as conventional risk assessment metrics. The doses of each contaminant are estimated by assuming daily ingestion rates of a particular abiotic (soil, water, sediment, air) or biotic resource (fish, food, game, plants, medicines) for a particular exposure period. In addition, other tribal exposure pathways should be recognized and considered even if they appear individually small, such as during use of native materials (basket reeds

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held in the mouth, cuts from flint-knapping, wearing of natural materials, smoking of foods and hides, and a myriad of activities associated with traditional lifestyles).

General environmental contact rates, including fish consumption rates, are published by the EPA in its Exposure Factors Handbook[17] for various activities (e.g., exercise, sleep, recreation, various types of work), various groups of people (e.g., adults or children), and various routes of exposure (e.g., ingestion, inhalation, or dermal contact) based on studies published in the scientific literature. These studies often evaluate specific aspects of the general US lifestyle and can be based on large data sets. However, for lifestyles with little specific data, such as tribal subsistence lifestyles, entire exposure scenarios including subsistence activities, resources, and traditional diets must be constructed through original research and/or extrapolation.[18] Examples of how some of the primary exposure factors might differ between the general population (suburban) and a subsistence tribal population are shown in Table 1.[19]

Exposure Factor	Suburban	Subsistence
Drinking Water	2 liters per day	4+ liters per day
Fish Ingestion	17.5 grams per day	500-1000+ grams per day
Duration of Exposure	30 years	70 years (+ generations)
Frequency of Exposure	180 days per year	365 days per year
Sweat Lodge, other	NO	YES

Table 1: Examples of Exposure Factors: Subsistence lifestyles can result in 10 to 100 times more exposure to environmental contaminants than suburban lifestyles.

Tribal people are exposed through pathways that EPA currently considers (air, ground water, surface water, soil, soil vapor, sediments, biota), however the distinction is 1) where in the environment the contact through those pathways occurs, and 2) how intensive the contact is:

1) The location of exposure is something that EPA needs to be more thoughtful about. Runoff to water that supports fish is obvious, but other locations, such as utility rights of way, or public lands, or local cattail marshes are examples of locations where EPA may not recognize that there are useful/edible resources present. In other words, EPA may not see a reason to consider a location if it does now know what resources are there and how they are used, or what landscape features are culturally important. Additionally, the more private cultural activities (with associated exposures) are something that only a tribe can tell about.

2) Exposure may be greater and usage may be more intense. For example, a marsh may attract birdwatchers who visit and tiptoe around, while a tribal member may go there to gather basket materials or cattail tubers and shoots for consumption. Gathering cattails may entail wading in the marsh, cutting shoots and pulling tubers from the sediment, incurring a certain inadvertent sediment ingestion exposure while doing so, washing adhered sediment from the tubers and shoots for consumption, preparing the leaves for baskets or mats, holding materials in the mouth while weaving with them, and so on. Another example is that the younger and/or smaller species of vegetation growing in utility rights of way may more likely be edible and medicinal than the older and less diverse areas adjacent to it. A utility right of way thus may serve as the functional equivalent to the prescribed burning done by tribes to increase biodiversity, except that the right of way is obviously sprayed with herbicides rather than burned. EPA does not recognize these potential exposure and consumption pathways in their labeling requirements for re-entry times and consumption limits. The right of way provides some grocery/garden and pharmacy services that

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should be recognized and at least semi-quantified (not just "considered").

In some instances several different exposure scenarios need to be applied in the same location because different groups of people do different things there. An example is the marsh that provides educational and recreational services to birdwatchers, and also provides provisioning and cultural/amenity services to tribes. Other locations may only have a heretofore unrecognized tribal interest that is irrelevant to the nearest non-tribal population. Additionally, there is a significant difference in exposure if one just visits an area rather than actually living in it and deriving food, medicine, etc. from it.

2.4 Additional Exposure Factors to Consider

This report discusses two additional factors that NTTC has identified as important for OPPT to assess when conducting TSCA risk assessments: heritage consumption rates and high levels of persistent, bioaccumulative, and toxic chemicals in subsistence foods.

2.4.1 Original Uses (Heritage Consumption Rates) vs. Contemporary Uses (May be Restricted or Suppressed): A Fish Consumption Rate Example

Even though many tribal lands have been lost and resources degraded, the objective of many tribes is to regain land, restore resources, and encourage more members to practice healthier (i.e., more traditional) lifestyles and eat healthier (i.e., more native and local whole) food. Therefore, the objective of subsistence exposure scenarios is to describe *original* lifestyles and resource uses. It is not to present a snapshot of *contemporary restricted* or *suppressed* uses, because the intent is to restore the ecology so that the original pattern of resource use is both possible (after resources are restored) and safe (after contamination is removed).

The following example is used to exemplify the need for harmonization between all EPA regulatory programs to identify, characterize, quantify, and address tribal exposures to toxic chemicals. An agency-wide directive would provide guidance to all EPA offices to identify principles of tribal exposure. TSCA Section 6(d) defers to other statutes if a chemical can be regulated through another EPA program, therefore, it is important for all EPA programs to understand traditional consumption patterns. The example provided here is background information for lessons learned that may be used in future TSCA assessments. Therefore, TSCA assessments should consider traditional tribal resource uses and consumption patterns and identify analogous instances in which tribal lifeways, resources and rights, including treaty-protected rights, may be implicated.

In 1980, EPA began to establish criteria for toxic contaminants in fish for the Clean Water Act by using a dataset to characterize human fish intake. Because EPA was crafting a single, national default, it sought a dataset that was sufficiently broad in its coverage as to be "statistically projectable to the U.S. population or sizeable segments thereof."[20] The most robust candidate then available was from a survey conducted in 1973-74 by NPD Research, Inc., which had been commissioned by the tuna industry and designed to take a snapshot of then-current fish consumption practices in households across the United States.[21] The NPD survey canvassed a demographic that was, in the vernacular of time, described as 94.3% "Caucasian," 4.6% "Black," 0.6% "Oriental," and 0.6% "Other."[22] The survey was a general survey, which included a large number of non-fish consumers, an issue that has been identified as a weakness in the study. Eventually the data from the survey became the basis for the national default fish consumption rate (FCR) of 6.5 grams/day (roughly one 8-ounce fish meal per month) suggested by way of guidance to states and tribes and incorporated as the basis of the health-based water quality criteria issued by EPA.

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Members of the fishing tribes and others soon questioned this FCR on a number of bases. They observed that, even as a measure of (then-) contemporary tribal consumption, 6.5 grams/day woefully underestimated tribal intake. Tribes and others also lodged the more fundamental criticism that an FCR derived from surveys of contemporary practices was likely to be distorted due to "suppression" – a term defined by the National Environmental Justice Council in its 2002 report on fish consumption:

> "A 'suppression effect' occurs when a fish consumption rate (FCR) for a given population, group, or tribe reflects a current level of consumption that is artificially diminished from an appropriate baseline level of consumption for that population, group, or tribe. The more robust baseline level of consumption is suppressed, inasmuch as it does not get captured by the [contemporary] FCR."[23]

When tribes' fish consumption practices are at issue, two aspects of suppression are raised that are different from other groups. First, the "appropriate baseline level of consumption" is clear for tribes, whereas it may be subject to debate for other groups. Only tribes have legally protected rights to a certain "original," or "heritage" *baseline* level of consumption. Second, the causes of suppression have exerted pressure on tribes for a longer period, and in more numerous ways, than on the general population. Whereas those in the general population may have begun to reduce their intake of fish in response to consumption advisories once these became more prevalent in the 1970s and thereafter, tribal members have been excluded from their fisheries, and harassed and imprisoned for exercising their fishing rights, even where treaties had been signed or other legal protections secured for tribal fishing rights. Indeed, the forces of suppression, often perpetrated or permitted by federal and state governments, have included inundation of fishing places; depletion and contamination of the fishery resource; and years of prosecution, intimidation, and gear confiscation.[24]

"Heritage" rates to refer to the rates of fish intake consonant with traditional tribal practices, prior to contact with European settlers and sometimes extending into recent or current generations. Heritage rates are thus fixed; they are determined by reference to this historical touchstone. For the fishing tribes, heritage rates may also be legally protected by treaty, executive order, or other federal law. Heritage rates, properly understood, are *baseline* rates – that is, they capture the amount of fish that would be consumed if fish were uncontaminated and available, and if tribal rights to acquire those fish were able to be fully enjoyed. Heritage rates are the only rates for the fishing tribes that can be said to be "unsuppressed" – that is, free from the biasing influence of suppression effects.

"Heritage" rates generally reflect an environmental condition that is relatively good; i.e., they represent how the resources would be used if there were no restrictions due to degradation, contamination, or loss of access. As such, they reflect appropriate *baseline* rates and practices – rooted in the past, but relevant for the future. Due to contemporary conditions of resource advisories and limited access, an accurate reflection of heritage subsistence practices often needs to be derived from over a century of information collected by explorers, early naturalists, settlers, observers and scientists, ethnographers, and other investigators. Although the term "heritage" rates has sometimes been used more or less interchangeably with the term "historical" rates, this usage may give a misimpression, implying that no one still eats (or wants to eat) at those rates and that they are not relevant to today's regulatory decision processes.[25] On the contrary, the existence of physical or chemical impediments to a resource use does not diminish the underlying legally protected rights. In addition, many tribal environmental programs are making progress in habitat improvement. Further, many tribal health programs are recommending healthier (i.e., more traditional) diets that often include or are based on heritage resource consumption.

