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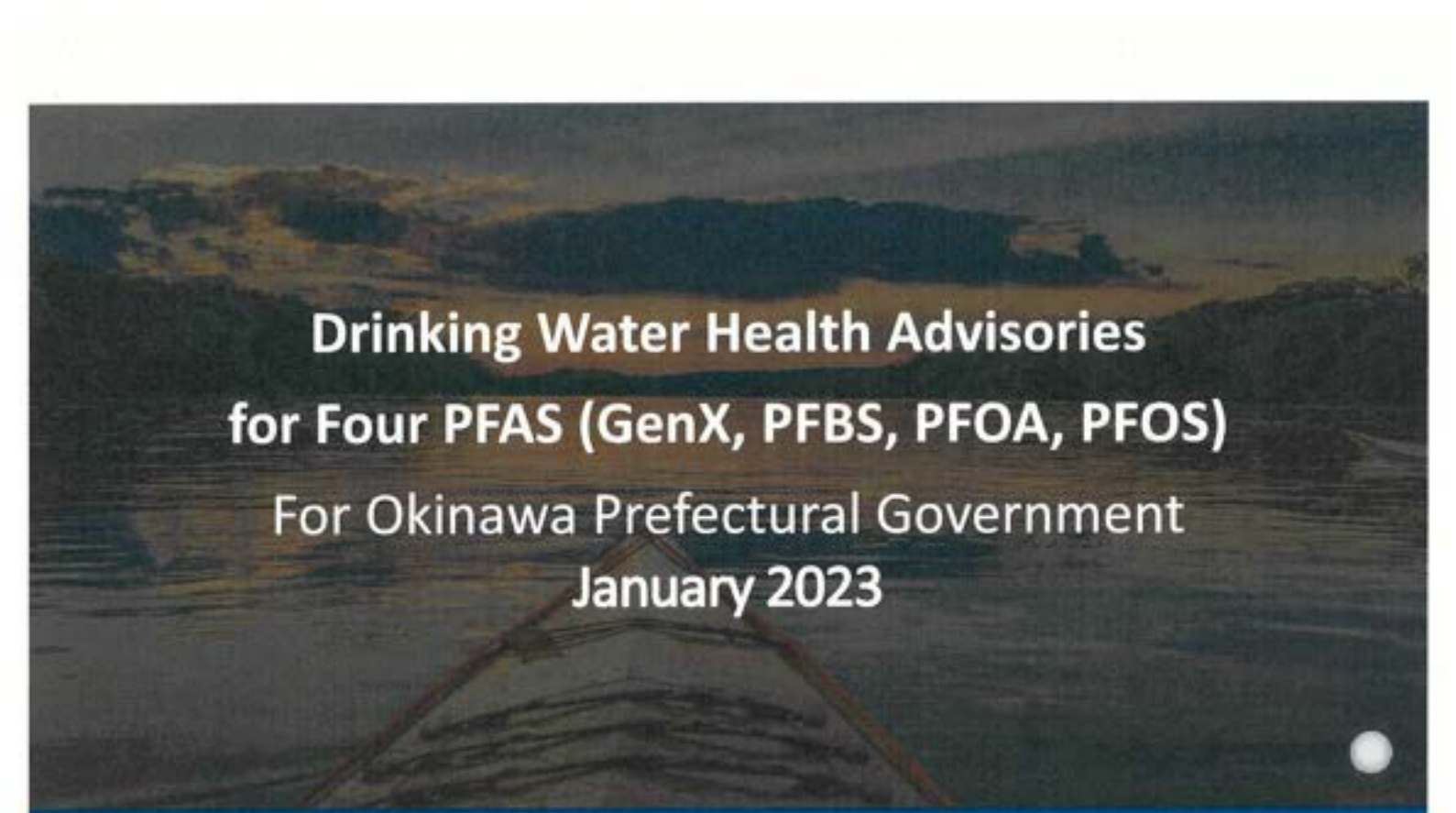
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Drinking Water Health Advisories for Four PFAS (GenX, PFBS, PFOA, PFOS) For Okinawa Prefectural Government January 2023

Overview

- Context for These Actions: PFAS and PFAS Strategic Roadmap
- What Is a Drinking Water Health Advisory?
- Health Advisory Values for the Four PFAS.
 - Interim Updated Health Advisory Documents for PFOA and PFOS.
 - Final Health Advisory Documents for PFBS and GenX Chemicals.
- Key Questions and Answers about these Actions

Context: Per- and Polyfluoroalkyl Substances (PFAS) Background

PFAS captures a large class of synthetic chemicals.

- Chains of carbon atoms surrounded by fluorine atoms.
- Wide variety of chemical structures.

Used in homes, businesses, and industry since the 1940s.

- Used by a number of industries and found in many consumer products.
- Detected in soil, water, and air samples.
- Most people have been exposed to PFAS.

Known or suspected toxicity.

- Potential developmental, liver, immune, and thyroid effects.
- Some are relatively well understood; many others are not.
- Resist decomposition in the environment and in the human body.

Context: EPA's PFAS Strategic Roadmap: EPA's Commitments to Action 2021-2024

- EPA announced the PFAS Strategic Roadmap in October 2021 – a bold, strategic, whole-of-EPA strategy to protect public health and the environment from PFAS.
- The PFAS Strategic Roadmap:
 - Lays out EPA's whole-of-agency approach to tackling PFAS;
 - Sets timelines for concrete actions from 2021 to 2024;
 - Fills a critical gap in federal leadership;
 - Supports states' ongoing efforts; and
 - Builds on the Biden-Harris Administration's commitment to restore scientific integrity.
- Among other actions, the PFAS Roadmap commits EPA to **developing drinking water health advisories** and a **national drinking water regulation**.

What is a Drinking Water Health Advisory?

- Drinking water health advisories:
 - provide information on contaminants that can cause health effects and are known or anticipated to occur in drinking water
 - **are non-enforceable and non-regulatory**
 - include information on analytical methods and treatment
- EPA has developed HAs for ~200 drinking water contaminants.
- An HA level or value is the concentration of a drinking water contaminant for a specific exposure duration, at or below which exposure is not anticipated to lead to adverse human health effects.
 - A **lifetime HA** (such as those EPA recently released) protects all Americans, including sensitive populations and life stages, from adverse health effects resulting from exposure throughout their lives.

Development of Health Advisories

- **Interim HAs for PFOA and PFOS** based on publicly available EPA *draft assessments* that were undergoing EPA Science Advisory Board review to provide information to public health officials while regulatory process is ongoing.
 - Address pressing need to replace 2016 PFOA/S HAs of 70 ppt based on more recent health effects studies showing that **PFOA/S can impact human health at much lower exposure levels than the 2016 HAs.**
 - Toxicity values **will change** as a result of work to address SAB recommendations. **But the HAs (and MCLGs) are likely to remain below the PFOA and PFOS minimum reporting limit of 4 ppt.**
- **Final HAs for PFBS and GenX chemicals** are based on publicly available, and peer-reviewed final toxicity assessments published in 2021.

Draft Chronic RfDs, Critical Effects, and Critical Studies Used to Develop the Lifetime iHAs for PFOA and PFOS

Source	RfD (mg/kg bw-day)	Exposure in Critical Study	Critical Effect	Principal and Associated Studies (Study Type)
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PFOA

Proposed Approaches to the Derivation of a Draft Maximum Contaminant Level Goal for Perfluorooctanoic Acid (PFOA) (CASRN 335-67-1) in Drinking Water [Draft] (U.S. EPA, 2021)

1.5×10^{-9}

PFOA measured in serum of 5-year-old children

Developmental immune health outcome (suppression of **tetanus** vaccine response in 7-year-old children)

Grandjean et al., 2012; Budtz-Jorgensen and Grandjean, 2018 (epidemiological study)

PFOS

Proposed Approaches to the Derivation of a Draft Maximum Contaminant Level Goal for Perfluorooctane Sulfonic Acid (PFOS) (CASRN 1763-23-1) in Drinking Water [Draft] (U.S. EPA, 2021)

7.9×10^{-9}

PFOS measured in serum of 5-year-old children

Developmental immune health outcome (suppression of **diphtheria** vaccine response in 7-year-old children)

Grandjean et al., 2012; Budtz-Jorgensen and Grandjean, 2018 (epidemiological study)

Summary of Four PFAS Health Advisories

- EPA is releasing health advisories for four PFAS:
 - Interim HAs:** PFOA and PFOS
 - Final HAs:** GenX chemicals (PFOA replacement) and PFBS (PFOS replacement)
- Analytical methods can detect GenX chemicals and PFBS at the HA values but cannot detect PFOA and PFOS at the level of the interim HAs.
- Because of this, EPA recommends that if water systems detect PFOA and PFOS, they take steps such as informing residents, undertaking monitoring, and examining steps to limit exposure.

Chemical	Health Advisory (ppt)	Minimum Reporting Level (MRL) ^a (ppt)
PFOA	0.004 (Interim)	4
PFOS	0.02 (Interim)	4
GenX Chemicals	10 (Final)	5
PFBS	2,000 (Final)	3

^a Fifth Unregulated Contaminant Monitoring Rule (UCMR 5) MRL is the minimum quantitation level that, with 95 percent confidence, can be achieved by capable analysts at 75 percent or more of the laboratories using a specified analytical method. These MRLs are based on the UCMR 5 requirement to use EPA Analytical Method 533.