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As a consequence of suppression, contemporary surveys of tribal populations will generally produce fish consumption rates that are artificially low compared to the appropriate, "heritage" baseline. It is the case, however, that EPA guidance still embraces a method that is focused on documenting contemporary fish intake. Recent surveys of tribal fish consumption practices have often followed this approach even if it is recognized that the original baseline amount of fish consumption is culturally important and is often much higher than at present.[26] Thus, surveys of contemporary resource consumption rates may, in effect, only confirm that fisheries are currently impaired or that some people are heeding any applicable fish consumption advisories or restrictions to traditional gathering and hunting. Note, too, that recent studies have documented "spillover" effects, whereby individuals beyond those "targeted" by a particular advisory or restriction also observe its warning and alter their practices accordingly.[27] On the other hand, some tribal members still have access to adequate numbers of fish and still eat close to heritage rates, particularly as fisheries are improved. This segment of some tribal populations can be masked in cross-sectional tribal consumption surveys, even if higher percentiles are calculated.

In a 2011 Tribal Science Priorities document to EPA, the Tribal Science Council (TSC) prioritized the characterization of tribal seafood consumption and specifically requested support from EPA "to develop seafood consumption survey methodology, train tribal members in use of survey methodologies, select an appropriate population to be surveyed, implement the survey, conduct statistical analysis of results, and develop reports describing survey development/implementation/results."[28] This was a recommendation to address and identify issues using methodologies (i.e. surveys) that EPA was aware of and comfortable with at the time. More recent studies have concluded that rather than developing fish consumption surveys to identify current suppressed resource use and consumption levels, a more appropriate method is to consider information relevant to "heritage" consumption rates and patterns, including current subsistence data (as well as anthropological, environmental archeological, and historical information).[29] These patterns are more consistent with treaty and other legal protections of aboriginal fishing rights and the desired consumption rates of the tribes.

Tribal fish consumption (freshwater, anadromous, shellfish) and heritage rates are relevant to OPPT risk assessment because chemicals regulated by OPPT frequently end up in waterways through fate and transport pathways that have to be evaluated by EPA. These pathways can be from air or water releases during manufacturing or consumer use, as well as during post-consumer use phases (landfills, recycling). Waterways, as an ultimate receptacle, can integrate across many individual releases (e.g. factories plus many individual usage locations). Fish and other aquatic organisms further integrate many chemicals if they are co-exposed to several, or filter feed in sediment deposition areas, and so on. These are the type of evaluations that EPA should be performing. For example, when OPPT develops their conceptual models and assessment questions when conducting problem formulation and initial assessments of brominated phthalate flame retardants, they should include potential exposure pathways to tribal populations through resources such as fish and other tribal resources documented throughout this report. OPPT should also consider the cumulative risks from preexisting chemicals in the resource to determine whether additional chemicals might push cumulative risks over a defined risk threshold. Additionally, new uses of chemicals should be as restrictive as possible to stop a chemical from entering the environment, rather than removing it after the fact. Several examples of OPPT regulated chemicals, such as PCBs, PBDEs, and trichloroethylene (TCE) have ultimately become problem chemicals in food and water supplies.

OPPT-Specific Recommendation: Include potential exposure pathways to tribal populations through resources such as fish and other tribal resources documented throughout the *Understanding Tribal*

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Exposures to Toxics report to develop conceptual models and assessment questions when conducting problem formulation and initial assessments of all TSCA Work Plan chemicals and new product evaluations. OPPT should also consider the cumulative risks from preexisting chemicals in the resource to determine whether additional chemicals might push cumulative risks over a defined risk threshold.

2.4.2 High Levels of Persistent, Bioaccumulative, and Toxic Chemicals in Subsistence Foods

EPA risk assessments, including TSCA chemical risk assessments, use protective levels based on children's and pregnant women's susceptibilities, yet fail to recognize that children and pregnant women in tribal communities are subject to a significantly higher exposure than the general population equivalent groups. EPA assumes that they are protecting tribal populations by protecting children in the general population. However, EPA has not verified this assumption using tribal scenarios that are inclusive or representational of both frequency and duration of tribal exposures. In some cases this assumption might be true, but it is clearly not true for fish consumption in salmon-bearing rivers. In other cases, such as soil ingestion, an extra safety factor might be adequately protective, but it is seldom if ever used.

Mercury exposure through fish consumption provides an example of some of the relevant issues. In a 2006 article, "Blood Mercury Reporting in National Health and Nutrition Examination Survey (NHANES): Identifying Asian, Pacific Islander, Native American, and Multiracial Groups," the authors concluded that future studies should address reasons for the high mercury levels in Asian, Pacific Islander, Native American, or multiracial groups and explore possible interventions for lowering risk of methylmercury exposure in these populations. Study subjects in NHANES who self-identified as Asian, Pacific Islander, Native American, or multiracial had a higher prevalence of elevated blood mercury than all other racial/ethnic participants in the survey.[30] This is significant because NHANES was designed as a random survey, not really suitable for evaluating subsistence fishing, reservation residents versus urban Indians, tribal populations in general, or locally-derived diets. Even so, ethnic subpopulations had higher mercury levels, presumably from eating more fish.

In a 2009 study, methylmercury (MeHg) exposure from fish consumption in vulnerable racial/ethnic populations, researchers report "a number of studies hypothesized that seafood/fish is the most prominent source of MeHg in blood and identified the Asian, Pacific Islander, Native American or multiracial groups as "high-risk" for MeHg blood levels, as compared to the other groups."[31] In 2011, another study concluded that more research with local-scale data is needed to better estimate fish consumption exposure for specific communities and tribes.[32]

Recommendation: Conduct a literature survey of polychlorinated biphenyls, flame retardants, and mercury in indigenous populations (including the Pacific Islands and non-native fishing and shellfishing communities) or in their natural resources. Determine whether proximity to a source of readily-available fish or shellfish is correlated with elevated levels of these contaminants. Examine demographic strata to test whether variables such as income or ethnicity are correlated with blood contaminant levels.

Recommendation: Fund research that will determine whether proximity to a source of readily-available fish or shellfish is correlated with elevated levels of persistent, bioaccumulative, and toxic chemicals that are currently being assessed by OPPT.

OPPT-Specific Recommendation: Lower action levels for contaminants in subsistence foods. In the absence of specific dietary information, a default wild food diet could be constructed, or an extra safety factor (lower action levels) could be used.

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The underlying policy question is whether to explicitly protect subsistence users, rather than merely 'considering' them under EO 12898 and later guidelines. It seems reasonable that if children can be explicitly protected, then subsistence users could also be protected.

OPPT should recognize that permitting contamination and then posting fish advisories is not an acceptable "regulatory" approach. Fish advisories *do* result in adverse effects because (1) a specific population group is disproportionately affected, (2) fishing and fish intake may be impossible to curtail if it is part of the culture and religion, (3) health effects may therefore occur even after information about contamination is provided, and (4) the ripple effect on tribal well-being (see Section 2.5) may not have been understood or considered.

2.5 What other aspects of tribal well-being are affected by the presence of toxic substances?

Spiritual and emotional well-being must also be considered in addition to the physical effects of toxic substances. Social cohesion through traditional activities, cultural resources, sacredness, and aesthetics are intangible resources, or ecosystem services, that may be at risk from the presence of chemicals in the environment. Physical, spiritual, and emotional well-being may be affected by impacts to tribal lifeways if they are being restricted due to the presence of toxic substances, and intergenerational transfer of knowledge and skills might be impaired. Therefore, impacts to these services, while they might be considered qualitative, must also be considered. In a 2008 article in Environmental Research, Harper and Harris state "because Tribal communities often do not have the choice of giving up more food, income, religion, culture, and heritage in order to avoid contamination, they are forced into choosing between culture and health. Many tribal members choose to incur chemical risk rather than giving up their culture and religion."[33]

As documented by a recent study[34] of the Karuk people, "[t]he loss of traditional food sources is now recognized as being directly responsible for a host of diet-related illnesses among Native Americans, including diabetes, obesity, heart disease, tuberculosis, hypertension, kidney troubles, and strokes."[35] These illnesses are currently a matter of grave concern throughout Indian Country. American Indians and Alaska Natives now suffer extraordinary rates of diabetes – two to three times that of all other racial/ethnic populations combined.[36] Further, it is also logical that the entire Kuruk (and many other) socio-cultural system was also centered around salmon, including seasonal meetings, traditional knowledge, education, the natural law, religion, and many other aspects of daily life. Baseline traditional diets, whether they are based on salmon, buffalo, wild rice, maize, or other staples, are keystone ecosystem services provided by the natural ecosystem.