Health Advisory Materials Available on EPA's Website

- Drinking water health advisory documents and supporting scientific documents
- Questions and Answers
- Fact sheet for communities
- Fact sheet for public water systems
- Technical fact sheet
- See <https://www.epa.gov/sdwa/drinking-water-health-advisories-pfoa-and-pfos>

Responding to Questions on Health Advisories (1)

- My water has measurable levels of PFOA/PFOS or GenX chemicals/PFBS above the health advisory:
 - Should I be concerned about my health?
 - *EPA's lifetime health advisory levels offer information that indicates the safe levels of exposure through drinking water over the course of a person's lifetime to avoid adverse health effects.*
 - *These levels are calculated to offer a margin of protection that also takes into account exposure through other sources beyond drinking water.*
 - *If you are concerned about potential health effects from exposure to these PFAS above the health advisory level, EPA encourages you to contact your doctor or health care professional.*

Responding to Questions on Health Advisories (2)

- My water has measurable levels of PFOA/PFOS or GenX chemicals/PFBS above the health advisory:
 - Should I drink bottled water?
 - *At this time, EPA is not recommending bottled water for communities based solely on concentrations of these chemicals in drinking water that exceed the health advisory levels.*
 - *If you are concerned about PFAS in your tap water, EPA recommends you contact your local water utility to see whether they can provide any specific recommendations for your community.*

Responding to Questions on Health Advisories (3)

- My water has measurable levels of PFOA/PFOS or GenX chemicals/PFBS above health advisory:
 - Should I install a filter?
 - *EPA recommends that communities and water systems that measure any levels of PFOA or PFOS or that measure Gen X chemicals or PFBS at levels higher than the health advisory levels inform their customers and consider taking actions to reduce PFAS levels in their drinking water by installing treatment technologies or obtaining a new uncontaminated source of drinking water, if available.*
 - *Individuals who are concerned about PFAS in their wells or in their homes may consider in-home water treatment filters that are certified to lower the levels of PFAS in water.*
 - *EPA has information available on these filters on EPA's [website](#).*
 - *If you are concerned about potential health effects from exposure to these PFAS above the health advisory level, contact your doctor or health care professional.*

Responding to Questions on Health Advisories (4)

- **Should I be concerned even if PFOA/PFOS are not detected in my drinking water?**
 - *The lower the levels of PFOA and PFOS, the lower the risk. This means that while PFOA and PFOS may be present in drinking water in trace concentrations that cannot be measured, water provided by these systems that test but do not detect PFOA or PFOS is of lower risk than if they are found at measurable levels.*
 - *EPA recommends that public water systems that find PFOA or PFOS in their drinking water take steps to inform customers, undertake additional sampling to assess the level, scope, and source of contamination, and examine steps to limit exposure. While water systems may not be able to eliminate all risks from PFOA and PFOS, they can successfully reduce those risks.*

Responding to Questions on Health Advisories (5)

- **What treatment technologies exist to remove PFOA, PFOS, GenX chemicals, and PFBS?**
 - *Activated carbon, anion exchange and high-pressure membranes have all been demonstrated to remove PFAS from drinking water systems. These treatment technologies can be installed at a water system's treatment plant and are also available in-home filter options.*
 - *Each of the four Health Advisory documents identifies the treatment technologies that have been demonstrated to remove the specific PFAS and the factors that impact performance of the technologies.*
 - *Learn more about these [treatment technologies](#).*

Responding to Questions on Health Advisories (6)

- **Is EPA going to establish a national drinking water regulation for PFOA, PFOS and additional PFAS?**
 - *EPA is developing a proposed National Drinking Water Regulation for PFOA and PFOS for publication in the coming weeks. As EPA undertakes this action, the agency is also evaluating additional PFAS and considering regulatory actions to address groups of PFAS. EPA anticipates finalizing the rule by the end of 2023.*
 - *The proposal will include both a non-enforceable Maximum Contaminant Level Goal (MCLG) and an enforceable standard, or Maximum Contaminant Level (MCL) or Treatment Technique.*
 - *The MCLG is the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, allowing an adequate margin of safety.*
 - *The enforceable standard is set as close as feasible to MCLG. EPA considers the ability to measure and treat a contaminant as well as costs and benefits in setting the enforceable standard.*

Next Steps

- Consistent with the PFAS Roadmap, EPA is developing a proposed national primary drinking water regulation for PFOA and PFOS
- Will utilize final input from the Science Advisory Board to develop the proposed Maximum Contaminant Level Goals (MCLGs) – the non-enforceable health-based goals to inform the standard-setting process.
- The enforceable standard (Maximum Contaminant Levels (MCLs) or treatment technique) will be set as close as feasible to the MCLG.
- The draft proposed rule is currently undergoing internal US federal government review, and EPA will issue the proposed rule for public comment when that process concludes.
- Expect a proposed rule in the coming weeks and a final rule by the end of 2023

Technical Fact Sheet: Drinking Water Health Advisories for Four PFAS (PFOA, PFOS, GenX chemicals, and PFBS)

Summary

As part of EPA's commitment to safeguard communities from per- and polyfluoroalkyl substances (PFAS), EPA has issued interim updated drinking water health advisories for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), and final health advisories for hexafluoropropylene oxide (HFPO) dimer and its ammonium salt (together referred to as "GenX chemicals") and perfluorobutane sulfonic acid and its related compound potassium perfluorobutane sulfonate (together referred to as "PFBS"). The interim health advisories for PFOA and PFOS are intended to provide information to states and public water systems until the National Primary Drinking Water regulation for PFAS takes effect. All four of these health advisories provide drinking water system operators, and state, tribal, and local officials who have the primary responsibility for overseeing these systems, with information on the health risks of these chemicals, so they can take the appropriate actions to protect their residents.

Background

What Are PFAS?

PFAS are synthetic chemicals that have been manufactured and used by a broad range of industries since the 1940s. PFAS are used in many applications because of their unique physical properties such as resistance to high and low temperatures, resistance to degradation, and nonstick characteristics. PFAS have been detected worldwide in the air, soil, and water. Due to their widespread use and persistence in the environment, most people in the United States have been exposed to PFAS. There is evidence that exposure above specific levels to certain PFAS may cause adverse health effects.

What Are Drinking Water Health Advisories?

Drinking water health advisories (HAs) provide information on contaminants that can cause human health effects and are known or anticipated to occur in drinking water. EPA's HAs are non-enforceable and non-regulatory and provide technical information to drinking water system operators, as well as federal, state, tribal, and local officials on health effects, analytical methods, and treatment technologies associated with drinking water contamination.

Why is EPA Issuing These HAs?

In 2016, EPA published HAs for PFOA and PFOS based on the evidence available at that time (U.S. EPA 2016, a,b). The science has evolved since then and EPA is now replacing the 2016 advisories with interim updated lifetime HAs for PFOA and PFOS that are based on new studies and draft toxicity values from EPA's 2021 draft PFOA and PFOS health effects documents. Fulfilling EPA's commitment in its October 2021 PFAS Strategic Roadmap, EPA has issued final lifetime HAs for GenX chemicals and PFBS.

How Does EPA Calculate HAs?

The following equation is used to derive a lifetime noncancer health advisory. A lifetime noncancer health advisory is designed to be protective of noncancer effects over a lifetime of exposure, including sensitive populations and life stages, and is typically based on data from experimental animal toxicity and/or human studies.

$$\text{Lifetime HA} = \left(\frac{\text{RfD}}{\text{DWI-BW}} \right) * \text{RSC}$$

Where:

RfD = chronic reference dose—an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure of the human population to a substance that is likely to be without an appreciable risk of deleterious effects during a lifetime.

DWI-BW = drinking water intake rate adjusted for body weight—the 90th percentile DWI for the selected population or life stage, adjusted for body weight (BW), in units of L/kg bw-day. The DWI-BW considers both direct and indirect consumption of tap water (indirect water consumption encompasses water added in the preparation of foods or beverages, such as tea or coffee).

RSC = relative source contribution—the percentage of the total oral exposure attributed to drinking water sources (U.S. EPA, 2000) where the remainder of the exposure is allocated to all other routes or sources.

What Types of Health Outcomes are Associated with Exposure to These Four PFAS, and How Did EPA Develop the HAs?

PFOA and PFOS

EPA is conducting extensive evaluations of human epidemiological and experimental animal study data to support the Safe Drinking Water Act (SDWA) National Primary Drinking Water Regulation for PFOA and PFOS. In November 2021, EPA released draft documents that summarize the updated health effects analyses for [EPA Science Advisory Board \(SAB\) review](#) (U.S. EPA, 2021a, b). EPA evaluated over 400 studies published since 2016 and used new human health risk assessment approaches, tools, and models. Human studies have found associations between PFOA and/or PFOS exposure and effects on the immune system, the cardiovascular system, development (e.g., decreased birth weight), and cancer. The new published peer-reviewed data and EPA analyses (U.S. EPA, 2021a, b) indicate that the levels at which negative health outcomes could occur are much lower than previously understood when the agency issued its 2016 HAs for PFOA and PFOS (70 parts per trillion or ppt). EPA's 2021 draft non-cancer reference doses (RfDs) based on human epidemiology studies for various effects (e.g., developmental/growth, cardiovascular health outcomes, immune health) range from $\sim 10^{-7}$ to 10^{-9} mg/kg/day. These draft RfDs are two to four orders of magnitude lower than EPA's 2016 RfDs of 2×10^{-5} mg/kg/day (U.S. EPA, 2021a, b).