Thus, there is a double impact to both nutrition and provision of ecosystem services when the baseline ecology is degraded. For example, many west-coast Native people consider themselves to be salmon people. When the salmon disappear, the entire psyche, identity, and culture is affected. In addition to the loss of healthy foods, the combination of other stressors (e.g., poverty, quality of education and health care quality, legal threats, and diminished territory) means that an additional cultural cost of contamination and advisories is imposed on top of a pre-existing social and cultural deficit.

An overlapping concept is that of ecosystem services, or the eco-cultural system services that nature provides if its quality is not degraded and access is unrestricted. The concepts of ecosystem services could be blended into all EPA risk assessment frameworks such as the one shown in Figure 3. This would also enable a harmonization of the National Environmental Policy Act (NEPA), the Comprehensive

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Environmental Response, Compensation, and Liability Act (CERCLA), the TSCA, the Clean Water Act (CWA), the Safe Drinking Water Act (SDWA), and the Natural Resource Damage Assessment (NRDA) risk/impact/injury approaches by including the same categories of metrics in all evaluations of risks and impacts. Being the gate keeper on toxic chemicals, TSCA should be at least as protective as the most restrictive of these programs, which is currently not the case. In order to do this, conventional risk assessments would need to include socio-cultural risks, and the ecosystem approach would need to specifically incorporate contaminant-derived risks to human and ecological health.

There are several ways to categorize ecosystem services. The most widely used is from the Millenium Ecosystem Assessment (MEA): Supporting & Habitat; Provisioning; Regulating; and Cultural & Amenity.[37]

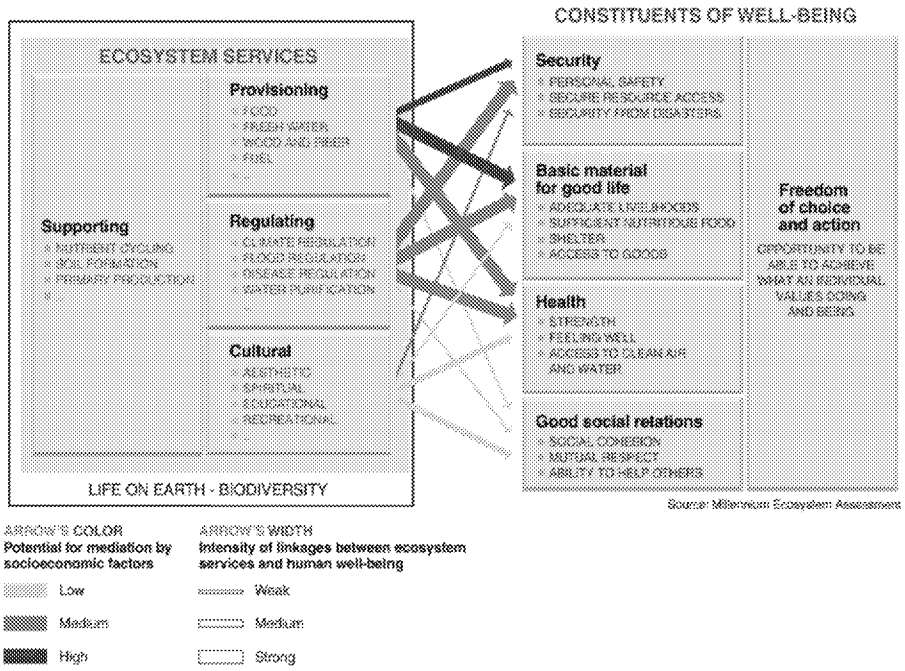

Figure 3: Ecosystems and Human Well-being Synthesis: A Report of the Millennium Ecosystem Assessment http://www.millenniumassessment.org/documents/document.356.aspx.pdf

Cultural and amenity services include the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences. These are active uses, even if they do not involve direct human exposure. The following list is not unique to tribes; individual tribes (or any community) would need to specify their own services obtained from the resource or area, to the extent that they wish to release the information.

- *Cultural diversity.* The diversity of ecosystems is one factor influencing the diversity of cultures.
- *Spiritual and religious values.* Many religions attach spiritual and religious values to ecosystems or their components.
- *Knowledge systems* (traditional and formal). Ecosystems influence the types of knowledge systems developed by different cultures.
- *Educational values.* Ecosystems and their components and processes provide the basis for both formal and informal education in many societies.

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- *Inspiration.* Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture, and advertising.
- *Aesthetic values.* Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for parks, scenic drives, and the selection of housing locations.
- *Social relations.* Ecosystems influence the types of social relations that are established in particular cultures. Fishing societies, for example, differ in many respects in their social relations from nomadic herding or agricultural societies.
- *Sense of place.* Many people value the "sense of place" that is associated with recognized features of their environment, including aspects of the ecosystem.
- *Cultural heritage values.* Many societies place high value on the maintenance of either historically important landscapes ("cultural landscapes") or culturally significant species.
- *Recreation and ecotourism.* People often choose where to spend their leisure time based in part on the characteristics of the natural.

The metrics used by the US Office of Homeland Security are very similar.[38] All healthy people (tribal nations and non-tribal communities) need sovereignty, jurisdiction, and self-determination for health and well-being:

- *Land Base*. A secure land base with jurisdiction and ownership.
- *Governance*. A stable, balanced government with self-determination of the tribal nation.
- *Resources.* Natural, cultural, legal, technical, organizational, and human resources adequate to define and meet threats to stability, self-determination, resources, culture, mental and physical health, religion, economy and security. Technical and legal staff. Health and human services adequately funded. Access to resources as needed.
- *Capital Resources.* Infrastructure, cyber, and domestic resources designed to respond to threats and protect tribal values and resources with strength and understanding in a traditional manner. Adequate housing, etc.
- *Security.* Confidence in natural resource adequacy and quality; confidence in a leadership that looks out for the members and the resources; confidence in adequate economic well-being; confidence that the culture, language, values, and people will survive; freedom from legal battles brought by the federal and other governments.
- *Culture.* Appreciation of individuals, creativity, support of the needy, devotion to the people, justice, and the shared history and blood ties to the land and to each other, according to teachings of elders.

Tribal narratives are descriptions of the eco-cultural system of a particular tribe including descriptions of affected resources, tribal history within a particular ecosystem, major resource uses, and eco-cultural services provided by the ecosystem. A tribal exposure scenario is a component of the tribal narrative. Other components can include a description of the subsistence economy, traditional styles of education and transfer of knowledge (traditional knowledge or traditional ecological knowledge), natural law and seasonal rounds, transportation and trade routes, and ethnohistory. The narrative can include tables of affected resources, the attributes, goods, and services provided by each resource and ecosystem under baseline conditions, and measurement endpoints for quantitative evaluation of the degree of impact/injury or risk (impact plus vulnerability). These tables can also be organized as ecosystem services. Examples are posted at: http://www.gtcceis.anl.gov/documents/eis/GTCC_EIS_February2011_Volume2.pdf, Appendix G.

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- *Religion.* Freedom to choose and practice any religion. Ceremony and preparation for ceremony and participation in ceremony as healing. Access to places of healing and sacred places. Community.
- *Economy.* Adequate food, clothing, shelter for individual and tribal needs, both in dollars and barter, but also including riches of the landscape, heritage, and knowledge.

OPPT-Specific Recommendation: Work with NTTC to develop one or more frameworks for describing ecosystem services in ways that allow a wider applicability to other tribes.

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Section 3 Existing Tribal Risk and Exposure Related Research

NTTC here highlights selected research to date documenting tribal risk and exposure. This is not intended to be an exhaustive list. Rather, the research compiled here is meant to provide a history of the research undertaken to this end, often with very limited funding sources; to reinforce recommendations that have been already been made to EPA based on this body of existing research; and to provide support for additional recommendations based on the research completed to date. While this report provides an overview of existing information on toxic exposure, impacts, and monitoring efforts as it relates to tribal communities, it is intended to be a living document. Thus, it is anticipated that as this document is circulated among tribal communities and research offices throughout the country, NTTC will update this document with additional research and information. Please select "Contact Us" at www.tribaltoxic.org to contribute additional tribal risk and exposure sources to this document. Most of the sources presented here are available for download (or upon request) from the Institute for Tribal Environmental Professionals Online Resource Center Access website.[39]

Existing research and tribal efforts should be used by EPA to develop a framework for integrating tribal exposure into current risk assessments that will protect tribal health and the natural resources that have sustained tribal communities for generations.