The most sensitive non-cancer effect based on the draft EPA analyses, decreased immunity (i.e., decreased serum antibody concentrations after vaccination) in children in a human epidemiology study, was selected as the basis for the draft RfD (toxicity value) in the PFOA and PFOS health effects draft documents (U.S. EPA, 2021a, b). EPA used the draft RfD to derive the interim updated HAs for PFOA and PFOS. In the critical study, EPA selected the critical effect of decreased serum antibody concentration in children associated with increased serum PFOA and/or PFOS concentrations. EPA expects this critical effect to be protective of all other adverse health effects observed in humans because this adverse effect can reduce the protection afforded by vaccines after exposure to PFOA/PFOS during a sensitive developmental life stage and it yields the lowest point of departure (POD) (U.S. EPA, 2021a, b). For both PFOA and PFOS, an intraspecies uncertainty factor

(UF_H) of 10 was applied to account for variability in the response within the human population (U.S. EPA, 2002). EPA identified children ages 0-5 years as a sensitive life stage, based on the critical study, and selected the corresponding DWI-BW. Based on a literature search of the available information on exposure sources and routes, EPA calculated the interim HAs for PFOA and PFOS using an RSC of 0.20, meaning that 20% of the exposure – equal to the RfD – is allocated to drinking water, and the remaining 80% is attributed to all other potential exposure sources (U.S. EPA, 2022a, b; U.S. EPA, 2000).

While there is evidence that PFOA is likely to be carcinogenic to humans, EPA has not derived a cancer risk concentration in water for PFOA at this time. For PFOS, there is suggestive evidence of carcinogenic potential in humans. Additional analyses of the cancer study data are ongoing for both PFOA and PFOS.

The underlying science that EPA used to develop the interim health advisories is currently undergoing SAB review, and therefore, these interim health advisories are subject to change. After receiving the SAB's final report, EPA will complete its revisions to address their feedback and recommendations, which could lead the agency to draw different conclusions than are reflected in the draft health effects analyses (U.S. EPA, 2021a, b). As a result, the interim health advisory levels for PFOA and PFOS (U.S. EPA, 2022a, b) could change. EPA may update or remove the interim health advisories for PFOA and PFOS upon finalization of the National Primary Drinking Water Regulation. ○

GenX Chemicals and PFBS

EPA's final health advisories for GenX chemicals and PFBS are based on animal toxicity studies following oral exposure to these chemicals. Studies of exposure to GenX chemicals have reported health effects in the liver, kidney, immune system, development, as well as cancer. The most sensitive non-cancer effect among the available data was an adverse liver effect (constellation of liver lesions) (U.S. EPA, 2021c). This critical effect was the basis for the final chronic RfD which EPA used to derive the final HA for GenX chemicals. To develop the final chronic RfD for GenX chemicals, EPA applied a composite UF of 3,000 (i.e., 10X for intraspecies variability (UF_H), 3X for interspecies differences (UF_A), 10X for extrapolation from a subchronic to a chronic dosing duration (UF_S), and 10X for database deficiencies (UF_D)) (U.S. EPA, 2021c). EPA identified lactating women as an adult life stage with the greatest potential exposure from drinking water, based on the critical study, and selected the corresponding DWI-BW. EPA calculated the final HA for GenX chemicals using an RSC of 0.20, meaning that 20% of the exposure -- equal to the RfD -- is allocated to drinking water, and the remaining 80% is attributed to all other potential exposure sources (U.S. EPA, 2022c). There is suggestive ○ evidence of carcinogenic potential of oral exposure to GenX chemicals in humans and the available data are insufficient to derive a cancer risk concentration in water for GenX chemicals.

For PFBS, animal studies have reported health effects on the thyroid, reproductive system, development, and kidney following oral exposure. The most sensitive non-cancer effect was an adverse effect on the thyroid (i.e., decreased serum total thyroxine) in newborn mice in a study with exposure throughout gestation in the mothers. This critical effect was the basis for the final chronic RfD which EPA used to derive the final HA for PFBS (U.S. EPA, 2021d; U.S. EPA, 2022d). EPA applied a composite UF of 300 (i.e., 10X for intraspecies variability (UF_H), 3X for interspecies differences (UF_A), and 10X for database deficiencies (UF_D)) (U.S. EPA, 2021d). EPA identified women of child-bearing age as a sensitive life stage, based on the critical study, and selected the corresponding DWI-BW. EPA calculated the final HA for PFBS using an RSC of 0.20, meaning that 20% of the exposure – equal to the RfD – is allocated to drinking water, and the remaining 80% is attributed to all other potential exposure sources (U.S. EPA, 2022d). There were no studies identified that evaluated potential cancer effects after PFBS exposure so the potential for cancer effects after PFBS exposure could not be evaluated.

What are the HAs for the four PFAS?

PFOA Interim Updated Health Advisory – Input Parameters and HA Value

Parameter	Value	Units	Source
Chronic RfD	1.5E-9	mg/kg/day	U.S. EPA, 2021a. <i>Draft</i> RfD based on developmental immune health outcome (suppression of tetanus vaccine response in 7-year-old children). Human epidemiological studies.
DWI-BW	0.0701	L/kg-day	U.S. EPA, 2019. 90th percentile direct and indirect consumption of community water, consumers-only population, two-day average, for children ages 0 to <5 years based on 2005–2010 National Health and Nutrition Examination Survey (NHANES).
RSC	0.2	N/A	U.S. EPA, 2021a. RSC based on a review of the current scientific literature.

PFOA Interim Updated Lifetime Health Advisory = 4E-09 mg/L or 0.004 ppt (EPA 2022a)

PFOS Interim Updated Health Advisory – Input Parameters and HA Value

Parameter	Value	Units	Source
Chronic RfD	7.9E-09	mg/kg/day	U.S. EPA, 2021b. <i>Draft</i> RfD based on developmental immune health outcome (suppression of diphtheria vaccine response in 7-year-old children). Human epidemiological studies.
DWI-BW	0.0701	L/kg-day	U.S. EPA, 2019. 90th percentile direct and indirect consumption of community water, consumers-only population, two-day average, for children ages 0 to <5 years based on 2005–2010 NHANES.
RSC	0.2	N/A	U.S. EPA, 2021b. RSC based on a review of the current scientific literature.

PFOS Interim Updated Lifetime Health Advisory = 2E-08 mg/L or 0.02 ppt (EPA 2022b)

GenX Chemicals Final Health Advisory – Input Parameters and HA Value

Parameter	Value	Units	Source
Chronic RfD	3E-06	mg/kg/day	U.S. EPA, 2021c. Final RfD based on critical liver effects (constellation of liver lesions as defined by the National Toxicology Program Pathology Working Group) in parental female mice exposed to HFPO dimer acid ammonium salt by gavage for 53–64 days.
DWI-BW	0.0469	L/kg-day	U.S. EPA, 2019. 90th percentile two-day average, consumer only estimate of combined direct and indirect community water ingestion for lactating women (13 to <50 years) based on 2005–2010 NHANES.
RSC	0.2	N/A	U.S. EPA, 2021c. Based on a review of the current scientific literature.

GenX Chemicals Final Lifetime Health Advisory = 0.00001 mg/L or 10 ppt (EPA 2022c)

PFBS Final Health Advisory – Input Parameters and HA Value

Parameter	Value	Units	Source
Chronic RfD	3E-04	mg/kg/day	U.S. EPA, 2021d: Final RfD based on critical effect of decreased serum total thyroxine (T4) in newborn (postnatal day (PND) 1) mice after gestational exposure to the mother.
DWI-BW	0.0354	L/kg-day	U.S. EPA, 2019. 90th percentile two-day average, consumer only estimate of combined direct and indirect community water ingestion for women of childbearing age (13 to <50 years) based on 2005–2010 NHANES.
RSC	0.2	N/A	U.S. EPA, 2021d. Based on a review of the current scientific literature.

PFBS Final Lifetime Health Advisory = 0.002 mg/L or 2,000 ppt (EPA 2022d)

Application of Health Advisories to Different Exposure Scenarios

Because the critical effects identified for PFOA, PFOS, and PFBS are developmental effects that can potentially result from short-term exposure to these PFAS during a critical period of development, EPA guidelines support applying the lifetime health advisories for these three PFAS to both short-term and chronic risk assessment scenarios (U.S. EPA, 1991).

The lifetime health advisory for GenX chemicals used a chronic RfD from the final EPA toxicity assessment (U.S. EPA, 2021c) based on the critical effect of adverse liver effects in adults (parental females) from a subchronic study (53–64 day exposure). In the assessment, a 10X UF_s for subchronic to chronic exposure was applied to derive the chronic RfD (U.S. EPA, 2021c). Because the critical effect identified for GenX chemicals is in adults, the HA applies to chronic exposure scenarios. The HA was based on exposure to lactating women, an adult life stage with the greatest drinking water intake rate. Application of the GenX chemicals HA to a shorter-term risk assessment scenario would provide a conservative, health protective approach in the absence of other information.

Consideration of Noncancer Health Risks from PFAS Mixtures

EPA recently released a *Draft Framework for Estimating Noncancer Health Risks Associated with Mixtures of Per- and Polyfluoroalkyl Substances (PFAS)* that is currently undergoing SAB review (U.S. EPA, 2021e). That draft document provides a flexible, data-driven framework that facilitates practical evaluation of two or more PFAS based on current, available EPA chemical mixtures approaches and methods. Examples are presented for three approaches—Hazard Index (HI), Relative Potency Factor (RPF), and Mixture BMD—to demonstrate application to PFAS mixtures. To use these approaches, specific input values and information for each PFAS are needed or can be developed.