3.1 Documenting Tribal Risk and Exposure Assessment Efforts

Tribes have been actively involved in tribal risk and exposure assessment for over 25 years, represented at national workshops, trainings, forums, and meetings that deal with risk assessment and management. Through these activities, tribal staff members have developed technical and scientific expertise in risk related areas, presenting papers and participating in the development of guidance that demonstrate an alternative tribal approach to environment risk assessment. For example, "[t]he Nez Perce Tribe became officially involved in the tribal risk arena in 1993 after determining that current risk models do not account for the myriad of activities that take place when tribal people interact with the environment."[40] In collaboration with other tribes that have similar lifestyles, the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) developed a tribal approach to risk assessment with scientific guidance from Dr. Barbara Harper.[41]

The first National Tribal Risk Forum was held in June 1996, hosted by the Shoshone-Bannock Tribes and followed by the second National Tribal Risk Forum held in October 1996. Concluding statements made during the October forum included:

> *It is critical that any person working in risk assessment and risk management have a holistic view of tribal use of resources, exposure and the resulting risks. By acknowledging and protecting tribal traditional values, cultures, philosophies, beliefs, lifestyles and teachings, indigenous peoples will survive and be more adequately protected from environmental contaminants and hazards imposed on the web of life by humans.*[42]

Early tribal risk assessment publications referenced during these forums included:

- S.G. Harris, "The Nez Perce Environmental Restoration & Waste Management's Recommendation for Refinement of Risk Assessment Proposed by Oregon Department of

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Energy's Columbia River Impact Evaluation Plan," Nez Perce Tribe Department of Environmental Restoration and Waste Management (1993)

- S.G. Harris, "A Limited Sample of Concerns of the Confederated Tribes of the Umatilla Indian Reservation Community Using an Appropriately Designed Risk Assessment Model," Waste Management Symposium (1996)
- D.L. Powaukee and R.O. Cruz, "Concerns of the Nez Perce Tribe on the University of Washington Consortium for Risk Evaluation with Stakeholder Participation Workshop on Risk and Land use Process," CRESP, University of Washington (1995)
- D.F. Conrad, D.L. Powaukee, and B.L. Harper, "Translating the Nez Perce World View into Environmental Management Strategies," Waste Management Symposium (1996)
- Shoshone-Bannock Tribes, "Risk Assessment in Indian Country: Guiding Principles and Environmental Ethics of Indigenous Peoples," In: National Tribal Risk Forum "An Indigenous Approach to Decision Making," Hosted by Shoshone-Bannock Tribes (1996)

The first full tribal exposure scenarios were published in 1997 and 2002, and several other scenarios have since been developed by the same authors:

- S. Harris and B. Harper, "A Native American Exposure Scenario." Risk Analysis, 17(6): 789-795 (1997)
- S. Harris and B. Harper, "Native American Diets and Exposure Factors." Environmental Research, Section A, 86:140-148 (2001)
- B. Harper, B. Flett, S. Harris, C. Abeyta, and F. Kirschner, "The Spokane Tribe's Multipathway Subsistence Exposure Scenario and Screening Level RME," Risk Analysis 22(3): 513-526 (2002)

In the 2011 article published in American Journal of Public Health, titled "Conceptual Environmental Justice Model for Evaluating Chemical Pathways of Exposure in Low-Income, Minority, Native American, and Other Unique Exposure Populations," Burger and Gochfeld recommended that EPA identify and assess unique and nonstandard exposure pathways to include for assessments regarding Native American populations. Additional recommendations in this article included:

- updating fish consumption guidance to reflect the needs of ethnic minorities, low-income populations, and Native Americans;
- encouraging researchers to report the distributions of their exposure data, highlighting distributions in the 95th and 99th percentiles;
- collecting data on site-specific contaminants in foods;
- targeting data collection on populations that depend on self-caught versus commercial food; and
- collecting and synthesizing robust site- and population- specific information, including patterns of use.

Tribal-specific events and resources are summarized here to demonstrate the past efforts and begin compiling culturally appropriate and sound scientific information and recommendations for OPPT to reference as needed for incorporating tribal exposure into Chemical Risk Assessments. This timeline and resource list will be expanded as information becomes available. Additionally, National Environmental Justice Advisory Council's (NEJAC) Recommendations to EPA – Protecting the Health and Safety of People Consuming or Using Fish, Aquatic Plants, and Wildlife; EPA's 2006 Paper on Tribal Issues Related to Tribal Traditional Lifeways, Risk Assessment, and Health & Well Being: Documenting What We've Heard; and EPA's 2013 A Decade of Tribal Environmental Health Research: Results and Impacts from EPA's Extramural Grants and Fellowship Programs; are detailed in Sections 3.2, 3.3, and 3.4.

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- 1996 National Tribal Risk Forums
- 1998 Tribal Risk Assessment Conference in NV[43]
- 1998 Intertribal Risk Assessment Committee (IRAC)[44]
- 2002 NEJAC Recommendations to EPA – Protecting the Health and Safety of People Consuming or Using Fish, Aquatic Plants, and Wildlife[45] (detailed in Section 3.2)
- 2002 – Identify and Explore Alternatives to the Classic Technical Risk Assessment Methodology[46]
- 2002-2005 Tribal Science Council and EPA Meetings - Integrating Tribal Traditional Lifeways into EPA's Current Risk Assessment Policies and Procedures[47]
- 2006 EPA's Paper on Tribal Issues Related to Tribal Traditional Lifeways, Risk Assessment, and Health & Well Being: Documenting What We've Heard[48] (detailed in Section 3.3)
- 2006 Tribal Science Council presents "risk" (exposure an impact) as a consideration for each one of their priorities[49]
- 2006 Future Studies Needed for Addressing Reasons for High Mercury Levels in Asian, Pacific Islander, Native American, and Multiracial Groups[50]
- 2008 Lowering the Action Level for Mercury is Part of the Federal Fiduciary Responsibility to American Indian Tribes[51]
- 2011 Recommendation to EPA – Consider Unique Exposure Pathways[52]
- 2011 Methyl Mercury Study Concludes More Local-Scale Data is Needed[53]
- 2011 TSC Request to EPA – Characterization of Tribal Seafood Consumption[54]
- 2012 Checklist for Developing Tribal Scenarios[55]
- 2013 A Decade of Tribal Environmental Health Research: Results and Impacts from EPA's Extramural Grants and Fellowship Programs[56] (detailed in Section 3.4)

3.2 National Environmental Justice Advisory Council Fish Consumption and Environmental Justice Recommendations

The National Environmental Justice Advisory Council (NEJAC), a federal advisory committee to the EPA, was requested by EPA's Office of Environmental Justice, in its meeting on December 3-6, 2001, to provide advice and recommendations on how EPA could improve the quality, quantity, and integrity of our Nation's aquatic ecosystems in order to protect the health and safety of people consuming or using fish, aquatic plants, and wildlife.

In the transmittal letter from NEJAC to EPA Administrator Christine Todd Whitman on November 19, 2002, which accompanied their report entitled "National Environmental Justice Advisory Council Fish Consumption and Environmental Justice,"[57] NEJAC identified six overarching consensus recommendations for how EPA should address fish consumption issues:[58]

> *Require states, territories, and authorized tribes to consider specific uses, including the use of the waterbody or waterbody segment for subsistence fishing, when designating uses for a waterbody, and to set water quality criteria that support the specific designated use; provided that where human health criteria are established based upon consumption of toxic chemicals that bioaccumulate in fish, regulators should employ appropriate human fish consumption rates and bioaccumulation factors, including cultural practices (e.g., species, fish parts used, and manner of cooking and preparation) of tribes and other indigenous and environmental justice communities using the waterbody; provided further that EPA should encourage and provide financial and technical support for states, territories, and authorized tribes to control effectively all sources, including both point sources and nonpoint sources, to achieve the criteria;*
>
> *Work expeditiously to prevent and reduce the generation and release of those contaminants to the Nation's waters and air that pose the greatest risk of harm to human health and aquatic resources,*

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including but not limited to persistent bioaccumulative toxics (PBTs) (e.g., mercury, dioxins, and polychlorinated biphenyls (PCBs)) and other toxic chemicals, and to clean up and restore aquatic ecosystems contaminated by pollutants;

Protect the health of populations with high exposure to hazards from contaminated fish, aquatic organisms and plants, and wildlife, including communities of color, low income communities, tribes, and other indigenous peoples, by making full use of authorities under the federal environmental laws and accounting for the cultural, traditional, religious, historical, economic, and legal contexts in which these affected groups consume and use aquatic and terrestrial resources;

Ensure that fish and other aquatic organism consumption advisories are used by regulators as a short-term, temporary strategy for informing those who consume and use fish, aquatic organisms and plants, and wildlife of risks while water quality standards are being attained and while prioritizing and pursuing the cleanup of contamination by appropriate parties; agencies must evaluate and address such risks, and require risk-producers to prevent, reduce, and clean up contamination of waters and aquatic ecosystems;

Because many American Indian and Alaska Native (AI/AN) communities are particularly prone to environmental harm due to their dependence on subsistence fishing, hunting, and gathering, conduct environmental research, fish consumption surveys, and monitoring, in consultation with federally recognized tribes and with the involvement of concerned tribal organizations, to determine the effects on, and ways to mitigate adverse effects on the health of AI/AN communities resulting from contaminated water sources and/or the food chain; and

Consistent with the 1988 EPA Indian Policy for the Administration of Environmental Programs on Indian Reservations, the federal trust responsibility to federally recognized tribes, and federal policies recognizing tribal sovereignty and promoting self-determination and self-sufficiency, provide equitable funding and technical support for tribal programs to protect AI/AN communities and tribal resources from harm caused by contaminated water and aquatic resources and, until tribes are able to assume responsibility for such programs, implement and require compliance with the federal environmental laws within Indian country; provided that, in consultation with tribes, EPA should promptly develop effective and appropriate regulatory strategies for setting, implementing, and attaining water quality standards within Indian country; and provided further that, EPA should work with Alaska Native villages to address the special circumstances that exist in Alaska and to protect the health of Alaska Natives from environmental threats associated with their extensive subsistence lifeways.