The health advisory documents provide an example of how to use the HI approach to assess the potential noncancer risk of a mixture of PFOA, PFOS, GenX chemicals, and PFBS (U.S. EPA, 2022 a-d). A mixture PFAS HI can be calculated when health-based water concentrations (e.g., HAs, MCLGs) for a set of PFAS are available or can be calculated. In the example, hazard quotients (HQs) are calculated by dividing the measured component PFAS concentration in water (e.g., expressed as ng/L) by the relevant HA (e.g., expressed as ng/L), as shown in the equation below. Component HQs are then summed across the PFAS mixture to yield the mixture PFAS HI. A mixture PFAS HI greater than 1 indicates an exceedance of the health protective level and indicates potential human health risk for noncancer effects from the PFAS mixture in water. When component health-based water concentrations (in this case, HAs) are below the analytical method detection limit, as is the case for PFOA and PFOS, such individual component HQs exceed 1, meaning that any detectable level of PFOA or PFOS will result in an HI greater than 1 for the whole mixture. Further analysis could provide a refined assessment of the potential for health effects associated with the individual PFAS and their contributions to the potential joint toxicity associated with the mixture. For more details, please see U.S. EPA (2021e).

$$HI = \left(\frac{[PFOA_{water}]}{[PFOA_{HA}]} \right) + \left(\frac{[PFOS_{water}]}{[PFOS_{HA}]} \right) + \left(\frac{[GenX_{water}]}{[GenX_{HA}]} \right) + \left(\frac{[PFBS_{water}]}{[PFBS_{HA}]} \right)$$

Where:

HI = hazard index;

[PFAS_{water}] = concentration for a given PFAS in water;

[PFAS_{HA}] = the HA value for a given PFAS

Where can I find more information?

To view the HA documents, go to: <https://www.epa.gov/sdwa/drinking-water-health-advisories-has>

To view the PFAS Strategic Roadmap: EPA's Commitments to Action 2021-2024, go to:
<https://www.epa.gov/pfas/pfas-strategic-roadmap-epas-commitments-action-2021-2024>

For information on drinking water, go to: www.epa.gov/safewater

References

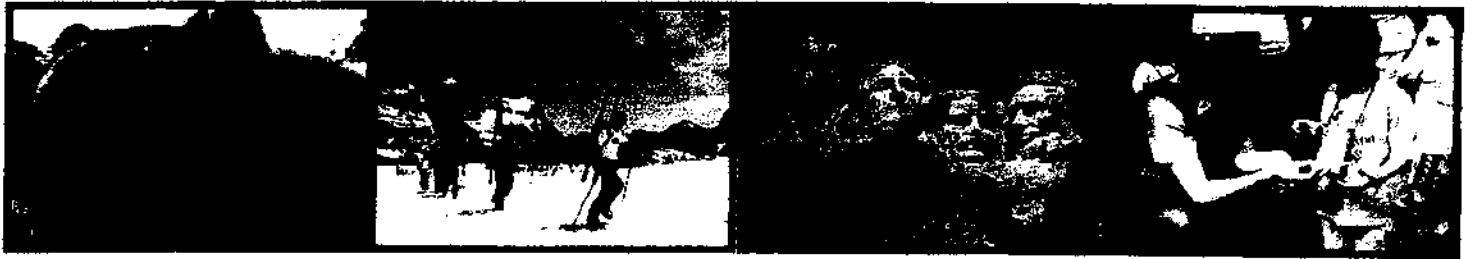
- U.S. EPA (U.S. Environmental Protection Agency). 1991. *Guidelines for Developmental Toxicity Risk Assessment*. EPA-600-FR-91-001. EPA, Risk Assessment Forum, Washington, DC. Accessed April 2022. https://www.epa.gov/sites/default/files/2014-11/documents/dev_tox.pdf.
- U.S. EPA (U.S. Environmental Protection Agency). 2000. *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000)*. EPA-822-B-00-004. EPA, Office of Water, Washington, DC. <https://www.epa.gov/sites/default/files/2018-10/documents/methodology-wqc-protection-hh-2000.pdf>.
- U.S. EPA (U.S. Environmental Protection Agency). 2002. *A Review of the Reference Dose and Reference Concentration Process*. EPA/630/P-02/002F. EPA, Risk Assessment Forum, Washington, DC. Accessed May 2022. <https://www.epa.gov/sites/default/files/2014-12/documents/rfd-final.pdf>.
- U.S. EPA (U.S. Environmental Protection Agency). 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)*. EPA-822-R-16-005. EPA, Office of Water, Washington, DC. Accessed June 2022. https://www.epa.gov/sites/production/files/2016-05/documents/pfoa_health_advisory_final_plain.pdf.
- EPA (U.S. Environmental Protection Agency). 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. EPA-822-R-16-004. EPA, Office of Water, Washington, DC. Accessed June 2022. https://www.epa.gov/sites/default/files/2016-05/documents/pfos_health_advisory_final_508.pdf.
- U.S. EPA (U.S. Environmental Protection Agency). 2019. *Exposure Factors Handbook Chapter 3 (Update): Ingestion of Water and Other Select Liquids*. U.S. EPA Office of Research and Development, Washington, DC, EPA/600/R-18/259F. https://www.epa.gov/sites/default/files/2019-02/documents/efh_-_chapter_3_update.pdf.
- U.S. EPA (U.S. Environmental Protection Agency). 2021a. *External Peer Review Draft: Proposed Approaches to the Derivation of a Draft Maximum Contaminant Level Goal for Perfluorooctanoic Acid (PFOA) (CASRN 335-67-1) in Drinking Water*. EPA-822-D-21-001. EPA, Office of Water, Washington, DC. Accessed April 2022. https://sab.epa.gov/ords/sab/f?p=100:18:16490947993:::RP,18:P18_ID:2601.
- U.S. EPA (U.S. Environmental Protection Agency). 2021b. *External Peer Review Draft: Proposed Approaches to the Derivation of a Draft Maximum Contaminant Level Goal for Perfluorooctane Sulfonic Acid (PFOS) CASRN 1763-23-1 in Drinking Water*. EPA-822-D-21-002. EPA, Office of Water, Washington, DC. Accessed April 2022. https://sab.epa.gov/ords/sab/f?p=100:18:16490947993:::RP,18:P18_ID:2601.
- U.S. EPA (U.S. Environmental Protection Agency). 2021c. *Human Health Toxicity Values for Hexafluoropropylene Oxide (HFPO) Dimer Acid and Its Ammonium Salt (CASRN 13252-13-6 and CASRN 62037-80-3). Also Known as "GenX Chemicals."* EPA/822/R-21/010. EPA, Office of Water, Health and Ecological Criteria Division, Washington, DC. <https://www.epa.gov/chemical-research/human-health->

toxicity-assessments-genx-chemicals

- U.S. EPA (U.S. Environmental Protection Agency). 2021d. Human Health Toxicity Values for Perfluorobutane Sulfonic Acid (CASRN 375-73-5) and Related Compound Potassium Perfluorobutane Sulfonate (CASRN 29420-49-3). EPA/600/R-20/345F. EPA, Office of Research and Development, Washington, DC. <https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=350888>.
- U.S. EPA (U.S. Environmental Protection Agency). 2021e. Draft Framework for Estimating Noncancer Health Risks Associated with Mixtures of Per- and Polyfluoroalkyl Substances (PFAS). EPA-822-D-21-003. EPA, Office of Water, Washington, DC. https://sab.epa.gov/ords/sab/f?p=100:18:16490947993:::RP,18:P18_ID:2601
- U.S. EPA (U.S. Environmental Protection Agency). 2022a. Interim Drinking Water Health Advisory: Perfluorooctanoic Acid (PFOA) CASRN 335-67-1. EPA/822/R-22/003. EPA, Office of Water, Health and Ecological Criteria Division, Washington, DC. <https://www.epa.gov/sdwa/drinking-water-health-advisories-has>.
- U.S. EPA (U.S. Environmental Protection Agency). 2022b. Interim Drinking Water Health Advisory: Perfluorooctane Sulfonic Acid (PFOS) CASRN 1763-23-1. EPA/822/R-22/004. EPA, Office of Water, Health and Ecological Criteria Division, Washington, DC. <https://www.epa.gov/sdwa/drinking-water-health-advisories-has>.
- U.S. EPA (U.S. Environmental Protection Agency). 2022c. Drinking Water Health Advisory: Hexafluoropropylene Oxide (HFPO) Dimer Acid (CASRN 13252-13-6) and HFPO Dimer Acid Ammonium Salt (CASRN 62037-80-3), Also Known as "GenX Chemicals." EPA/822/R-22/005. EPA, Office of Water, Health and Ecological Criteria Division, Washington, DC. <https://www.epa.gov/sdwa/drinking-water-health-advisories-has>.
- U.S. EPA (U.S. Environmental Protection Agency). 2022d. Drinking Water Health Advisory: Perfluorobutane Sulfonic Acid (CASRN 375-73-5) and Related Compound Potassium Perfluorobutane Sulfonate (CASRN 29420-49-3). EPA/822/R-22/006. EPA, Office of Water, Health and Ecological Criteria Division, Washington, DC. <https://www.epa.gov/sdwa/drinking-water-health-advisories-has>.



国立公園局概要



幹部 Leadership

局長：チャック サムズ
副局長：マイケル レイノルズ
副局長：ショーン ペンジ

管 Administration

国立公園局は、米国内務省の局のひとつで、国立公園システムを構成する424のユニットを管理しています。

国立公園局では、国家歴史登録財、国家遺産、国定原生・景勝河川、国定歴史建造物、国定トレイル等の関連サイトも管理しています。

綱領 Mission Statement

1916年8月25日ウッドロー・ウィルソン大統領は国立公園局設置法に署名しました。同法には「国立公園局は、景観、自然及び歴史的資源並びに野生生物を保全し、次の世代が同様に享受できるように損なわずに引き継ぐ」という基本目的が規定されています。

ウェブサイト Website

詳細は www.nps.com でご覧になれます。

国立公園の数 The Number of Parks

国立公園システムは、“ユニット”と呼ばれる424箇所の管理地域から構成されており、その総面積は8,400万エーカー（約34万平方キロメートル）以上にも及びます。ユニットには、124の歴史公園、75の記念物、59の国立公園、25の戦跡・軍事記念公園、18の保護区域、18のレクリエーション

地域、10の海岸、4の街道、4の湖岸、2の保護地が含まれます。

イエローストーン国立公園は、1872年3月1日我が国（そして世界で）最初の国立公園として議会により設立されました。

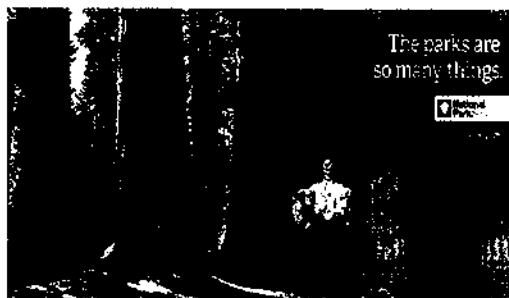
ランゲル・セントイライアス国立公園・保護地域は最も大きなユニットで1,320万エーカーあります。一番小さなユニットはタデウシュ・コンチュシュコ国立史跡で、0.02エーカーです。

予算 Budget

2016年度の予算は、32億ドル。毎年国立公園局では、地元経済に対して26万6千件の雇用を創出し、120億ドルの経済効果を生み出しています。

レクリエーション利用 Recreation Visits

1920	100万人
1940	1,700万人
1960	7,900万人
1980	1億9,800万人
2000	2億8,600万人
2022	3億1,300万人



利用者サービス Visitor Services

国立公園局は909のビジターセンターやコンタクトステーションを運営しています。2008年には、1億2,700万人の利用者が60万5,000件のイベントやレンジャー・プログラムに参加しました。また、56万5,000人以上の子供たちが「ジュニア・レンジャー」プログラムに参加しました。

職員とボランティア Employees & Volunteers

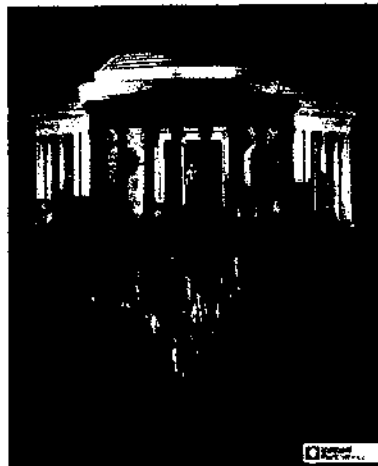
国立公園局では、約20,000人職員（常勤職員、臨時職員、季節雇用職員）が勤務しています。

22万1,460人の公園ボランティア（Volunteer in Parks: VIP）が、年間で640万時間貢献しています。これは2,600人以上の職員に匹敵します。

保全 Preservation

- 421種の絶滅危惧種及び希少種の生息地保全
- 150万の考古学的な遺跡
- 2万7千の歴史及び先史時代の建造物
- 1億点の学術収蔵品（ジョージ・ワシントンが就任式に着用したコート、カール・サンダーバーグのタイプライター）
- 1万7千マイルのトレイル
- 世界最大の肉食獣、アラスカ・ブラウン・ベア

世界最大の生物、ジャイアントセコイア
 デナリ国立公園にある北アメリカの最高峰、マッキンリー (2万320フィート)
 世界最長の洞窟、マンモスケイブ国立公園 (365マイル以上)
 国内最深の湖、クレーターレイク国立公園 (1,932フィート)
 西半球の最低地点デスバレー国立公園のバッドウォータ



PARK



ー・ベイスン (海拔-282フィート)

コンセッション (営業権 所有業者) Concessions

国立公園局は、120の公園ユニットにおいて約600のコンセッションヤーと、請負契約を結んでいます。コンセッションヤーは飲食、宿泊、交通、小売り、その他のサービスを提供しています。

従業員数は2万5千人、年間売上は11億ドル、政府へ毎年6,600万ドルが営業権料として支払われています。

**パートナーシップ
Volunteers**

国立公園に対する国民の支持は、国立公園と同じくらい古くからあるものです。1916年に国立公園局が設立される前から、アメリカの国家遺産を体現する特別な場所を守るために、国民は援助を申し出ていました。

今日では国立公園局のミッションを遂行するために非常に重要な役割を担っています。150以上の非営利団体が時間や専門知識、そして年間5,000万ドルもの貢献をしています。国立公園基金は連邦議会によって設立が認められ、基金調達、パートナーシップ構築、補助金交付を行い、一般国民の関心を高めています。同基金は、1億3,700万ドルの補助金とプログラム支援を過去7年間に提供しています。65の協力団体が、プログラムや公園関連グッズの提供により、国立公園における教育や自然解説の体験を強化しています。これらの団体は年間2,600万ドルを国立公園局に提供しています。



料金 Fees

147の国立公園ユニットで、5ドルから25ドルを入場料を課しています。売上は国立公園局の来場者サービスや施設の向上に使用されています。

アメリカ・ビューティフル・ナショナル・パークス・アンド・フェデラル・リクリエーションル・

パスは80ドルの年間パスで、国立公園局を含む5つの官庁が所管する連邦政府の土地に立ち入ることができます。16歳以下の子供は無料です。62歳以上の国民は10ドルで生涯シニア・パスが使用できます。無料の生涯アクセス・パスは、永久的な障害をもつ国民に提供されています。



未来 The Future

国立公園局は2016年に100周年を迎えます。この記念日のための計画を進める中で、国立公園局は「すべてのアメリカ人の利益と喜びであり続けるよう、我々の国立公園を管理保全する」という基本目的を守り続けます。

「我々の長期に渡る繁栄は我々が吸い込む空気、飲む水、種を蒔く土地を誠実に管理するかどうかにかかっている。それは神聖な預かり物である。」 -バラク・オバマ、2009年。

NEA
 A SECOND CENTURY OF SERVICE

找你喜欢的
公园

NATIONAL
MUSEUM of
NATURAL
HISTORY

• Smithsonian

EXHIBITION BOOT CAMP



OFFICE OF EXHIBITS
SPRING 2018



OUR VISITORS

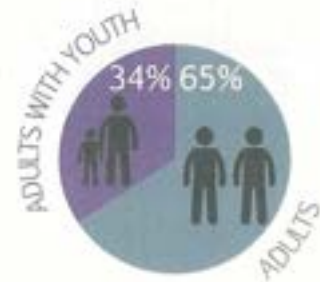


UNDERSTANDING OUR VISITORS



36 AVERAGE VISITOR AGE

MEDIAN VISIT DURATION PER EXHIBIT



SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY, OFFICE OF EVALUATION

WHAT ARE EXHIBITS?



PHYSICAL SPACE

Social experience and immersion



VISUAL MEDIUM

Centered on objects and images



MULTIPLE FORMS OF ENGAGEMENT

Reading, touching, seeing, listening



SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY, OFFICE OF EVALUATION

WHAT KIND OF PLATFORMS?



EXHIBIT PROPER



PROGRAMMING



TRAVELING EXHIBIT



SOCIAL MEDIA

SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY - OFFICE OF EXHIBITS

WORKING AS A TEAM



SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY - OFFICE OF EXHIBITS

EXHIBIT TEAMS



SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY | 2014 | 100 EXHIBITS

WHO'S ON THE CORE TEAM?



SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY | 2014 | 100 EXHIBITS

WHO'S ON THE CORE TEAM?



MEET THE OUTBREAK TEAM

SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY | OFFICE OF EXHIBITS

WHO'S ON THE CORE TEAM?



EXHIBIT DEVELOPER

- Leads definition of exhibit goals and messages and ensures product meets its intended purpose and audience
- Develops ideas for interpretive strategies
- Supports content research and planning
- Liaison between team and advisory team and other content focused groups

SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY | OFFICE OF EXHIBITS

WHO'S ON THE CORE TEAM?



PROJECT MANAGER

- Facilitates all team communication; sets agendas and meetings; acts as a bridge between various project players
- Produces and maintains the overall schedule and budget
- Responsible for milestone approval process

METROCHINA NATIONAL MEDIA & COMMUNICATIONS CENTER - OFFICE OF EXHIBITS

WHO'S ON THE CORE TEAM?



WRITER

- Drafts statement of purpose and concept narrative
- Responsible for all written and spoken material, such as labels, videos, audio, interactives, etc.
- Integrates comments from reviewers into script
- Works with designer to ensure text works well in the design
- Proofreads graphic files through production

METROCHINA NATIONAL MEDIA & COMMUNICATIONS CENTER - OFFICE OF EXHIBITS

WHO'S ON THE CORE TEAM?

DESIGNER



- Responsible for all visual aspects of the exhibit
- Works with the team to conceptualize and develop an effective visitor experience
- Advises on the selection of artifacts and specimens
- Works with the Project Manager to maintain assigned budget and schedule
- Prepares drawings for all aspects of exhibition
- Observes installation and helps maintain quality control

SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY, OFFICE OF EXHIBITS

WHO'S ON THE CORE TEAM?

EDUCATOR



- Input on interpretive strategies, visitors learning, and accessibility standards
- Audience advocate
- Ensures educational goals and objectives are measurable and measured
- Liaison between the core team and E&O department
- Develops exhibit-related public programs, school programs, and other public engagement activities

SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY, OFFICE OF EXHIBITS

WHO'S ON THE CORE TEAM?

CONTENT EXPERT



- Provides exhibit content
- Verifies scientific accuracy
- Helps define messages and goals
- Liaison to other content specialists
- Selects specimens and objects
- Reviews script

SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY OFFICE OF EXHIBITS

WHO'S ON THE CORE TEAM?