Although such information is not easily incorporated into national-scale risk assessments, it is informative in the development of policies to protect human health. Policies that protect highly exposed populations are likely to be more protective than policies not based on such groups.[59, 60]

The recommendations cited above and NEJAC's full report, National Environmental Justice Advisory Fish Consumption and Environmental Justice,[61] were submitted to EPA for review, consideration, response, and action. An EPA response to this transmittal letter, addressed to Administrator Christine Todd Whitman on November 19, 2002, could not be located.[62]

3.3 EPA "Documenting What We've Heard"

"Paper on Tribal Issues Related to Tribal Traditional Lifeways, Risk Assessment, and Health & Well Being: Documenting What We've Heard"[63] was published in April 2006 following meetings held with the Tribal Science Council and EPA between 2002 and 2005 to discuss integrating tribal traditional lifeways into EPA's current risk assessment policies and procedures. The report is one of many examples that

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describe risk, risk assessment, risk management, EPA's approach, unique tribal exposures, health and well-being, and tribal traditional lifeways. Although this report is prefaced with the following background statement, EPA is just beginning to integrate tribal traditional lifeways and subsistence lifestyles into EPA's current risk assessment policies and procedures:

> *In September of 2002, the TSC tribal representatives formally identified tribal traditional lifeways and subsistence as their highest priority science issue, with a focus on both looking at ways to integrate tribal traditional lifeways and subsistence lifestyles into EPA's current risk assessment policies and procedures as well as discussing potential development of a new environmental decision-making paradigm, one focusing on human health and ecological well- being.*[64]

3.4 A Decade of Tribal Environmental Health Research Recommendations

EPA's Tribal Environmental Health Research Program has funded and identified numerous projects and recommendations, as described in "A Decade of Tribal Environmental Health Research: Results and Impacts from EPA's Extramural Grants and Fellowship Programs." This report provides a summary of the projects that have been funded through EPA's Science to Achieve Results (STAR) grants by EPA's Office of Research and Development, National Center for Environmental Research, Tribal Environmental Health Research Program, and makes recommendations for the application of those projects. "One practical application of the research is to develop and use quantitative data to establish environmental quality standards that more accurately reflect the unique exposures of special populations, such as the stricter water quality standards established by the Makah Nation based on STAR grant data, to ultimately reduce their risks and protect their health and culturally important resources."[65] The Spokane Tribe of Indians has also developed tribal codes that protect tribal lifeways from cumulative impacts due to environmental chemicals.

Projects for tribal communities have identified solutions and applied interventions that have reduced health and ecological impacts from the consumption of water and water-based resources, chemical contaminants, and impacts of climate change while enhancing their ability to conduct community-level risk assessments. This research has also supported change in state policy-making and the creation of tools to help tribal communities maintain their traditional lifestyle, health and well-being. Over a decade of conclusions and recommendations are summarized here:

> *<u>Theme: Cultural Practices, Language and Traditional Ecological Knowledge</u>*
> *• Understand and integrate the cultural aspects of the community into research and develop culturally relevant educational materials, such as a booklet on wild plant knowledge in the Cherokee language, to explain risks and how to mitigate them to more effectively reduce exposures of sensitive populations as they engage in traditional practices.*
>
> *<u>Theme: Subsistence Foods and Water Resources</u>*
> *• Utilize community-based research to develop wellness plans, such as those being developed by the Alaska Native Tribal Health Consortium around sustenance berry use, that preserve traditional diets while managing risk and protecting public health.*
> *• Use quantitative data on contaminant levels, such as those used by the St. Lawrence Island Yupik people to assess the contaminants in rendered oils and organ meat that are part of their traditional diet, to help communities avoid or reduce the risks associated with traditional diets.*

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Theme: Community-Based Participatory Research and Community Outreach and Education

- *Develop strong partnerships with the community and enlist community representatives to guide the research design and implementation, as was done for the research project on the Crow Reservation that was guided by the Crow Environmental Health Steering Committee. This approach ensures that the research is informed by the local culture and relevant to the communities' needs, and ultimately, the results will be more readily accepted and used to protect community health and natural resources.*
- *Communicate research results to community members in a culturally sensitive manner, as was done, for example, during the town council meetings of the Northern Alaskan Iñupiat, and provide personal follow-up in the native language, such as the in-home follow-up in the Crow language provided to Crow residents, to increase the community members' understanding of the results and how to use them to reduce their exposures to environmental contaminants.*

Theme: Risk Assessment and Sensitive Populations

- *Incorporate risk assessment methodologies to create exposure scenarios that can be applied at the national, regional and local levels, such as those detailed in the Traditional Tribal Subsistence Exposure Scenario and Risk Assessment Guidance Manual, ultimately helping sensitive populations to reduce exposures and protect community and environmental health.*
- *Use the knowledge obtained from environmental public health indicators that are reflective of communities' health views and priorities, such as the Tribal Environmental Public Health Indicators that were developed for Salish Sea tribes, to assess and improve the health status of these communities and their members.*

Theme: Impacts on Regulations and Management Plans

- *Develop and use quantitative data to establish environmental quality standards that more accurately reflect the unique exposures of special populations, such as the stricter water quality standards established by the Makah Nation based on STAR grant data, to ultimately reduce their risks and protect their health and culturally important resources.*
- *Assist communities in developing resource management and monitoring plans, such as the tribal aquatic water quality monitoring plans developed by several tribes to monitor cultural uses of tribal water, that protect environmental resources and community health.*

Tribal Environmental Health Research Program STAR Grants for several related RFAs are listed here as resources to assist with addressing EPA's data gaps.[66]

Science for Sustainability and Healthy Tribes (2013 Request for Applications (RFA))

- Assessment, Monitoring and Adaptation to Food and Water Security Threats to the Sustainability of Arctic Remote Alaska Native Villages
- From Home to School: Tribal Indoor Air Quality Intervention Study
- Water, Our Voice to the Future: Climate change adaptation and waterborne disease prevention on the Crow Reservation
- Identifying, Assessing and Adapting to Climate Change Impacts to Yurok Water and Aquatic Resources, Flood Security and Tribal Health
- Subsistence Hunting an Associated Activities of Native North Americans in Remote Communities: Measurements of Indoor Air Quality in Tents as Related to Wood-Smoke Exposures, and the Identification of Potential Health Risks

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- Coastal Climate Impacts to First Foods, Cultural Sites, and Tribal Community Health and Well-being

The following research was supported by STAR #RD-83479101 2011-2013

- *Development of Indigenous Community Health Indicators for Use in Evaluating Non-Physical Aspects of Health and Well-Being*[67] – Jaime Donatuto and Larry Campbell, Swinomish Indian Tribal Community

Issues in Tribal Environmental Research and Health Promotion: Novel Approaches for Assessing and Managing Cumulative Risks and Impacts of Global Climate Change (2007 RFA)

- An Epidemiologic Study of Time Trends and Health Effects of Persistent Organic Pollutants, Mercury and Micronutrients
- Community-Based Risk Assessment of Exposure to Contaminants via Water Sources on the Crow Reservation in Montana
- Impacts of Climate Change on Health Benefits of a Tribal Alaskan Resource: Integrating Traditional Ecological Knowledge With Risk Assessment Through Local Monitoring
- Understanding the Cumulative Effects of Environmental and Psycho-Social Stressors that Threaten the Pohlik-lah and Ner-er-ner Lifeway: The Yurok Tribe's Approach

Lifestyle and Cultural Practices of Tribal Populations and Risks From Toxic Substances in the Environment (2002 RFA)

- Environmental Contaminants in Foodstuffs of Siberian Yupiks from St. Lawrence Island, Alaska
- Iakotisa'tstentsera:wis Ne Ohontsia: Reducing Risk by Restoring Relationships
- Risks to Northern Alaskan Iñupiat: Assessing Potential Effects of Oil Contamination on Subsistence Lifestyles, Health and Nutrition
- Lifestyles and Cultural Practices of Tribal Populations and Risks From Toxic Substances in the Environment
- Reducing Risks of the Anishinaabe from Methyl Mercury

Environmental Justice: Partnerships for Communication (2000 RFA)

- Bioaccumulative Toxics in Native American Shellfish (Jamie Donatuto, Swinomish Indian Tribal Community)

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Section 4 Conclusions and Recommendations

It is NTTC's perception that EPA has not adequately considered tribal concerns regarding exposure to toxic chemicals. Although EPA recognizes tribal sovereignty, and despite the 1984 EPA Indian Policy principle #5 that states "the agency, in keeping with the federal trust responsibility, will assure that tribal concerns and interests are considered whenever EPA's action and/or decisions may affect reservation environments," it remains difficult for tribal exposure scenarios to be incorporated into federal policy. Additionally, risk measurements for ecological and cultural impacts are almost totally ignored.[68] The federal trust responsibility to federally-recognized Indian tribes requires EPA, among other things, to protect the sovereignty of each tribal government and manage a resource for the benefit of a tribe which includes full fiduciary responsibility. Based upon NTTC's evaluation of TSCA and review of OPPT's risk assessment process, NTTC concludes that tribal populations are unnecessarily left at significant risk. NTTC therefore offers the following conclusions and recommendations.