NEW MEDIA SPECIALIST

- Introduces appropriate new media applications and technologies
- Ensures digital experience successfully conveys educational goals and objectives
- Works with other SI offices to establish a clear communication and protocol
- Liaison between the core team and outside media contractors

FABRICATION POINT OF CONTACT

- Liaison between the core team and the production team
- Provides input to ensure production feasibility of the intended design
- Shares their knowledge around current conservation requirements on the production materials
- Supports designer to ensure intended design stays within the production budget

SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY OFFICE OF EXHIBITS

WHO'S ON THE APPROVAL TEAM?

The approval team affirms that the exhibit is credible and in keeping with the mission of the museum.

- Assistant Director for Exhibitions
- Assistant Director for Education and Outreach
- Assistant Director for Communication
- Associate Director for Science
- Chair of the relevant scientific department

METROPOLITAN MUSEUM OF ART, OFFICE OF EXHIBITS

WHAT IS THE ADVISORY TEAM?

The advisory team refers to the broad group the regularly gives input on an exhibit's content and/or design, supporting the work of the core team.



METROPOLITAN MUSEUM OF ART, OFFICE OF EXHIBITS



DEVELOPING THE EXHIBITION STRATEGY

MUSEUMS AND HERITAGE MUSEUM OF NATURAL HISTORY, HISTORY SPACE OF EXHIBITS

WHO IS THE EXHIBIT FOR?



Families, teens, tourists, connoisseurs?
What are their needs, wants, interests?

MUSEUMS AND HERITAGE MUSEUM OF NATURAL HISTORY, HISTORY SPACE OF EXHIBITS

WHAT WILL THIS EXHIBIT DO?



BRITISH MUSEUM NATURAL HISTORY MUSEUM OF NATURAL HISTORY - OFFICE OF EXHIBITS



BRITISH MUSEUM NATURAL HISTORY MUSEUM OF NATURAL HISTORY - OFFICE OF EXHIBITS

PRINCIPLES OF EXHIBIT WRITING

Reading in an exhibition is not the same as reading a book.

We write for our visitors, not our colleagues.

We make the content relevant to our visitors.

SMITHSONIAN INSTITUTION | NATIONAL MUSEUM OF NATURAL HISTORY | OFFICE OF EXHIBITS

WHAT CAN YOU EXPECT FROM YOUR WRITER?

Your writer will advocate for **engaging stories** and **accessible text**.

Your writer will **collaborate** with you.

Your writer will ask you a lot of **questions**.

Your writer will **challenge** you.

Your writer will depend on you for scientific accuracy. You can depend on your writer for **clear and engaging text**.

SMITHSONIAN INSTITUTION | NATIONAL MUSEUM OF NATURAL HISTORY | OFFICE OF EXHIBITS

HOW MANY WORDS DO WE GET?



GALLERY TITLE & TEXT

25-75 words (fewer than 50 is best)

SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY - GETTY 2 OF 1987/17

HOW MANY WORDS DO WE GET?



SPECIMEN LABELS

25-30 words

SUBTEXT

75 words max (this is 49)

ANNOTATIONS

5-10 words

ILLUSTRATION TITLE

10 words max

OBJECT LABEL

DIRECTIVE

SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY - GREEN & LIT EXHIBITS

SCRIPT EDITING: TEXTUAL & VISUAL



SAINT-DENIS NATIONAL MUSEUM OF NATURAL HISTORY / OFFICE OF EXHIBITS



SAINT-DENIS NATIONAL MUSEUM OF NATURAL HISTORY / OFFICE OF EXHIBITS

VISUAL COMMUNICATION

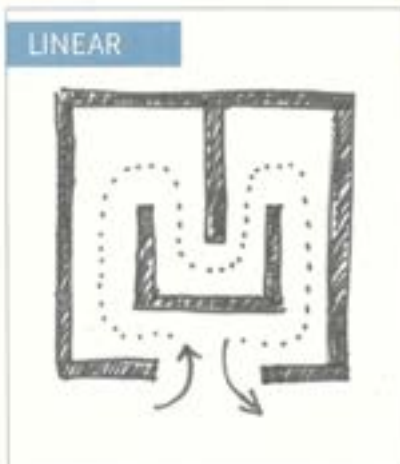


USING DESIGN TOOLS TO:

- CONVEY CONTENT
- TELL A STORY
- CREATE AN EXPERIENCE
- EVOKE AN EMOTION
- ENGAGE THE INTENDED AUDIENCE

SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY OFFICE OF EXHIBITS

PHYSICAL LAYOUT



SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY OFFICE OF EXHIBITS

GRAPHIC DESIGN

INSPIRATION/REFERENCE IMAGES



GRAPHICS SPECIFICATIONS

FONTS

IMPACT LABEL

SANCHEZ

Alegreya Sans Regular

Alegreya Sans Italic

Alegreya Sans Bold

COLORS



INSPIRATION/REFERENCE IMAGES: 70% OF MATERIAL; GRAPHICS SPECIFICATIONS: 30%

PRETTY PICTURES AND MORE



RENDERINGS: 40% OF MATERIAL; PLANS: 20% OF MATERIAL; ELEVATIONS: 10% OF MATERIAL; TECHNICAL DRAWINGS: 30%



EXHIBITION DEVELOPMENT PROCESS

SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY - OFFICE OF EXHIBITS

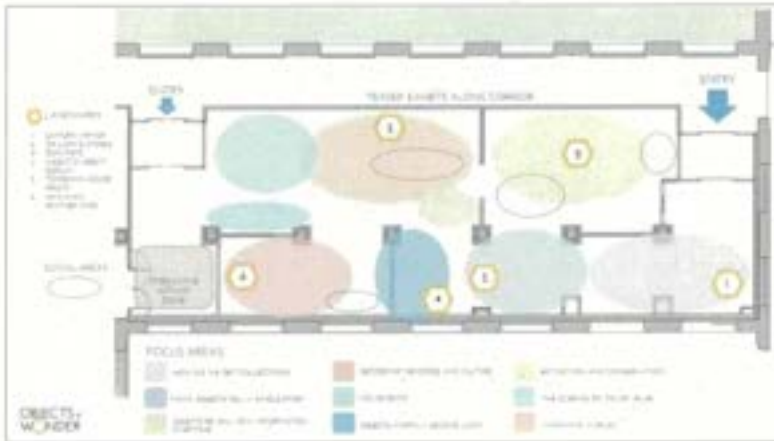
PHASES OF EXHIBITION DEVELOPMENT



SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY - OFFICE OF EXHIBITS

PHASE 1

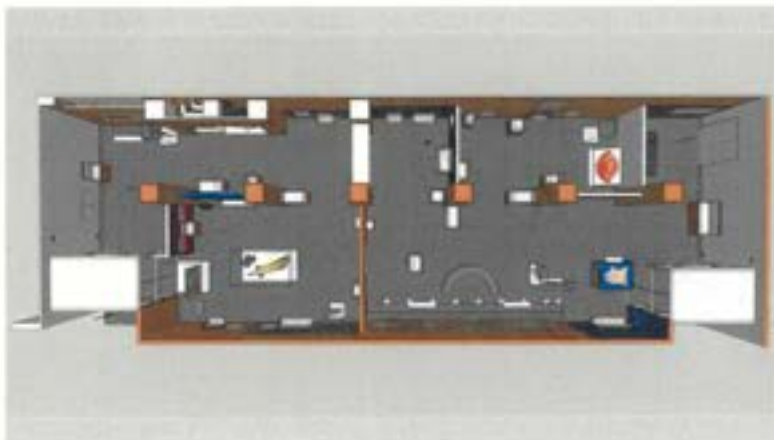
STATEMENT OF PURPOSE & CONCEPT DEVELOPMENT



MULTIMEDIA MUSEUM, U.S. IN THE NATURAL HISTORY MUSEUM, OFFICE OF EXHIBITS

PHASE 2

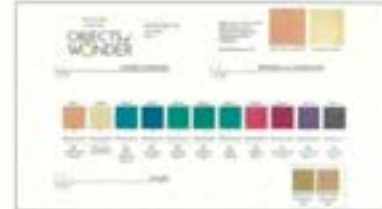
DRAFT SCRIPT & 35% DESIGN DEVELOPMENT



MULTIMEDIA MUSEUM, U.S. IN THE NATURAL HISTORY MUSEUM, OFFICE OF EXHIBITS

PHASE 3

FINAL SCRIPT & 65% DESIGN DEVELOPMENT



SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY, OFFICE OF EXHIBITS

PHASE 4

FINAL DESIGN



SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY, OFFICE OF EXHIBITS

PHASE 5

PRE-PRODUCTION & FABRICATION



PHOTOGRAPHS BY KYLE M. DE WATERS, ARTIST - OFFICE OF EXHIBITS

PHASE 6

INSTALLATION & OPENING



PHOTOGRAPHS BY KYLE M. DE WATERS, ARTIST - OFFICE OF EXHIBITS

WHAT HAPPENS AFTER OPENING DAY?



PUNCH LIST

EVALUATION

MAINTENANCE

UPGRADES

SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY - OFFICE OF EXHIBITS

ARE YOU READY?

SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY - OFFICE OF EXHIBITS



史密森尼博物院
Smithsonian Institution
國立自然歷史博物館
National Museum of Natural History

翁竣熙 · 建築師

Chun-Hsi Wong, Architect

行政部主任

Associate Director for Operations

NMNH - 1910



自然歷史博物館建築物歷史

NMNH Architecture History

- 本館 (Main Building)- 1904 - 1911
- 東館 (East Wing)- 1961 - 1963
- 西館 (West Wing) - 1963 – 1965
- 主機械房 (Central Plant) - 1991 -1993
- 東庭 (East Court) - 1997 – 1998
- 西庭 (West Court) - 1998 - 1999

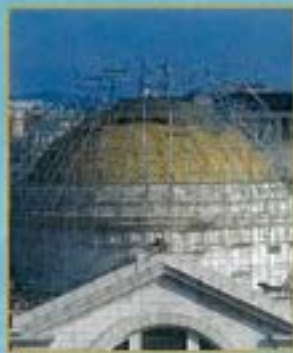
NMNH – 2000



自然歷史博物館空間

NMNH Areas

- 122600 m² Total Net Area
 - 28800 m² 公共空間•展覽空間 (Public/Exhibits Space)
 - 43650 m² 研究•收藏空間 (Research/Collection Space)
 - 17650 m² 辦公室 (Administration/Office Space)
 - 32500 m² 建築支持空間 (Building Support Space)



自然歷史博物館人口

NMNH Population

- 遊客 - 1年有5百萬 (5 Million Visitors/Year)
 - 14%國外遊客 (Foreign Visitors)
 - 73%美國外洲遊客 (Out of State US Visitors)
 - 13%是華盛頓地區遊客 (DC Area Visitors)
- 工作人員/志願工作人員 - 1200人
Staff/Volunteers – 1200/day
- 客席研究員 - 1年- 1萬1千人
Official Visitors/Researcher – 10000 per year

自然歷史博物館預算

NMNH Budget

- 預算(Budget): 16 億3千萬美元 (\$163 Million)
 - 聯邦政府 (Federal): 13 億9千萬 (\$139 Million)
 - 自然歷史博物館 (NMNH): 5 億5千萬 (\$55 Million)
 - 史密森尼中央支持 (SI Central Support): 3 億4千萬 (\$34 Million)
 - 建築預算 (Capital Budget): 5 億 (\$50 Million)
 - 私人資金 (Trust): 2 億 (\$20 Million)
- 工作人員 (Staff): 361
 - 聯邦政府 (Federal): 275
 - 私人資金 (Trust): 86

A View Inside NMNH

Carol Butler
January 27, 2023



1

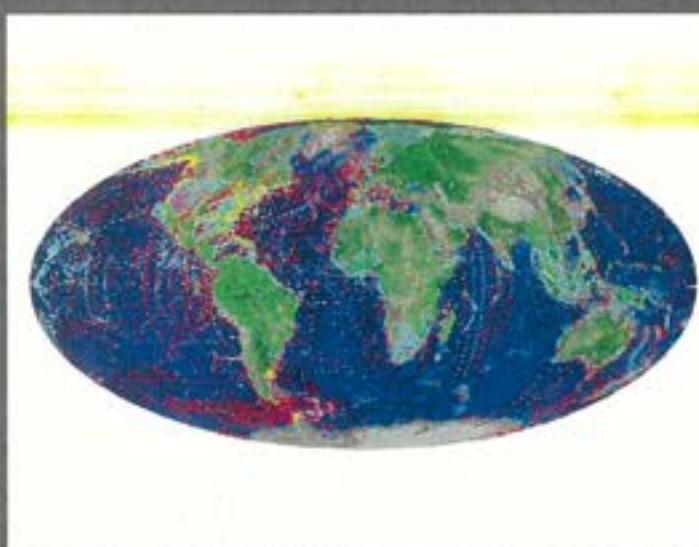
The Big Picture – We are mission-driven

Mission

We inspire curiosity, discovery, and learning about nature and culture through outstanding research, collections, exhibitions, and education.

Vision

- *Understanding the natural world and our place in it.*
- **Science Themes, Initiatives, Priorities**



2

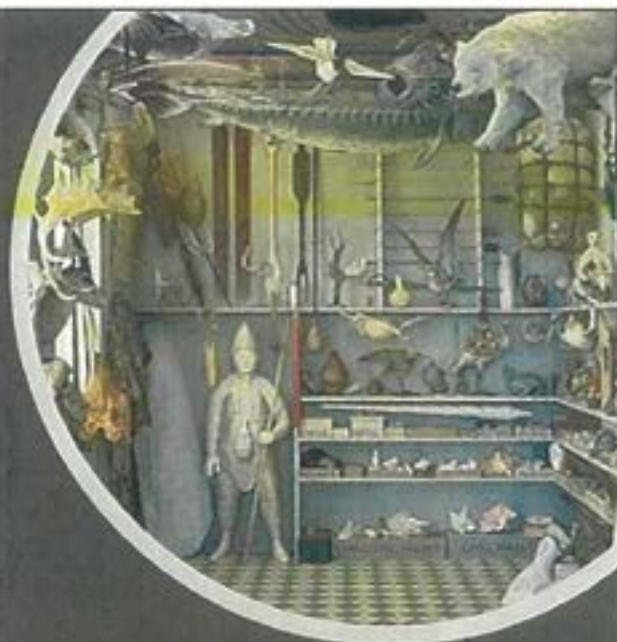
Our Collections – 148 Million; High Research Use

- Biology (Botany, Entomology, Invertebrate and Vertebrate Zoology)
- Geology (Mineral Sciences, Paleobiology)
- Anthropology
- Global
- Origins of the solar system to today
- Earliest pre-date the Smithsonian
- Preservation types – Dry, Fluid, Archival, Frozen, Slide mounted
- At the museum, Museum Support Center, off-site agreements, loans
- Hundreds of publications each year,
- Thousands of research visitor days
- Millions of web hits for data, data portals

3

The History of Natural History: The *Kunstkammer* or “Cabinet of Curiosities”

- Personal possessions
- Curiosity
- Power
- Prestige and status; personal or national pride
- Wealth
- Entertainment
- Documentation of observations
- Proof of phenomena and explanation



4



What is Natural History now?

- Documentation of observations
- Future oriented
- Active
- Expectation of 100 years of preservation
- Reliant upon high quality data
- Preservation of today and the past
- Responsive to sources, communities
- **RESEARCH DRIVEN**

5



Why Museums are possible - PRESERVATION

- Agents of Deterioration
- Techniques
- Storage Containers

6

When Planning STORAGE ...

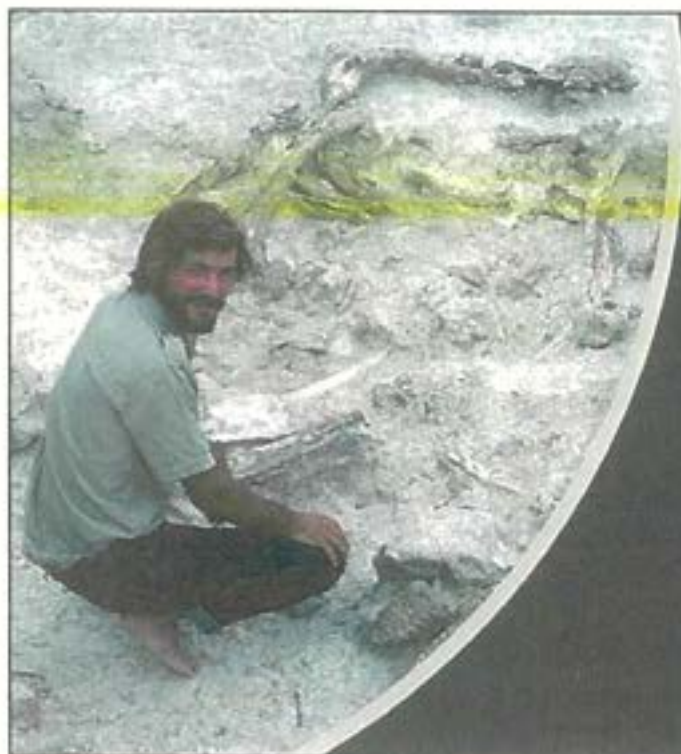
- Agents of deterioration
- Ensuring Access
- Sustainability – consider local conditions, materials, practices
- Expect increase
- Initial costs and long-term use of storage



7

How we Acquire Collections

- Donation
- Field Collecting
- Transfer from US Agencies
- Bequest
- Propagation
- **REGISTRATION IS ESSENTIAL**



8

Costs of Collection Management

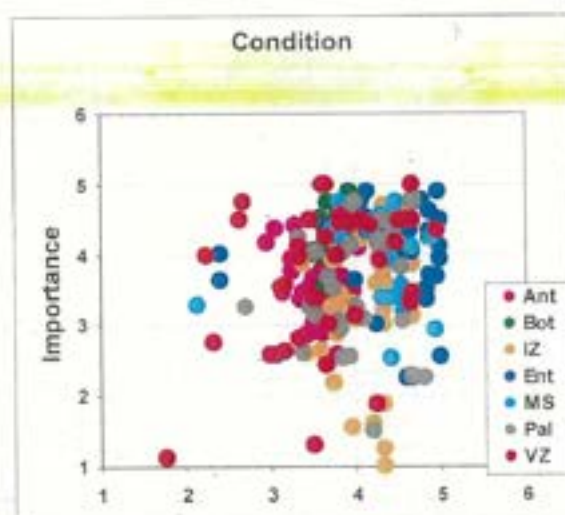
- Labor
- Scientific expertise
- Skills
- Ongoing maintenance
- Associated infrastructure



9

Guiding Plans and Documents

- Collection Management Policy
- Collection Assessment
- Collection Stewardship Plan
 - Digitization Plan
 - Physical Care Plan
 - Acquisition Plan



10

Raising Awareness

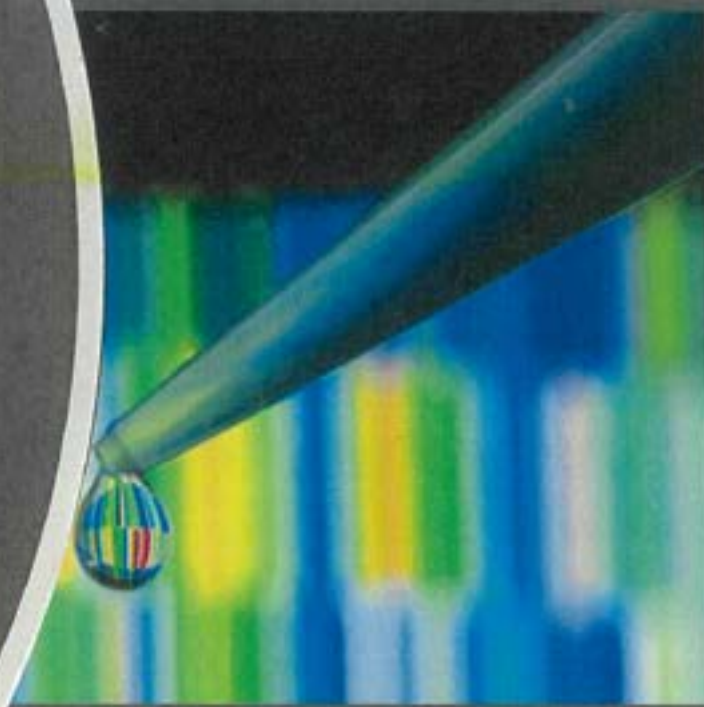
- Exhibits
- Educational Programs
- School programs K-12
- Internships, Fellowships
- Professional Engagement
- Scholarly Publications, Presentations



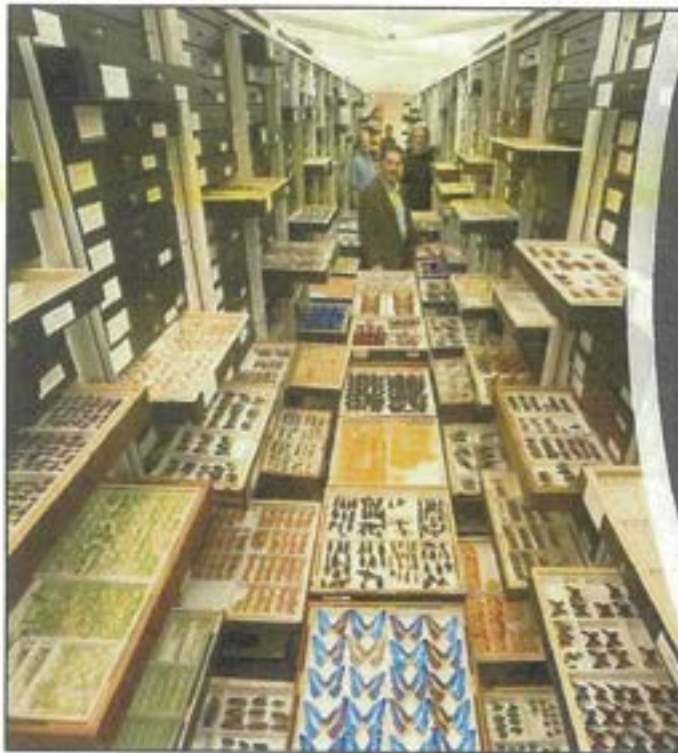
11

Academic Research Environment

- Funding
- Fellows
- Facilities
- Relationships, Partnerships



12



Current Issues

- Ethical Stewardship
- Aging Facilities, Staff
- Post-Covid environment – economic impact
- Pressure of a growing collection
- Digitization and costs
- Sustainability, local environment
- Challenge of Quasi-Federal Status, being a large museum in a large institution
- Response to a changing world
- *For all museums - RELEVANCE*

13

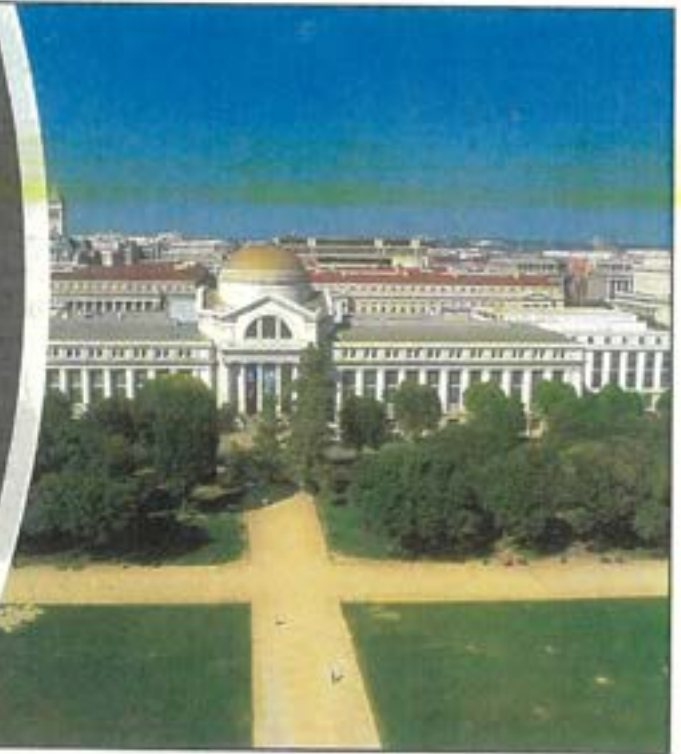
As you plan

- What is the mission of your new museum?
- What audiences will it serve?
- What is the museum's scope ?
- Are your resources sustained?

14

Thank You for your visit!
Best wishes for Success!

butlerc@si.edu



令和4年度 土木環境委員会 海外視察調査日程

最終

月 日	現地時間	日本時間	日 程	備 考
令和5年 1月25日 (水)	7:25 10:32 ~ 14:20 15:00 18:30 20:00 20:30	6:00 6:00 ~ 6:20 7:35 ~ 9:45 10:55 ~ 4:20 8:30 ~ 10:00 10:30	県議会ロビー集合 県議会発 → 那覇空港着【議会バス】 那覇空港発 → 羽田空港着【JAL900便】 羽田空港発 → ダラスフォートワース国際空港着（経由地）【JAL12便】（10時間30分） ダラスフォートワース国際空港発 → ロナルド・レーガン・ワシントン・ナショナル空港着【JAL7410便】 ホテル着 ※チェックイン ～ 夕 食 ～ ホテル着	日本との時差 (-)13時間 (2時間10分) 【テキサス州】 (3時間48分) ホテル泊
1月26日 (木)	8:30 10:00 ~ 12:00 12:30 ~ 13:30 14:30 ~ 16:00 18:30 20:00 20:30	22:30 0:00 ~ 2:00 2:30 ~ 3:30 4:30 ~ 6:00 8:30 ~ 10:00 10:30	ホテル発 ①米環境保護庁（EPA） ～ 昼 食 ～ ②米内務省国立公園局（NPS） ～ 夕 食 ～ ホテル着	【ワシントン市内】 Ronald Reagan BuildingのEPA wing (1300 Pennsylvania Avenue) US Department office Interior 1F(1849 C St. NW, Washington, DC 20240) ホテル泊
1月27日 (金)	8:00 9:00 ~ 11:30 12:00 ~ 13:00 13:00 ~ 16:00 18:30 20:00 20:30	22:00 23:00 ~ 2:00 2:00 ~ 3:00 3:00 ~ 6:00 8:30 ~ 10:00 10:30	ホテル発 ③スミソニアン国立自然史博物館（館内視察及び座学） ～ 昼 食 ～ ④スミソニアン国立自然史博物館（館内視察及び座学） ～ 夕 食 ～ ホテル着	【ワシントン市内】 10th&Constitution Avenue NW Washington, DC 20560 10th&Constitution Avenue NW Washington, DC 20560 ホテル泊
1月28日 (土)	9:30 10:00 ~ 12:00 12:30 ~ 13:30 14:00 ~ 15:00 18:30 20:00 20:30	23:30 0:00 ~ 2:00 2:30 ~ 3:30 4:00 ~ 5:00 8:30 ~ 10:00 10:30	ホテル発 ⑤スミソニアン国立自然史博物館（施設見学） ～ 昼 食 ～ ⑥スミソニアン国立航空宇宙博物館（施設見学） ～ 夕 食 ～ ホテル着	【ワシントン市内】 10th&Constitution Avenue NW Washington, DC 20560 655 Jefferson Dr SE, Washington, DC 20665 ホテル泊
1月29日 (日)	5:00 6:56 8:15 8:15 10:30 ~	19:00 20:56 22:15 22:15 0:30	ホテル発 ロナルド・レーガン・ワシントン・ナショナル空港発 → シカゴ・オヘア国際空港着（経由地）【JAL7339便】 （乗り継ぎまで2時間15分）※待ち時間中、出国手続き シカゴ・オヘア国際空港発 → 羽田空港着【JAL9便】	【ワシントン郊外】 (1時間19分) 機内泊 (14時間25分)
1月30日 (月)	0:55	14:55 17:05 ~ 20:00 20:10 ~ 20:30 20:30	羽田空港国際線到着 ※待ち時間中、入国手続き 羽田空港発 → 那覇空港着【JAL923便】 那覇空港発 → 県議会着【議会バス】 解散	(2時間55分)

調査事項

公害防止及び環境保全について

- (1) 世界自然遺産の管理・活用状況
- (2) PFASによる環境汚染について
- (3) 国立自然史博物館の誘致について

○宿泊ホテル（4泊）

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