Key Findings

1) OPPT continuously identifies data gaps as an impediment to their ability to assess tribal risk from the TSCA Work Plan chemicals and has requested that NTTC and tribes provide the necessary data for tribal exposure and risk assessments. However, it is unlikely that tribes will be able to compile the information necessary for EPA to consider exposure pathways for TSCA Work Plan chemicals without specific project funding or technical assistance by EPA to complete tribal exposure scenarios.

2) OPPT has requested that NTTC and tribes provide them with tribes' priorities for chemicals of concern. However, it is unlikely that tribes will be able to compile the information necessary to prioritize TSCA Work Plan chemicals without specific project funding or technical assistance by EPA to complete a prioritization ranking using tribal exposure scenarios.

3) Tribal exposure pathways are not well recognized because identification of resources and areas used by tribes is often not considered. For example, public lands and utility rights-of-way are primary areas where wild foods are gathered, but human consumption is generally not considered in setting concentration guidelines for those types of areas.

4) When contemporary tribal uses are recognized as being higher than the general population (such as fish consumption rates or wild-gathered food and medicine), a distinction between contemporary resource use and original subsistence quantities rates is often missed. As a consequence, contemporary resource use surveys may only confirm that resources are degraded, restricted through advisories, or otherwise impaired, rather than accurately describe original subsistence rates as intended.

5) Even if data gaps for contaminants in tribal resources are filled, there is a policy gap in failing to explicitly protect subsistence users, rather than merely "considering" them in developing guidance and regulation.

NTTC believes that the recommendations below are aligned with EPA's FY2014-2018 Strategic Plan for advancing EPA's priorities and mission to protect human health and the environment by addressing a tribal-specific issue in all five strategic goals identified by the agency and also emphasizing the following cross-agency strategies that set clear expectations for the way EPA does business in achieving its results:

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- Working to Make a Visible Difference in Communities
- Launching a New Era of State, Tribal, Local and International Partnerships

NTTC recommends the following overarching agency-wide recommendations that are relevant to all five of EPA's Strategic Goals and provide a foundation for the OPPT-specific recommendations outlined below:

Overarching Recommendation: Develop and implement a formal agency-wide directive to institutionalize the evaluation of tribal exposure pathways for risk assessment of toxic chemicals and cleanup standards to address the most highly exposed and disproportionately impacted populations.

Overarching Recommendation: EPA should ensure that its guidance or policies condoning less protective cancer risk levels for various highly exposed subpopulations[69] are not interpreted to support standards or decisions that permit less protective risk levels for tribes or tribal populations.

Overarching Recommendation: Establish the Tribal Environmental Health Research Program as a Research Center under the National Center for Environmental Research to provide continued funding for developing, compiling, and sharing tribal-specific information for addressing tribal environmental health and disease prevention.

The overarching recommendations are restated in the sections below and supported with additional information, OPPT-specific recommendations, and supporting recommendations directed to all EPA offices that conduct risk assessment.

EPA can address the disproportionate adverse health outcomes to tribal members by responding to recommendations that have been submitted for more than two decades by tribes and researchers and taking the recommended steps to incorporate meaningful and appropriate metrics for toxic exposures that tribal members experience through their unique cultural, ceremonial, and subsistence practices. Additionally, these recommendations emphasize the need for funding to monitor toxics in the environment and stronger regulations for persistent, bioaccumulative, and toxic chemicals in order to protect the health of those highly exposed.

4.1 Develop and implement an agency-wide directive to evaluate tribal exposure pathways

EPA must consider exposure pathways specific to tribes when planning human health and ecological risk assessments. EPA has not yet recognized that current "subsistence" data typically reflects things like a couple of additional deer integrated into an otherwise suburban diet, or a few berries, herbs, and so on. This can be vastly different from a fully subsistence diet (all wild food). NTTC recommends that EPA:

Overarching Recommendation: Develop and implement a formal agency-wide directive to institutionalize the evaluation of tribal exposure pathways for all risk assessments of toxic chemicals and clean-up standards to address the most highly exposed and disproportionately impacted populations. Assume that there will be some impact to tribal resources from any environmental release unless confirmed otherwise.

Chemicals don't exist in a vacuum, there has to be consistency of exposure evaluation throughout all of EPA's programs. Since TSCA chemicals are used in a variety of products and manners they affect all media and ultimately all programs within EPA. Therefore, risk assessments in all EPA departments,

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including OPPT, should be consistent and protective of tribal communities.

Recommendation: In collaboration with tribes, publish a Tribal-Specific Exposure Scenarios Examples companion document to EPA's Exposure Factors Handbook.[70] Wild edible food and associated exposures may exist in heretofore unrecognized places, and heritage (rights-based) fully subsistence diets need to be developed for the major United States ecozones with a provision that individual tribes have the option to refine regional diets according to their own culture and practices.

OPPT-Specific Recommendation: Integrate tribal traditional and subsistence lifeways into EPA OPPT's risk assessment policies and procedures using the following resources: Subsistence Exposure Scenarios for Tribal Applications,[71] which provides an overview of methods that can be used to develop exposure scenarios for unique tribal natural resource usage patterns, and Traditional Tribal Subsistence Exposure Scenario and Risk Assessment Guidance Manual,[72] which provides a framework for evaluating risks in Indian Country.

OPPT-Specific Recommendation: Include potential exposure pathways to tribal populations through resources such as fish and other tribal resources documented throughout the *Understanding Tribal Exposures to Toxics* report to develop conceptual models and assessment questions when conducting problem formulation and initial assessments of all TSCA Work Plan chemicals and new product evaluations.

During OPPT's scoping and problem formulation process, they typically consider human exposure pathways and body burdens for the general population. For example, EPA's Scoping and Problem Formulation Materials for PCBs,[73] includes the statements that "major contributors to dietary exposure to PCBs include fatty foods such as fish, meat, and dairy products… average dietary exposure among the U.S. population is about 2 ng of PCB per kg of body weight per day" and "exposure may occur via dermal contact with PCBs in soil or other media, or incidental ingestion of PCB-contaminated soil or dust," in their description of human exposure pathways and body burdens. However, EPA must consider higher consumption levels and dermal contact resulting from tribal practices if they are to protect the most highly exposed and disproportionately impacted populations.

OPPT-Specific Recommendation: Include additional resource uses and locations that enable a full accounting of tribal contact with chemicals of concern during OPPT's problem formulation and initial assessments of a chemical's fate and transport.

OPPT must include additional resource uses and locations in their scoping and problem formulation process, in order to account fully for tribal contact with chemicals of concern. For example, EPA's TSCA Work Plan Chemical Problem Formulation and Initial Assessment: 1,4-Dioxane,[74] provides a conceptual model of potential exposure pathways for 1,4-dioxane that includes potential source pathways to drinking water through wastewater treatment plants and surface water as well as to drinking water through incineration or product disposal, landfills, and ground water / wells. However, these pathways do not include surface water to fish and other sources of edible and traditional resources described in this report.

OPPT-Specific Recommendation: Consider the cumulative risks from preexisting chemicals in tribal resources to determine whether additional chemicals might push cumulative risks over a defined risk threshold.

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OPPT-Specific Recommendation: Consider the "dwelt-in" environment for exposure calculations.

OPPT-Specific Recommendation: Work with NTTC to develop one or more frameworks for describing ecosystem services in ways that allow a wider applicability to other tribes.

Supporting Recommendation: Continue to develop and use a broader risk assessment framework that includes a component of cultural risk or well-being, along the lines of the previous Comparative Risk[75] methodology used by EPA several decades ago.

Supporting Recommendation: Continue to develop ways to incorporate traditional knowledge into specific steps of the conventional risk management process, even though this may be qualitative data.

Supporting Recommendation: Continue to develop ways to describe disproportionate adverse health outcomes to tribal members from increased exposure to toxics experienced through their unique cultural, ceremonial, and subsistence practices.

Supporting Recommendation by the Tribal Science Council: Integrate tribal traditional lifeways and subsistence lifestyles into EPA's current risk assessment policies and procedures and determine potential development of a new environmental decision-making paradigm, one focusing on human health and ecological well-being.[76]

4.2 Ensure guidance condoning less protective cancer risk levels for highly exposed subpopulations do not support decisions that permit less protective risk levels for tribes or tribal populations

Overarching Recommendation: EPA should ensure that its guidance or policies condoning less protective cancer risk levels for various highly exposed subpopulations[77] are not interpreted to support standards or decisions that permit less protective risk levels for tribes or tribal populations.

Tribal populations are not merely the "high-end tail" of a general population distribution. Tribal populations are citizens of distinct sovereign nations and the practices and lifeways that entail higher exposures are themselves often secured by treaties or otherwise legally protected. Tribal members' exercise of these legally protected rights would be undermined were EPA to permit such exercise to be burdened by relatively high levels of excess cancer risk.

OPPT-Specific Recommendation: Lower action levels for contaminants in subsistence foods. In the absence of specific dietary information, a default wild food diet could be constructed, or an extra safety factor (lower action levels) could be used.

4.3 Establish the Tribal Environmental Health Research Program as a Research Center under the National Center for Environmental Research

Overarching Recommendation: Establish the Tribal Environmental Health Research Program as a Research Center under the National Center for Environmental Research to provide continued funding for developing, compiling, and sharing tribal-specific information for addressing tribal environmental health and disease prevention.

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Although EPA's Tribal Environmental Health Research Program has funded and identified numerous projects and recommendations through EPA's Science to Achieve Results (STAR) grants by EPA's Office of Research and Development, and National Center for Environmental Research, a consistent and united effort is needed to support tribal capacity to understand, monitor, assess, and mitigate toxics' impacts to tribes, including subsistence foods and those resources handled, utilized, or consumed in tribal lifeways.

OPPT-Specific Recommendation: Assist tribes with identifying priority chemicals for risk assessment that may not have been identified in OPPT's 2014 Update to the Work Plan Chemicals[78] and consider "chemicals detected in subsistence and traditional use resources"[79] when screening and prioritizing, chemicals for further attention.

OPPT's two-step process to identify priority chemicals for review and assessment in 2011 was based on an exposure score that did not include subpopulations' exposure. While many of the chemicals are PBTs that would be detected in biomonitoring programs, a weighting criterion based on tribal impact might identify additional chemicals or change the ranking of other chemicals.

OPPT-Specific Recommendation: Fund information-gathering activities to produce sufficient tribal-specific information on unique exposures to evaluate EPA's original list of 345 chemicals identified in Step 1 of the Chemical Work Plan process to consider how tribes' unique exposure to some of these chemicals may warrant priority for assessment.

Step 2 of OPPT's Chemical Work Plan process scored the 345 chemicals identified in Step 1 based on three characteristics: hazard, exposure, and potential for persistence and/or bioaccumulation based on then-available information. EPA's Exposure Score was based on a combination of chemical use, general population and environment exposure, and release information. Chemicals with High or Moderate hazard or persistence/bioaccumulation scores that could not be scored for exposure because of an absence of data, together with chemicals that could not be scored for hazard, were identified separately as candidates for information gathering. The TSCA Work Plan states that EPA may consider a variety of information-gathering activities, including both voluntary data submission and regulations issued under Sections 4 and 8 of TSCA. This screening process is intended only to support initial decisions to determine the relative priority for further assessments and to identify potential data needs for individual chemicals or chemical groups.[80] It seems unlikely that information gathering will provide any future results without specific funding for this effort.

OPPT-Specific Recommendation: Conduct a literature survey of polychlorinated biphenyls, flame retardants, and mercury in indigenous populations (including the Pacific Islands and non-native fishing and shellfishing communities) or in their natural resources. Determine whether proximity to a source of readily-available fish or shellfish is correlated with elevated levels of these contaminants. Examine demographic strata to test whether variables such as income or ethnicity are correlated with blood contaminant levels.

Supporting Recommendation: Fund research that will determine whether proximity to a source of readily-available fish or shellfish is correlated with elevated levels of persistent, bioaccumulative, and toxic chemicals that are currently being assessed by OPPT.

Supporting Recommendation: Include tribal community members in all steps of the risk assessment process. Some of the gaps in the data and methods being used by EPA and other agencies to assess, manage, and communicate risk can only be filled by community- and tribally-

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based research. "Communities and tribes have expertise that is simply not going to be able to be replicated by non-member researchers."[81]

Supporting Recommendation: Community-based research is necessary for comprehensive risk assessment, but historic ethnographic information is just as important to understanding tribal resource use, particularly in accordance with heritage (original subsistence) patterns. EPA must recognize that qualitative and ethnographic data can be just as "scientific" (i.e., accurate, reliable, repeatable, and verifiable) as contemporary statistical data. Indeed, it can be more accurate even if it is less quantitative.

Supporting Recommendation: Tribal survey training is needed for collecting contemporary tribal consumption rate data, and ethnographic and literature-based research methodological training is needed to develop heritage (original subsistence) data.

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[1] http://www.epa.gov/opptintr/existingchemicals/pubs/tscainventory/basic.html last accessed January 12, 2015
[2] http://www.epa.gov/oppt/existingchemicals/pubs/TSCA_Work_Plan_Chemicals_2014_Update-final.pdf last accessed January 18, 2015
[3] http://www.epa.gov/oppt/existingchemicals/pubs/wpmethods.pdf last accessed January 18, 2015
[4] http://www.epa.gov/oppt/existingchemicals/pubs/wpmethods.pdf last accessed January 18, 2015
[5] http://www.epa.gov/oppt/existingchemicals/pubs/Chem.Priorization.August2011.DiscussionGuideOnly.pdf last accessed January 18, 2015
[6] Recommended prioritization factor by Fred Corey in response to EPA's request for comments in Identifying Priority Chemicals for Assessment and Review, Topic 1(a) Prioritizations Factors to submit what other factors, if any, should the Agency add, and why (for Step 1 in which EPA planned to use a specific set of data sources to identify candidate chemicals that meet one or more of the priority factors identified). http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2011-0516-0003
[7] The discussion of exposure assessment's history draws heavily on O'Neill C. (in progress, 2015) *Exposed: Asking the Wrong Question in Risk Regulation*.
[8] Lioy P. and Weisel C. 2014. *Exposure Science: Basic Principles and Applications.* 19-20.
[9] Ott W. 2007. *Exposure Analysis*, 8-10 in Exposure Analysis (Wayne R. Ott, et al., eds., 2007); Wallace L. 2007. *Personal Monitors*, 99-112 in Exposure Analysis (Wayne R. Ott, et al., eds., 2007).
[10] Ott W. 2007. *Exposure Analysis*, 10-12 in Exposure Analysis (Wayne R. Ott, et al., eds., 2007); Flachsbart P. 2007. *Exposure to Carbon Monoxide*, 113-46 in Exposure Analysis (Wayne R. Ott, et al., eds., 2007).
[11] Harper B. and Harris S. 2008. *A possible approach for setting a mercury risk-based action level based on tribal fish ingestion rates*. Environmental Research, 107(1), 60-68.
[12] Quoted from Harper et al., 2007.
[13] Burger J. and Gochfeld M. 2011. *Conceptual Environmental Justice Model for Evaluating Chemical Pathways of Exposure in Low-Income, Minority, Native American, and Other Unique Exposure Populations*. American Journal of Public Health, 101: 300077 - http://dx.doi.org/10.2105/ajph.2010.300077
[14] Harper B., Harding A., Waterhous T., and Harris S. 2007. *Traditional Tribal Subsistence Exposure Scenario and Risk Assessment Guidance Manual.* Corvallis: Oregon State University. http://superfund.oregonstate.edu/outreachevents; and https://app.box.com/shared/70r3579u5gh7ysdugfv7; Harper B., Harding A., Harris S., Berger P. 2012. *Subsistence Exposure Scenarios for Tribal Applications.* Human and Ecological Risk Assessment 18(4): 810-831. Published online Jul 12, 2012. doi: 1080/10807039.2012.688706; PMCID: PMC4155929; NIHMSID: NIHMS596982 also posted at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4155929/
[15] Harper B., Harding A., Waterhous T., and Harris S. 2007. *Traditional Tribal Subsistence Exposure Scenario and Risk Assessment Guidance Manual.* Corvallis: Oregon State University. http://superfund.oregonstate.edu/outreachevents; and https://app.box.com/shared/70r3579u5gh7ysdugfv7
[16] Driscoll R., Mulligan W., Schultz D., and Candelaria, A. 1988. *Malignant Mesothelioma*. New England Journal of Medicine; 318:1437-1438 June 2, 1988 DOI: 10.1056/NEJM198806023182205
[17] US EPA. 2011. *Exposure Factors Handbook 2011 Edition (Final).* U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F http://www.epa.gov/ncea/efh/pdfs/efh-complete.pdf last accessed June 15, 2015
[18] Harper B., Harding A., Waterhous T., and Harris S. 2007. *Traditional Tribal Subsistence Exposure Scenario and Risk Assessment Guidance Manual.* Corvallis: Oregon State University. http://superfund.oregonstate.edu/outreachevents; and https://app.box.com/shared/70r3579u5gh7ysdugfv7; Harper B., Harding A., Harris S., Berger P. 2012. *Subsistence Exposure Scenarios for Tribal Applications.* Human and Ecological Risk Assessment 18(4): 810-831. Published online Jul 12, 2012. doi: 1080/10807039.2012.688706; PMCID: PMC4155929; NIHMSID: NIHMS596982 also posted at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4155929/
[19] Harper B. personal communication. http://epa.gov/ncer/tribalresearch/multimedia/webinar090630p.pdf
[20] Javitz, H. 1980. *Seafood Consumption Data Analysis, Final Report.* SRI International, Menlo Park, CA, September 24, 1980. (explaining that SRI had conducted a literature review and identified four datasets for consideration, which were "the only ones that met the minimum requirement of being statistically projectable to the U.S. population or sizeable segments thereof").
[21] Of the four datasets considered, SRI determined the "most reliable" source to be "a survey conducted during 1973 and 1974 by NPD Research, Inc., a market research and consulting firm that specializes in the analysis of consumer purchasing behavior as recorded in monthly diaries. That study was funded by the Tuna Research Institute as part of a study of tuna consumption." SRI at 18. Each of the other sources considered were, according to SRI, marred by significant deficiencies, e.g., a NMFS database excluded freshwater and recreationally caught fish; a USDA consumption survey failed to account for fish consumed in "mixtures" and had a small sample size; a third survey may have excluded "gamefish" and the dataset was no longer available for queries, such as consumption rates at particular percentiles of the surveyed population. Id. at 33-35.
[22] The percentage calculations are mine, based on a table describing the absolute number of respondents in each of these categories alongside the total number of respondents. SRI at 42. Note that these calculations have been rounded to the nearest

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tenth of a percentage, and do not account for 2 out of the total 24652 respondents for whom this demographic data is recorded as "missing."

[23] NEJAC. 2002. *Fish Consumption and Environmental Justice*. A report developed from the NEJAC meeting of December 3-6, 2001.

[24] O'Neill C. 2013. *Fishable Waters*. American Indian Law Journal 1(2): 181-284.

[25] Donatuto J. and Harper B. 2008. *Issues in Evaluating Fish Consumption Rates for Native American Tribes*. Risk Analysis 26(6): 1497-1506

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[29] Harper B. and Walker D. 2015. *Comparison of Contemporary and Heritage Fish Consumption Rates in the Columbia River Basin*. Human Ecology: Volume 43, Issue 2. Page 225-236. DOI: 10.1007/s10745-015-9734-4; Harper B. and Walker D. 2015. *Columbia Basin Heritage Fish Consumption Rates*. Human Ecology: Volume 43, Issue 2. Page 237-245. DOI: 10.1007/s10745-015-9735-3

[30] Hightower J., O'Hare A., and Hernandez G. 2006. *Blood Mercury Reporting in NHANES: Identifying Asian, Pacific Islander, Native American, and Multiracial Groups*. Environmental Health Perspect, 114:173–175 (2006). doi:10.1289/ehp.8464 available via http://dx.doi.org/ Online September 21, 2005

[30] "A 'suppression effect' occurs when a fish consumption rate (FCR) for a given population, group, or tribe reflects a current level of consumption that is artificially diminished from an appropriate baseline level of consumption for that population, group, or tribe. The more robust baseline level of consumption is suppressed, inasmuch as it does not get captured by the FCR." NEJAC. 2002. *Fish Consumption and Environmental Justice*. A report developed from the NEJAC meeting of December 3-6, 2001. For tribal people in the Pacific Northwest, the forces of suppression, often perpetrated or permitted by federal and state governments, have included inundation of fishing places; depletion and contamination of the fishery resource; and years of prosecution, intimidation, and gear confiscation. Suppressed fish consumption rates form a problematic basis for setting water quality standards that are designed to ensure "fishable waters" under the Clean Water Act. If water quality standards are set at a level that assumes only suppressed fish intake, the waters will only ever be clean enough to support that level of suppressed fish intake.

[30] *See generally*, *See* Donatuto J. and Harper B. 2008. *Issues in Evaluating Fish Consumption Rates for Native American Tribes*, 28 Risk Analysis 1497.

[30] *Id.* at 43-49.

[30] US EPA. 2000. *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000)*, U.S. Environmental Protection Agency, Washington, DC, EPA/822/B-00-004/4304 available at http://water.epa.gov/scitech/swguidance/standards/upload/2005_05_06_criteria_humanhealth_method_complete.pdf

[30] *See* O'Neill C. 2000. *Variable Justice: Environmental Standards, Contaminated Fish, and "Acceptable" Risk to Native Peoples*, 19 Stanford Environmental Law Journal 3, n.194 (cataloguing different uses of the term "subsistence," and different groups included among those referred to as "subsistence fishers" in the TSD), [30] *Id.*, [30] *See, e.g.*, Harper B., Harding A., Harris S., Berger P. 2012. *Subsistence Exposure Scenarios for Tribal Applications.* Human and Ecological Risk Assessment 18(4): 810-831. Published online Jul 12, 2012. doi: 1080/10807039.2012.688706; *see also* Harper B, et al. 2002. *The Spokane Tribe's Multipathway Subsistence Exposure Scenario and Screening Level RME*, 22 Risk Analysis 513.

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[33] Harper B. and Harris S. 2008. *A possible approach for setting a mercury risk-based action level based on tribal fish ingestion rates*. Environmental Research, 107(1), 60-68.

[34] Norgaard, K. 2004. *The Effects of Altered Diet on the Health of the Karuk People.* The Karuk Tribe of California: Department of Natural Resources Water Quality Program. available at *http://www.researchgate.net/publication/228774153_The_effects_of_altered_diet_on_the_health_of_the_Karuk_people_A_preliminary_report*

[35] Norgaard, K. 2004. *The Effects of Altered Diet on the Health of the Karuk People.* The Karuk Tribe of California: Department of Natural Resources Water Quality Program. available at

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http://www.researchgate.net/publication/228774153_The_effects_of_altered_diet_on_the_health_of_the_Karuk_people_A_preliminary_report

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[37] Ecosystems and Human Well-being Synthesis: A Report of the Millennium Ecosystem Assessment http://www.millenniumassessment.org/documents/document.356.aspx.pdf

[38] The original Homeland Security Sector Risk Snapshots is no longer available online. The updated Sector Risk Snapshots, May 2014, is available at https://www.hsdl.org/?view&did=754033, last accessed May 18, 2015.

[39] http://www7.nau.edu/itep/main/orca/index.asp

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[42] Nez Perce Tribe Department of Environmental Restoration and Waste Management. 1997. *National Tribal Risk Assessment Forum: Defining Tribal Approaches in Environmental Risk Assessment indigenous Peoples Perspectives Concerning Radioactive Waste Management*. http://www.wmsym.org/archives/1997/sess40/40-04.htm last accessed June 16, 2015.

[43] In December 1998, EPA facilitated a Tribal Risk Assessment Conference in Las Vegas, NV. Although in draft format that are not citable, the summary notes provide tribal concerns and action items.

[44] The Intertribal Risk Assessment Committee (IRAC) was identified in the 1998 Tribal Risk Assessment Conference notes as being comprised of tribal representatives to focus on the myriad of risk issues facing tribal communities; to promote tribal views on environmental risk management including assessments and other guidelines, methodologies, and decision-making processes affecting tribes; and, to facilitate communication on risk between Indian tribes and federal agencies. Additional references to this committee could not be located online.

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[57] http://www.epa.gov/environmentaljustice/resources/publications/nejac/fish-consump-report_1102.pdf last accessed January 17, 2015

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[60] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3417550/

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[75] Boutin, B., Brown M., Clark R., Lipscomb J., Miltner R., Murphy P., Papa L., Reasoner D., and Rheingans R. 1998. *Comparative Risk Framework Methodology and Case Study*. U.S. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment, Washington Office, Washington, DC, 1998. http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=12465#Download last accessed June 21, 2015

[76] US EPA. 2006. *Paper on Tribal Issues Related to Tribal Traditional Lifeways, Risk Assessment, and Health & Well Being* http://www.epa.gov/osp/tribes/pdf/TTL%20Tribal%20Risk%20Issues%20Paper.pdf last accessed 17 January 2015

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[77] See, e.g., US EPA. 2000. *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000)*, U.S. Environmental Protection Agency, Washington, DC, EPA/822/B-00-004/4304 available at http://water.epa.gov/scitech/swguidance/standards/upload/2005_05_06_criteria_humanhealth_method_complete.pdf last accessed May 26, 2015. With ambient water quality criteria derived for carcinogens based on a linear low-dose extrapolation, the Agency will publish recommended criteria values at a 10-6 risk level. States and authorized Tribes can always choose a more stringent risk level, such as 10-7. EPA also believes that criteria based on a 10-5 risk level are acceptable for the general population as long as States and authorized Tribes ensure that the risk to more highly exposed subgroups (sportfishers or subsistence fishers) does not exceed the 10-4 level. Clarification on this risk management decision is provided in Section 2 of EPA's Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health.

[78] http://www.epa.gov/oppt/existingchemicals/pubs/TSCA_Work_Plan_Chemicals_2014_Update-final.pdf last accessed January 18, 2015

[79] Recommended prioritization factor by Fred Corey in response to EPA's request for comments in Identifying Priority Chemicals for Assessment and Review, Topic 1(a) Prioritizations Factors to submit what other factors, if any, should the Agency add, and why (for Step 1 in which EPA planned to use a specific set of data sources to identify candidate chemicals that meet one or more of the priority factors identified). http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2011-0516-0003 last accessed June 2, 2015.

[80] http://www.epa.gov/oppt/existingchemicals/pubs/wpmethods.pdf last accessed January 18, 2015

[81] NEJAC. 2002. *Fish Consumption and Environmental Justice, A report developed from the NEJAC meeting of December 3-6, 2001.*

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